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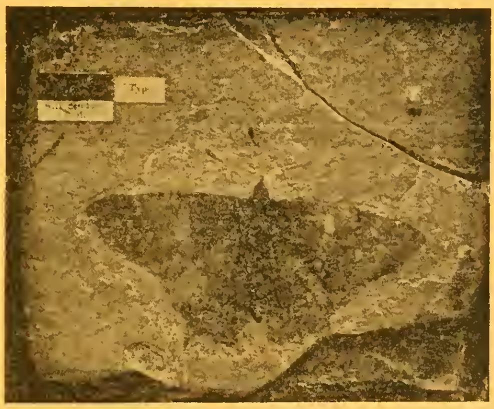

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PSYCHE

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TWO GYNANDROMORPHOUS ANTS.[1]

By William Morton Wheeler.

Two gynandromorphous ants which have turned up in recent collections are of unusual interest since they differ significantly from any of the similar anomalies previously described. One is a gynandromorph in the strict sense of the term, *i. e.*, a combination of the female and male of our common *Lasius* (*Acanthomyops*) *latipes* Walsh, the other a dinergatandromorph, or combination of the soldier (dinergate) and male of a Philippine ant, *Camponotus* (*Colobopsis*) *albocinctus* Ashmead.

For many years I have been expecting to find a gynandromorphous Lasius, both because the species of this genus are among the commonest and most widely distributed Eurasian and North American ants and because it seemed to me that at least an ergatandromorph, or combination of worker and male characters might occur as readily as in other ants, since these two phases in Lasius are of about the same size. On September 21, 1917, while turning over a large stone at Colebrook, Conn., in a pasture less than a quarter of a mile from the spot in which I took the gynandromorphous Mutillid described in a former number of Psyche,[2] I found a compact cluster of about two hundred of the bright yellow workers of *L. latipes* and in their midst a black insect, which I took to be an unusually large male. I placed the specimens in a vial of strong alcohol and continued my collecting. On returning home I was surprised to find that the dark specimen was a remarkable gynandromorph of a Lasius in which the sexual differences are more extreme than in any other species of the genus or indeed of any of the North American ants, except the Ecitons. Many years ago McClendon and I[3] endeavored to show that *L. latipes* is peculiar

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 153.

[2] A Gynandromorphous Mutillid. Psyche 17, 1910, pp. 186–190, 1 fig.

[3] Dimorphic Queens in an American Ant (Lasius latipes Walsh). Biol. Bull. 4, 1903, pp. 149–163, 3 figs.

in possessing two forms of females, one, which we called the β-female, being reddish-yellow, with long golden pile, large, flattened femora and tibiæ, short, slender tarsi and incrassated antennæ; and one, which we called the α-female, of a darker color and intermediate in structure and pilosity between the β-female and the female of *L. claviger* Roger.[1] The gynandromorph taken at Colebrook is evidently a combination of the male and β-female. These phases, when they appear as separate individuals measure respectively 4 and 8 mm., and could hardly be combined to form a viable lateral gynandromorph, so that it is probably for this reason that the specimen, as will appear from the description and figure, is of a different type. Unfortunately I did not have access to a dissecting microscope till the specimen had become so thoroughly hardened in the alcohol that I despaired of gaining any satisfactory knowledge of its internal reproductive organs. The gynandromorphous *C. albocinctus* was found among a small series of dried and mounted specimens collected for me in 1917 by Dr. F. X. Williams at Los Baños, near Manila. The following detailed descriptions and the figures will give an idea of the external peculiarities of the two specimens.

Lasius (Acanthomyops) latipes Walsh (Fig. 1)

Gynandromorph. Length 8 mm., being that of the normal β-female, but with the thorax and gaster more slender. Head shaped like that of a normal female, but with the eyes and ocelli much larger and more prominent, the right posterior ocellus smaller than the left and the surface black, with isolated, reddish-yellow spots as indicated by the less densely stippled areas in the figure. Left mandible of the female type, reddish-yellow, smooth, shining, sparsely punctate; right mandible black, like the left in form and size but subopaque and very finely longitudinally striolate as in the male. Clypeus with somewhat more than its right half reddish-yellow (female), the remainder black (male). Antennæ both alike, black, 13-jointed (male) and with slightly swollen first funicular joint but stouter than in the male, in form only slightly approaching the female, as in normal individuals of this sex the scape is incrassated distally and the funiculus is spindle-shaped, with very broad and transverse joints in the middle. The surface

[1] These females are figured in the paper cited and in my ant book (Fig. 55 B and C, p. 94).

of the head is subopaque as in the male and not smooth and shining as in the female, but the pilosity is long as in the latter though the hairs are dark and not golden as in the female. Thorax similar to that of the female but the pro- and epinotum are somewhat narrower and the former is asymmetrical, being shorter on the left than on the right side so that the head is turned to the left. The mesonotum and scutellum are more like those of the male. The thorax is black and has the same sculpture and short, sparse

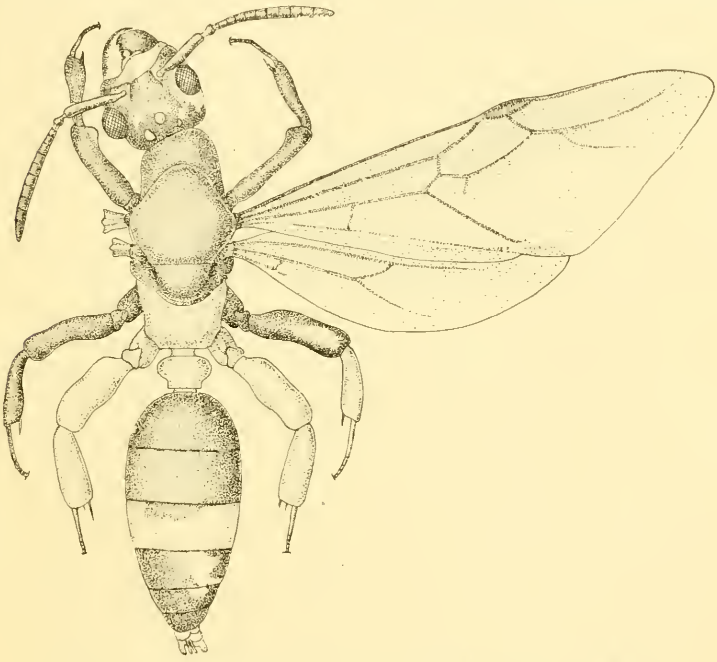

Fig. 1. Gynandromorph of *Lasius* (*Acanthomyops*) *latipes* Walsh.

pilosity as in the male, with the exception of the epinotum, which is reddish-yellow and has the long, abundant, golden hairs of the female. The petiole, too, is entirely of the female type in shape, color and pilosity. The gaster is narrower and more pointed posteriorly than in the normal female and with six visible segments and therefore more nearly of the male type. Its first and second segments are entirely black above (male), the third reddish-yellow (female), except for a black, asymmetrical transverse blotch at the anterior border on the dorsal surface; the fourth, fifth, and sixth segments are black (male), but the fourth has an irregular reddish-yellow band extending over its full length on the right side above, and the fifth has a small spot of the same color on the same side at the anterior margin. On the ventral side the first segment is black throughout, the second with an oblique reddish-yellow blotch to the left of the median line, the third with a narrow black longitudinal streak in the middle and a large rounded black spot on the left posterior corner. The fourth ventral segment is entirely black and very small, the fifth yellow. External genitalia of the male type, much as in normal individuals but more robust and turned somewhat to the right side. Sculpture, pilosity and pubescence of the gaster as in the male. Legs very peculiar in that the hind pair, including their coxæ, are of the normal female form, pilosity and color, whereas the right fore leg and left middle leg, including their coxæ, are entirely black and in form intermediate between the male and female types though somewhat more like the latter in form and size. Left fore leg black on its extensor and reddish yellow on its flexor surface and more nearly like the normal female fore leg in form than the right fore leg. Right middle leg much more like that of the female than the left middle leg, the coxæ and femur black, the latter with a long fusiform reddish-yellow spot on its extensor surface, the tibia and tarsus reddish-yellow throughout as in the female. The pilosity on the legs is short and sparse (male), except along the flexor border of the left fore tibiæ and on the hind legs where the hairs are long and of the female type. Both pairs of wings are normally developed and in size and shape as in the female, but the hind pair dropped off readily soon after the specimen was placed in alcohol, whereas the fore pair remain firmly attached, showing a pronounced tendency to deälation (female) only in the metathoracic articulations. The fore pair has the posterior half of the recurrent vein absent. This reveals a condition half way between those of the normal female and male, since in the former the recurrent vein is complete and closes the discoidal cell, whereas in the male it is usually entirely absent so that the wing is without a discoidal cell.

The unusual interest of the specimen lies in the fact that it cannot be placed in any of the categories of gynandromorphs, for as a whole it belongs neither to the more frequent lateral, nor to the rarer anteroposterior, decussating, mosaic or blended types, but exhibits a mixture of all of them. The mandibles and clypeus have the sexual characters of the lateral type but the arrangement of colors in the clypeus is the reverse of that of the mandibles and hence decussating. The head is female in form but partly blended, partly mosaic and feebly lateral. The eyes, antennæ, anterior ocellus and left posterior ocellus are strongly male. The right posterior ocellus, the right eye, which is distinctly smaller than the left, and the large area of reddish-yellow integument surrounding it, show that the right side of the head is more female than the left. The thorax in front of the epinotum is a blend of male and female characters, the pronotum being more female, the mesonotum and scutellum more male as are also the color, sculpture and pilosity of these three regions, whereas the epinotum and petiole are purely female. The wings are female but with the female tendency to deälation only in the hind pair and the reverse or male tendency to persistence in the articulations of the anterior pair. But the latter show in the retention of the anterior half of the recurrent vein a very interesting condition precisely half-way between that of the normal male and female wing. The hind legs are purely female but the two anterior pairs show a peculiar decussation, the left fore and right middle leg being more female in form and coloration and the right fore and left middle leg more male. This decussation of characters is similar to that of the mandibles and clypeus but less pronounced. It is very probable that the internal reproductive organs are more or less hermaphroditic, as they are situated in segments which externally exhibit a very striking mosaic of male and female characters.

Camponotus (Colobopsis) albocinctus Ashmead (Fig. 2*c*)

Dinergatandromorph. Length 4 mm.

In all respects like a normal soldier, except in its smaller size (the normal soldier measures about 5 mm.) and in having the head asymmetrical, with its smaller right half exhibiting male characters. The right eye is larger, more convex and nearer the middle of the side of the head than the left. The right antenna is 13-jointed, with the terminal joint short and aborted, and the right mandible, though much shorter than in the male (Fig. 2*a*) has only two teeth separated by a wide concavity of the apical border.

The clypeus on the right side has the lateral extension characteristic of the male and the same type of frontal carina, whereas the left frontal carina is prolonged backward as in the soldier (Fig. 2[b]) but does not border so deep a scrobe-like depression. In the soldier the head is ferruginous or yellowish-red, with its posterior third infuscated, but in the male entirely black. In the dinergatandromorph the infuscation extends much further forward between the frontal carinæ and onto the right side. There are no

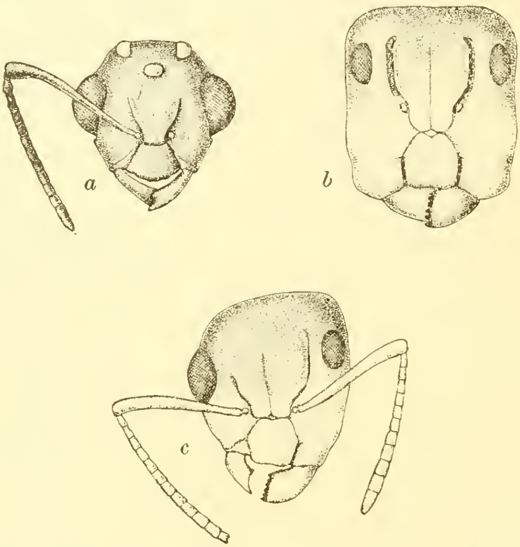

Fig. 2. *Camponotus* (*Colobopsis*) *albocinctus* Ashmead. *a*, head of male; *b*, of soldier; *c*, of dinergandromorph.

traces of ocelli. As the thorax, petiole, gaster and legs are in all respects like the corresponding parts of a normal though small soldier the internal reproductive organs are, in all probability, those of a normal soldier, *i. e.* of the abortive female type.

I have not seen the worker of *C. albocinctus* but there can be no doubt that as in other species of the subgenus it has a small head, more rounded, less rectangular and narrower in front than in the soldier, with less convex mandibles and the clypeus shaped more as in the male. The species of *Colobopsis* are peculiar in having sharply marked soldier and worker forms, whereas in other subgenera of *Camponotus* the workers are polymorphic, *i. e.* form a more or less evenly graded series from maximal to minimal individuals. To my knowledge this is among ants the only known gynandromorph that exhibits an unmistakable combination of male and soldier characters. In other cases the male characters are combined either with the worker or with the female. Even the lateral gynandromorph of *Camponotus ligniperda*, described and figured by Klapálek,[1] represented a combination of the male and worker minor.

The dinergatandromorph of *C. albocinctus* seems to me to be very significant in connection with the previously known thirty Formicid gynandromorphs and the *Lasius latipes* described above.[2] It is evident that the male characters may be combined not only with the female as in the gynandromorphs of other animals, but also with the soldier and worker. And although the latter are abortive females, they nevertheless behave in combination with the male like entities quite as distinct and independent as the fertile female. This suggests that the worker and soldier are not products of nutrition but are germinally predetermined. In other words, it would seem that in ants with male, female and worker castes, we must postulate three, in species with a soldier caste, four different kinds of eggs. This view is also supported by the following considerations: first, Bugnion and Miss Thompson have shown that in termites, which have developed castes surprisingly like those of ants, the soldiers, workers and sexual forms can be recognized as distinct *on hatching from the egg;* second, embryological study has shown that the insect egg is the most precociously specialized of all animal ova, so specialized, in fact, that not only the anterior and posterior poles but also the dorsal and ventral and right and left sides of the organism that is to arise from it are morphologically predetermined even before the extrusion of the polar bodies; and third, artificial castration has shown that operations on the primary sexual characters of young insect larvæ fail to disturb the development of the secondary sexual characters and instincts.

[1] Obojetnik Camponotus ligniperdus Latr. Sitzb. Böhm. Ges. Wiss., 1896, 4 pp., 2 figs.; Wheeler, Some New Gynandromorphus Ants, with a Review of the Previously Recorded Cases. Bull. Amer. Mus. Nat. Hist. 19, 1913, p. 675, Fig. 11.

[2] Reviews of the known cases are given in my papers: Some New Gynandromorphous Ants, etc., *loco citato*, pp. 653–683, 11 figs. and Gynandromorphous Ants Described during the Decade 1903–1913. Amer. Natural, 48, 1914, pp. 49–56.

All these considerations point to the conclusion that in such very ancient and extremely specialized organisms as insects, sex and caste peculiarities have been impressed on the organization of the very young egg and are not determined by fertilization or by the incidence of trophic stimuli during larval development. I was, therefore, led in my first paper on the ant gynandromorph to postulate its origin from a pair of fused oöcytes. The difference between the various types of gynandromorphs—lateral, frontal, mosaic, blended, etc.—was supposed to be due to the differences in the two kinds of ova, the plane of their fusion, regulatory tendencies that would avoid reduplication of organs, and differences in growth in the component ova or their parts to account for such cases of imperfect lateral gynandromorphs, as *e. g.* that of the *Camponotus albocinctus* described above, in which the male is so much smaller than the soldier component. My views have been treated as rankly heretical by Boveri[1] and his pupil, Fräulein Elsa Mehling,[2] but Cockayne,[3] who has recently made a comprehensive study of Lepidopteran gynandromorphs, while pointing to certain defects in my hypothesis, remarks that "it explains better than any other how in heterochroic gynandromorphs the areas occupied by the two colors and two sexes are identical. "He also mentions with approval the fact that "Doncaster has recently suggested that a gynandromorph is produced by the fertilization of each of the nuclei of a binucleate ovum by a separate spermatozoon. He has proved the existence of these binucleate ova and has actually proved the conjugation of a separate spermatozoon with each and seen the resultant mitoses." I should, of course, regard such a binucleate ovum as the first result of the fusion of two ova. The hypothesis of Boveri and Fräulein Mehling, according to which the gynandromorph arises from an egg in which one of the two first cleavage nuclei unites with a sperm, is disproved, according to Cockayne "by the existence [in certain Lepodoptera] of perfect halved gynandromorphous hybrids both sides of which show equal admixture of the characters of both parents." Morgan has more recently endeavored to account for gynandromorphs

[1] Ueber die Entstehung der Eugsterschen Zwitterbienen Arch. Entwickl. Mech. Org. 41, 1915, pp. 264–311, 2 pls.

[2] Ueber die Gynandromorphen Bienen des Eugsterschen Stockes. Verhandl. phys. med. Ges. Würzburg 43, 1915, pp. 173–236, 8 pts.

[3] "Gynandromorphism" and Kindred Problems. Journ. Genet. 5, 1916, pp. 75–129, 5 pts.

in *Drosophila* as due to a lagging sex-chromosome. As a full account of his researches has not yet been published, I am unable to undertake the task of harmonizing it with what I conceive to be the conditions in the Formicidæ.

A MALFORMED *LEPTINOTARSA DECEMLINEATA*.

By C. L. Metcalf,
Ohio State University.

The two accompanying illustrations show an interesting and peculiar malformation of a specimen of the Colorado potato beetle. The specimen was collected by Mrs. Cleo F. Metcalf at Orono, Maine, August 17, 1916. It was taken in company with many normal individuals feeding upon potato. Unfortunately its peculiar condition was not noted until it had been killed. A prolonged search failed to reveal any other specimens in any way abnormal. The chief purpose in describing it here is to record for the curious naturalist, who does not lack a sense of humor, a freakish, though not uncomely, product of one of nature's sportive moods.

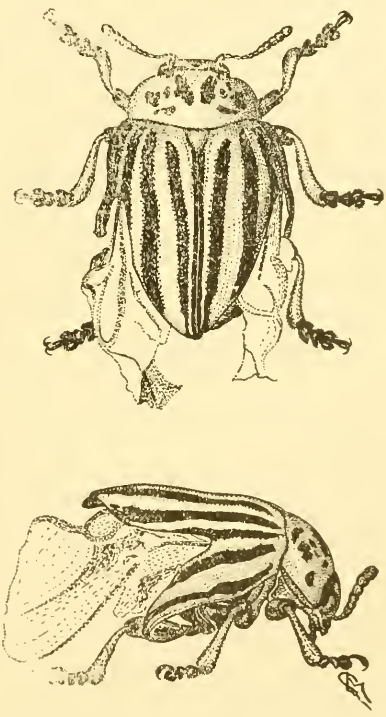

Fig. 1. Malformed *Leptinotarsa decemlineata*, showing anomaly in structure and pattern of the elytra; below, same in lateral view. About three times natural size.

The visible abnormality consists of a deep, V-shaped excision of each elytron extending from the apex to about the basal third of the normal elytron. The elytra are a little foreshortened; the middorsal line is nearly straight in side view; and the usual convexity covering the tip of the abdomen is entirely wanting, leaving the abdomen exposed from behind.

The two forks of the elytron formed by the excision are unequal, the median fork being about twice as wide at base and somewhat longer. The lateral fork is bent sharply ventro-laterad and is sinuate, its tip especially curving away from the excision. The apex of the excision is broadly rounded; its sides are convex inward.

The color markings are as little disturbed as could well be,—the black suture and five black stripes on each elytron being readily recognizable. The first and second stripes run nearly their full length. The third runs a little mediad of the apex of the excision, shows a slight tendency to fork to the outer prong, and margins the inner prong about halfway to its apex, gradually attenuating to a point. Its course is such as not to encroach upon the normal width of the intervening yellow stripe. The second and third stripes do not, therefore, unite toward the apex as in the typical individual. The fourth black stripe has a slightly different position on the two elytra. On the left it runs just laterad of the apex of the excision margining the outer prong with black, within, almost to its apex; gradually narrowing. On the right elytron the fourth stripe curves abruptly about three millimeters from the humerus, eluding the margin of the excision over its basal half, thence terminating in normal width; after which the margin is again yellow. The fifth stripe runs about a normal course with respect to the margin of the elytron. This stripe and the yellow interval between it and the fourth stripe are somewhat abnormally widened about mid-length.

The most noteworthy feature of the insect is the very close symmetry of the two malformed elytra. Besides the slight difference in the course of the fourth stripe, the only discrepancy is in the length of the elytra at the suture; the left one exceeds the right by about a half millimeter.

It is interesting to speculate as to the probable cause of such development. Mere mechanical injury or pressure would seem to be an inadequate explanation, unless presumed to occur at a very early stage. The close similarity of the anomaly in the two wings seems to me to point to a deep-seated, physiological disturbance, the nature of which I am entirely unable to conjecture.[1]

It is unfortunate that the specimen was not noted in time to make possible extensive observations of its behavior, and that an examination of the internal structures of the fresh specimen was neglected. The specimen is in the collection of the writer.

[1] See Brues, Charles T., The Structure and Significance of Vestigial Wings among Insects. Biol. Bull., Vol. IV., No. 4, March, 1903, pp. 179–190.

NEW SPECIES OF THE GENUS VILLA (*ANTHRAX*).

By Charles W. Johnson,
Boston Society of Natural History, Boston, Mass.

In my work on the Dipterous fauna of New Jersey and New England, two species of this genus have been the source of considerable misgivings. One has been associated with *Anthrax morio* as a possible variation. The other was determined by the late D. W. Coquillett as *Anthrax lepidota* O. S. The former is quite widely distributed, while the latter, as far as known, is confined to "pine barrens" of New Jersey. The following diagnoses are given, pending further studies and figures of our eastern species.

Villa webberi sp. nov.

♂ ♀. Face and front black, with blackish pile and sparse yellowish tomentum, antennæ black, the style about as long as the three joints taken together. Thorax and scutellum black, pile black, longer and more dense on the pleura, brown in front and whitish on the posterior angles. Abdomen black, pile blackish, white on the sides of the first, second and sixth segments. A sparse yellowish tomentum (easily denuded) is present on most of the segments, especially along the posterior margins. Legs yellowish, front and middle femora, except the tips, and all of the tarsi, dark brown, tomentum yellowish, spines black. Halteres black, tips of the knobs whitish. Wings about half black and half hyaline. The irregular dividing line crossing the following cells: marginal just before the tip of the first vein, near the basal fourth of the first submarginal, and basal third of the first posterior, middle of the discal, basal angle of the third posterior, basal fourth of the fourth posterior, middle of the anal and basal third of the axillary cell. Length of holotype 6 mm., allotype 9 mm., paratypes vary from 5 to 10 mm.

Twenty-one specimens. Holotype, Lunenburg, Mass., June 3, 1914 (R. T. Webber); allotype, Great Barrington, Mass., June 16, 1915, and four paratypes, Mt. Ascutney, Vt., July 11, 1908, Bennington, Vt., June 21, 1915, Brookline, Mass., June 17, 1918, and Darien, Conn., June 10, 1912 (C. W. Johnson), in the collection of the Boston Society of Natural History. The other paratypes, Brookline, Mass., June 17 (C. W. J.), Lunenburg, Mass., June 5 to 25

(Webber), Montreal, Can., June 11 (Chagnon), Ottawa, June 14 (Bro. Germain), Canada and Kentucky (Mus. Comp. Zoöl.), and near Lander, Wyo., June (Roy Moodie) are in the collections of the Museum of Comparative Zoölogy, McGill Univ., Ottawa Museum, Gipsy Moth Laboratory and the author.

Readily separated from *A. morio* by the less amount of black, which in *morio* covers about two-third of the wing, filling nearly all of the anal and axillary cells, and a slightly larger proportion of the other cells. In the color of the wings it resembles more closely *A. bigradata* Loew and *A. edwardsi* Coq., but lacks the light colored pile characteristic of those species.

Villa lepidotoides sp. nov.

Anthrax lepidota Johnson (*non* Osten Sacken) Smith's Insects of N. J. Ann. Rept., N. J. State Museum, 1909 (1910), p. 746.

♂. Head black, with sparse yellow tomentum and black hairs, antennæ black. Thorax and scutellum black, with golden yellow tomentum, on the sides between the humeri and wings. The tomentum is longer and whitish, on the pleura yellow. Abdomen black, first and base of the second and fourth segments broadly banded with white; tomentum, the extreme posterior edges of which are yellowish, the last two segments with yellow tomentum and black hairs. Legs black, with sparse yellowish tomentum, the rows of spines on the posterior tibiæ conspicuous, on the front and middle tibiæ absent. Halteres brown with a yellowish-white knob. Wings hyaline with about one-third of the anterior dark brown, the line between the brown and hyaline crossing the following cells: near the extreme tips of the costal, outer two-thirds of the marginal, near the base of the first submarginal and first posterior (forming small squares of brown at the base of each), basal fourth of the discal and fourth posterior and middle of the anal cell. This leaves all of the second submarginal, the second and third posterior and the axillary cell hyaline. A subhyaline spot is present near the end of the second basal cell. Length, 5 mm. One specimen, collected by the late Erich Daecke, at Iona, Gloucester Co., N. J., June 16, 1902. Type in the author's collection.

Similar to *A. lepidota* O. S. from Mexico and Southern California, but readily separated by the yellow tomentum of the thorax and scutellum and the three bands of whitish tomentum on the abdomen. The venation also differs, the veins forming the outer portion of the submarginal cell are less sinuous, the anterior branch of the third vein reaching the margin at the tip of the wing and not before the tip. The fifth vein forming the posterior margin of the discal cell is also less curved. The brown extends slightly further into the first and fourth posterior cells giving the margin a trilobed appearance.

Villa bigradata (Loew).

Anthrax bigradata Loew, Cent., viii, 37, 1869.

A specimen from Muskeget Island, Mass., June 18, 1913, collected by Dr. G. M. Allen, and a specimen from Provincetown, Mass., June 13 (Webber), can only be referred to this West Indian species. Coquillett records it from Califronia. This distribution is interesting, though not unusual as several members of this family have a similar or much wider distribution.

SYNCHRONOUS MOVEMENTS IN *VANESSA ANTIOPA* LARVÆ, WITH NOTES ON THE ATTRACTION OF CERTAIN MALE LEPIDOPTERA BY THE FEMALES OF THEIR OWN SPECIES.

By Fred H. Walker,
Salem, Mass.

About the middle of last April, while taking my regular Sunday morning walk along a favorite woodland path, I saw a *Vanessa antiopa* depositing her eggs on a willow sapling. I broke off the twig with the eggs attached, carried them home and placed them in a breeding cage. The larvæ appeared in 17 to 18 days, went through the regular course of feeding and moulting and the latter part of May developed into a fine brood of over one hundred full-grown caterpillars. One evening a few days before pupation began, the cages (the colony had been divided and now occupied two cages) were brought out to the light for the purpose of putting in fresh food for the occupants, one cage being set on top of the other. The cages were partially filled with small willow branches, and the caterpillars were scattered all over the cages, some on the top and sides and others on the leaves and branches.

After they had been in the light a few minutes, I noticed that each and every caterpillar was moving its head up and down with a sort of a twitching motion, in perfect synchronism. These movements occurred at intervals of about two seconds and continued for about five minutes after they were first noted; I cannot say that I saw the beginning of this performance, but all the caterpillars in both cages were moving their heads vigorously when first noted, and at the end the movements stopped gradually until all were at rest. The following night I prepared to resume my observations, this time placing the cages about ten feet apart, but on this occasion during an hour's vigil no movement took place and the second day afterward pupation began.

Professor Edward S. Morse of Salem and others have observed and recorded the synchronous flashing of thousands of fireflies[1] which would not seem to be simply accidental considering the large numbers involved. In conversation with Mr. A. P. Morse of Wellesley, he said that if his recollection was correct, he had seen when a boy synchronous movements in a colonial black and yellow larva on oak, probably a species of Anisota; also in Datana (probably *ministra*) on black walnut; and in a green and black sawfly larva on gray birch.

In my observations on the *Vanessa antiopa* larvæ the movements doubtless signified alarm and were possibly protective, but why the alarm shown but once after several weeks of the same routine and then the perfect synchronism in both cages? By a process of elimination in regard to the known sensory equipment of insects, I get no satisfactory results; a floor of wood and tin precludes the use of sight organs, not the least sound could be detected and the slender legs of the upper cage were the only material path excepting the air through which vibrations could be transmitted.

The theory of vibratory communication would seem the most probable, and if it were known that insects could transmit as well as receive vibratory impressions, it would explain many things. Folsom says of insects:

"They have many curious integumentary organs which from their structure and nerve connections are probably sensory end organs, though their functions are either doubtful or unknown. Such an organ is the sensillum placodeum—function doubtful;

[1] *Science*, July 26, 1918, pp. 92–93.

not auditory and probably not olfactory, though the function is doubtless a mechanical one."

Before passing from mechanical considerations, it should be noted that the telephone receiver and transmitter are practically of the same construction, and while rejecting any electrical influence, if insects are equipped with means for receiving vibrations, it may also be possible for them to transmit them.

In the matter of the attraction of the males of certain species of moths by the females at apparently long distances, Fabre notes that the male moths came with the wind at one time, and that the reflux of scented atoms in a direction contrary to the aerial current seems inadmissible.

I have tried the experiment of fastening a female *turnus* butterfly to a twig with varying results. On one occasion during the summer of 1917 I captured what appeared to be a freshly emerged specimen of this species and even before the act of securing it to a leaf was completed, the males began to arrive and I took about twenty specimens in a short time. They came from many directions, sometimes varying greatly from a direct line but always reaching the goal. If I remember correctly a light air was stirring, the butterflies coming with the wind as well as against it. The sense of smell was doubtless the controlling factor for a limited distance, as however erratic the flight at a distance the course was direct in the last few rods.

Smell concerns matter and it is difficult to conceive of the divisibility of matter to such an extent as to fill the air with scent atoms unperceived by the human sense of smell particularly against the wind or in the absence of perceptible air currents except for limited distances. Fabre[1] endeavored to mask or stifle any possible effluvia emanating from his female moths by surrounding them with various noxious odors but apparently without the slightest effect, the males arriving in undiminished numbers and without hesitation.

In strict justice to the case of *Sympathetic Vibratory Communication* vs. *The Sense of Smell*, I shall have to testify for the defendant in so far as to say that a female dog belonging to a neighbor at certain times seemed to attract the males from all directions regardless of air currents; and her only known external vibratory organ had been amputated in infancy.

[1] Life of the Caterpillar, pp. 275, 276.

Postscript. Since writing the above paper, Mr. A. P. Morse has called my attention to an article in the American Museum Journal of February, 1918, p. 145, by Mr. W. L. McAtee who quotes Mr. E. A. Goldman of the U. S. Biological Survey mentioning a curious instance of synchronal insect movements: "When looking among the tree tops for birds, he has been taken unawares by an army of these (driver) ants. The soldiers of the driver ants have tremendously developed heads and jaws; their bite brings blood and they hang on till the heads are pulled off. The most interesting feature of their attack is the remarkable unanimity with which they set their teeth (?) into the skin. Whether they accomplish this by mental telepathy or otherwise, the fact remains that several ants scattered here and there over one's anatomy all decide to bite at one particular moment."

It may be that the action of the pulse was the stimulating influence that caused the ants to bite Mr. McAtee all at the same moment. Prof. W. M. Wheeler writes me: "There is doubt in my mind about McAtee's interpretation of the simultaneous biting of the soldiers of the driver ants. It may be merely a simultaneous response to the movement of the body of the person covered with ants. Such a movement of the skin would act as a stimulus and cause all the irritated ants to use their mandibles at the same moment. I have a feeling that I have noticed something of the kind in the tropics in other ants."

NEW RECORDS OF ORTHOPTERA IN NEW ENGLAND.

By Albert P. Morse.
Wellesley College, Wellesley, Mass.

Parcoblatta lata Brunner. This common native wood-roach of more southern range (formerly placed in genus Ischnoptera) has been taken in New England in a single instance. It was captured by me on July 13 on the ground floor of a dwelling-house at Wellesley, Mass., and identified and recorded by Hebard, who regards it as adventive in New England.

Manomera blatchleyi Caudell. An adult female of this walking-stick was taken by me at Greenwich, Conn., August 25, 1892, and laid eggs after capture. An immature female was taken at the same place and time.

Amblycorypha floridana carinata Rehn and Hebard. Half a dozen examples of this northern race of a southern katydid are recorded by Rehn and Hebard from Nantucket and Woods Hole, Mass.

Scudderia curvicauda borealis Rehn and Hebard. This is a diminutive boreal race of our common Curve-tailed Bush-Katydid. I took a very few examples at Orono in central, and Cherryfield and Whitneyville in eastern Maine, August 5 to 30, 1913. These were found among shrubbery on cold, heath-grown bogs.

Conocephalus spartinæ Fox. This brightly-colored little long-horned grasshopper is locally abundant on saltmarshes along the New England coast. Fox described it from Woods Hole, Mass. I took it years ago at Stamford and Niantic, Conn.; at Faneuil Station, Mass., before the construction of the Charles River Basin and the freshening of the marsh at that point; and more recently at Rowley, Mass., and York Beach and Pine Point near Old Orchard, Me. It is in the Scudder collection from Cape Cod. It thus agrees closely in extent of distribution in New England with the Seaside Locust, *Trimerotropis maritima.*

Conocephalus saltans Scudder. Locally common on the sandy moors of Nantucket, Mass., among bunchgrass (Andropogon scoparius), wild indigo (Baptisia tinctoria), and huckleberry bushes. The presence of this flightless grasshopper on Nantucket is of especial significance in its bearing on the geological conditions which resulted in the dispersal and present distribution of the characteristic plants and animals of the sandy coast-plain of New Jersey northeastward.

Diestrammena marmorata DeHaan. This Asiatic cave- or camel-cricket has established itself from time to time in greenhouses and cellars nearly all over the world. It has been sent me from Kennebunk, Me., and Springfield, Mass., and I have taken it in numbers at Danvers, Mass., a locality first called to my attention by the late Rev. H. W. Winkley.

Ceuthophilus gracilipes var. *stygius* Scudder. A male, taken at Beverly, Mass., is in the collection of the Boston Society of Natural History.

Ceuthophilus neglectus Scudder. (Diagnostic note.) This species differs from all our other New England species in the structure of the abdomen of the male and can usually be recognized at once by the yellowish color of the underparts, and the following points: the ninth tergum is usually completely hidden by the crescentically thickened parabolic hind margin of the eighth tergum; the subgenital plate is also distinctive,—short, scoop-shaped, with thickened, semicircular, nearly horizontal margin.

Nemobius griseus E. M. Walker. I have taken this cricket sparingly on sandy tracts at Brunswick, Me., Provincetown, and South Sudbury, Mass., in September.

Nemobius maculatus Blatchley. Mr. B. H. Walden has sent me this species from New Canaan, Conn., taken in September.

Gryllotalpa vulgaris Latreille. I found three examples of this, the common European mole-cricket, in the collection of local insects of the Maria Mitchell Scientific Association at Nantucket. They were without data but believed to have been taken on the island. This is highly probable, since another European orthopteron, a flightless bush-katydid, *Leptophyes punctatissima*, has been captured there by Prof. H. T. Fernald. Both species were doubtless introduced in commercial importations of plant material from Europe, such as Scotch broom, pines, and heather.

Acrydium granulatum incurvatum Hancock. This is the western broad-shouldered form of our common Angulate Pygmy or Grouse Locust. Mr. C. W. Johnson has taken examples at Capens and Sugar Island, Moosehead Lake, Me., in July.

Acrydium hancocki Morse. This robust ally of our common Ornate Pygmy Locust, described from and common in Iowa, I took at Randolph, N. H., in July, 1898, and in the summer of 1913 found it at Fort Kent, Fort Fairfield, and Houlton, Me., August 24 to 28.

Acrydium arenosum angustum Hancock. This Pygmy Locust is well-distributed in New England. I have taken it at various points from Cherryfield in eastern Maine, and Newport in northern Vermont, to Nantucket, Mass., and New Haven, Conn.

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Notices not to exceed four lines in length concerning exchanges desired of specimens or entomological literature will be inserted free for subscribers, to be run as long as may be deemed advisable by the editors.

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Wanted: Insects of the family Embridæ (Scoptera). I would give insects of any order except Lepidoptera. I would like to correspond with persons interested in this family.—Raoul M. May, 2202 W. 10th St., Los Angeles, California.

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Wanted: 19th Illinois Entomological Report; Coleoptera of Southern California, by H. C. Fall; Notes on Lachnosterna of Temperate North America, by J. B. Smith; Complete Works of Thos. Say, Le Conte edition.—J. S. Wade, U. S. Bureau of Entomology, Washington, D. C.

Wanted for cash: Lowest representatives of all families of insects, preserved in fluid.—G. C. Crampton, Amherst, Mass.

Wanted: Living larval material of Tabanidæ, obtainable by sifting the soil at edge of water.—Packing in wet material, not water, each larva separate. Will send collecting outfit. Exchange insects of any order, or cash.—Werner Marchand, 10 Dickinson St., Princeton, N. J.

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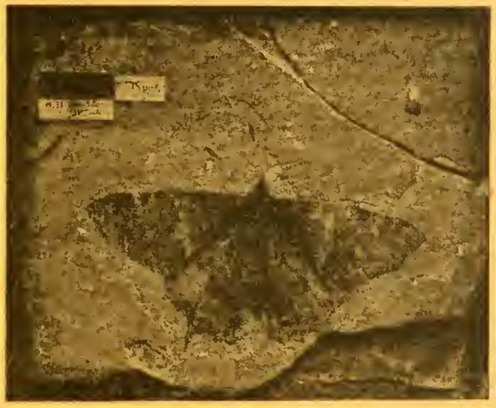

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A LIST OF THE ORTHOPTERA OF NEW ENGLAND.

By Albert P. Morse,

Wellesley College, Wellesley, Mass.

Eighteen years ago Mr. S. H. Scudder published in this journal a briefly annotated list of the Orthoptera of New England (Psyche, Vol. 9, September, 1900, pp. 99–106) enumerating 98 species, and on page 119 following added six more from data supplied by Mr. Samuel Henshaw.

Since that date much work has been done upon the group, greatly increasing the number of species known from New England and changing their scientific nomenclature. In a Manual of the New England Orthoptera soon to be published I have enumerated 130 species from the district. The following list is intended to serve as a short memorandum of these.

Order DERMAPTERA,—Earwigs.

1. Maritime Earwig, *Anisolabis maritima* Géné.

Nearly cosmopolitan. Introduced and established at various points on our seabord, living as a scavenger among the shingle and sea-wrack at or near highwater mark. Hibernates as an adult. Eggs laid in summer. Reported from Maine, Massachusetts, Rhode Island, and Connecticut.

2. Ring-legged Earwig, *Euborellia annulipes* Lucas.

Introduced. Taken in slaughter-house at Brighton, Mass., Feb. 1909 (A. P. M.), and by Walden among shipments of plants in Connecticut.

3. Little Earwig, *Labia minor* Linné.

Generally distributed and probably occurs in small numbers throughout New England. Has been captured from May 25 to Nov. 4 under various circumstances, in gardens, manure-heaps, and fungi. Nocturnal, flying at dusk, and to lights in evening.

4. Brown Earwig, *Prolabia arachidis* Yersin.

Introduced. Taken in sugar refinery at Boston in 1889 (Henshaw) and in Brighton slaughter-house, Feb. 1909 (A. P. M.). In New England occurs only under artificial conditions.

5. European Earwig, *Forficula auricularia* Linné.

Introduced from Europe. Established at Newport, R. I., and vicinity. Has been taken also at Kingston, R. I., and in brown-tail moth nests imported with parasites at Melrose, Mass.

6. *Spandex percheron* Guerin et Percheron.

One example of this species (t. Hebard, Notes, Entom. news, xxviii, 323, 1917) is recorded from New England. The record is based on a badly mutilated specimen in the Harris collection, taken in Boston or vicinity, which was described as new by Scudder under the name of *Spongophora bipunctata* (Boston journ. nat. hist., vii, 415, 1862).

Order ORTHOPTERA, Family Blattidæ, Cockroaches.

Native Species (*Ischnoptera* auct.).

7. Common, or Northern, Wood-Roach, *Parcoblatta virginica* Brunner.

Common under bark, boards, stones, etc., in June and July, less so in August. Males fly freely to light; females are wingless. Orono, Me., Hartland, Vt., and southward.

8. Uhler's Wood-Roach, *Parcoblatta uhleriana* Saussure.

Much less common than the preceding but frequently seen in eastern Massachusetts and recorded from Marthas Vineyard and Connecticut. Habits and seasons same as preceding.

9. Pennsylvanian Wood-Roach, *Parcoblatta pensylvanica* DeGeer.

Scarce or rare in eastern New England, locally plentiful on shore of Lake Champlain. Found under boards and stones from June 5 to October. Recorded from Prout's Neck, Maine, Sherborn and Winthrop, Mass., Mt. Carmel, Ct., South Hero, Vt.

10. Broad Wood-Roach, *Parcoblatta lata* Brunner.

Adventive from further south. One example taken at Wellesley, Mass., July 13, 1916, in dwelling-house (A. P. M.).

Introduced Species which have established themselves for longer or shorter periods.

11. German Roach, Croton-bug, *Blattella germanica* Linné.

Domiciliary. Probably occurs throughout New England under artificial conditions of constant heat, moisture, and food, in houses, shops, etc. Adults and young at all seasons. Locally abundant if not checked.

12. Oriental Roach, *Blatta orientalis* Linné.

Much less common than the preceding; found under the same conditions.

13. American Roach, *Periplaneta americana* Linné.

Locally plentiful under the same conditions as the preceding but less generally established. Our largest common roach.

14. Australian Roach, *Periplaneta australasiæ* Fabricius.

Occasionally becomes established in greenhouses, etc. Taken in Maine, Massachusetts, and Connecticut.

15. Surinam Roach, *Pycnoscelus surinamensis* Linné.

Remarks under preceding apply equally well to this. Recorded from Massachusetts and Connecticut.

Exotic species from West Indies, Central or South America, introduced with tropical fruit; adventive, liable to occur at any time or in any place where such merchandise is unpacked.

16. *Nyctibora lævigata* Beauvois ("*sericea*" of authors).

Female, Orono, Me., May 16, 1889, bananas (Me. exp. sta.). Female, Manchester, N. H. (Miss Susy C. Fogg). Male, Boston, Mass., Feb. 20, 1887 (F. H. Sprague). Natick, Mass., summer, 1901, fruit store (A. P. M.). Female, Springfield, Mass., Aug. 17, 1898 (C. Ladd). Wellesley, Mass., fall, 1899,—nymph, recorded by Scudder (List, Psyche 1900, 100) as "*Eurycotis*, possibly *finschiana* Sauss."

17. *Nyctibora noctivaga* Rehn ("*holosericea*").

Wellesley, Mass., Jan. 15, 1904, bananas; adult. Young in various stages: Dalton, Mass., Jan. 2, 1899 (E. A. Halle). Hyde Park, Mass., Oct. 1, in house (Miss M. E. Cherrington). Framingham, Mass., May 25, in store (C. A. Frost). Newtonville, Mass., June 12, 1916 (A. W. Wilcox).

18. *Eurycotis opaca* Brunner.

Female, Orono, Me., June 18, 1909 (Me. exp. sta.).

19. *Eurycotis tibialis* Hebard.

Female, Orono, Me. ? (Me. exp. sta.).

20. *Epilampra maya* Rehn.

Female, Woodstock, Vt., August, 1911 (Hugh Morgan). Female, Framingham, Mass., April 10, 1914, bananas in grocery store (C. A. Frost).

21. Green Roach, *Panchlora cubensis* Saussure.

Female, Augusta, Me., 1906 (U. S. N. M.). Orono, Me., 1892, in tropical fruit (Me. exp. sta.). Woodstock, Vt. (A. P. M.). Boston, Mass., Dec. 26, 1878, flying in store (M. C. Z.); Framingham, Mass., Aug. 1, 1914 (C. A. Frost); Melrose, Mass., June 17, 1914 (F. W. Dodge); Salem, Mass., Aug. 1, 1890, Aug. 12, 1917; Stoneham, Mass., Nov. 15, 1915 (C. V. Blackburn); Wellesley, Mass., Dec. 12, 1894, on window; Jan. 9, 1918, bananas (A. P. M.).

22. Green Roach, *Panchlora exoleta* Burmeister.

Salem, Mass., June 7, 1884, probably in bananas (Peabody Museum).

23. *Hormetica advena* Scudder.

One female, Belmont, Mass. (type). Native country unknown.

Family Phasmidæ, Walkingsticks.

24. Northern Walkingstick, *Diapheromera femorata* Say.

Not uncommon locally, usually in deciduous shrubbery, in southern New England. Known from South Bridgton, Me. (Me. exp. sta.), Manchester, N. H., and Sudbury, Vt., southward, from late August till October.

25. Blatchley's Walkingstick, *Manomera blatchleyi* Caudell.

One adult female, one immature, Greenwich, Ct., Aug. 25, 1892 (A. P. M.).

Family MANTIDAE, Praying Mantids.

26. Carolina Mantis, *Stagmomantis carolina* Johannsen.

Reported by Mr. Samuel Henshaw from Rhode Island, many years ago, through Prof. Packard. Probably adventive or introduced, as it does not naturally live within a long distance of our border.

27. Chinese Mantis, *Paratenodera sinensis* Saussure.

Introduced several times into Connecticut and Massachusetts but has not established itself.

28. European Praying Mantis, *Mantis religiosa* Linné.

Introduction of this species into Connecticut by egg-masses from the colony at Rochester, N. Y., was once attempted but they failed to hatch.

Family TETTIGONIIDÆ,—Katydids, Green Grasshoppers, Cave-crickets, etc.

29. Oblong-winged Katydid, *Amblycorypha oblongifolia* DeGeer.

Common in vines, shrubbery, and coarse weeds in Connecticut, less numerous in eastern Massachusetts, and recorded from southern New Hampshire. Mid-August to October.

30. Carinate Florida Katydid, *Amblycorypha floridana carinata* Rehn et Hebard.

Half-a-dozen examples are recorded from Nantucket and Woods Hole, Mass., and it will probably be found in Connecticut. Frequents bushes and weeds.

31. Round-winged Katydid, *Amblycorypha rotundifolia rotundifolia* Scudder.

Common in southern New England in grass and low bushes in August and September. It is reported from as far north as the White Mountain region.

32. Northern Bush-Katydid, *Scudderia septentrionalis* Serville.

Very rare. Has been taken in Maine and eastern Massachusetts in July and August on undergrowth in woods.

33. Texan Bush-Katydid, *Scudderia texensis* Saussure et Pictet.

Common in swampy ground from July till October. Recorded from Norway, Me., Seabrook, N. H., eastern Massachusetts, and throughout Connecticut.

34. Broad-winged Bush-Katydid, *Scudderia pistillata* Brunner.

A boreal species common in low shrubbery throughout New England. July till September.

35. Curve-tailed Bush-Katydid, *Scudderia curvicauda curvicauda* DeGeer.

Very common in shrubbery in southern New England and extending northward to middle Vermont and southwestern Maine (Fryeburg). July to September.

35a. Northern Curve-tailed Bush-Katydid, *Scudderia curvicauda borealis* R. et H.

A northern race of the preceding, a few examples of which I have taken in eastern Maine in cold heath-grown bogs, in August.

36. Fork-tailed Bush-Katydid, *Scudderia furcata furcata* Brunner.

Very common in tall grasses, bushes, and shrubbery, from July till October, from southern Maine and New Hampshire southward.

37. European Short-winged Bush-Katydid, *Leptophyes punctatissima* Bosc d'Antic.

Three examples of this species have been captured on Nantucket. It was doubtless introduced with commercial importations of plant materials but whether it still survives is unknown.

38. The Katydid, True Katydid, *Pterophylla camellifolia* Fabricius.

Arboreal, frequenting oak trees especially. Common locally in Connecticut and warmer parts of Massachusetts in September and October.

39. The Sword-bearer, *Neoconocephalus ensiger* Harris.

Our commonest cone-head, known from Norway, Me., southward. Late July till September. In grasslands, wild and cultivated.

40. Robust Cone-head, *Neoconocephalus robustus robustus* Scudder.

Common coastwise from Cape Cod southward, in sand-grass, and cat-tail marshes. August and September.

41. Round-tipped Cone-head, *Neoconocephalus retusus* Scudder.

Common, locally at least, in southern Connecticut in tall grass in meadows. August to October.

42. Unmusical Cone-head, *Neoconocephalus exiliscanorus* Davis.

One example is recorded by Walden from New Haven, Ct. It is said to be locally common in the vicinity of New York from August onward.

43. Broad-tipped Cone-head, *Neoconocephalus triops* Linné.

Two adventive examples of this southern species have been taken in Massachusetts in houses in winter, introduced with spinach greens from the south.

44. Larger Meadow-Grasshopper, *Orchelimum vulgare* Harris.

Very common in southern New England and probably occurring throughout. Prefers tall grasses and dense weedy jungles on moist or wet ground. July till October.

45. Bruner's Meadow-Grasshopper, *Orchelimum gladiator* Bruner.

In the same haunts as the preceding but less common in southern New England.

46. Dusky-faced Meadow-Grasshopper, *Orchelimum concinnum* Scudder.

Locally common in the coarse vegetation of tidal runways of coastwise saltmarshes in southern New England. Recorded from Rye Beach, N. H., vicinity of Boston, and Connecticut, from July 22 to Sept. 6.

47. Slender Meadow-Grasshopper, *Conocephalus fasciatus fasciatus* DeGeer.

Abundant in damp grasslands throughout New England from late July till October.

48. Short-winged Meadow-Grasshopper, *Conocephalus brevipennis* Scudder.

Very common in weedy jungles and dense grass in most of New England from late July till hard frost. Recorded from Eastport, Me., and Jefferson, N. H., southward.

49. Saltmarsh Meadow-Grasshopper, *Conocephalus spartinæ* Fox.

Locally abundant in short grasses of coastwise saltmarshes. Known from Old Orchard, Me., southward.

50. Wingless Prairie Grasshopper, *Conocephalus saltans* Scudder.

Common among low shrubs and tufts of bunch-grass on the sandy moors of Nantucket. August and September.

51. Long-legged Shield-bearer, *Atlanticus americanus* Saussure, and

52. Short-legged Shield-bearer, *Atlanticus testaceus* Scudder.

Scarce. Our two Shield-backed Grasshoppers live in dry woodlands, bushy pastures, etc., where they may be found crawling slowly over the dead leaves, or perhaps stridulating from some bush. Adults are recorded from the vicinity of Boston, Cape Cod, Marthas Vineyard, Connecticut, and Sudbury, Vt., from late July till October. A third species possibly occurs in western New England.

53. Asiatic or Greenhouse Cave-cricket, *Diestrammena marmorata* DeHaan.

Introduced into greenhouses and cellars in several parts of New England. It multiplies rapidly and quickly becomes abundant. I have received examples from Kennebunk, Me., Danvers and Springfield, Mass. Adults and young throughout the year.

Native Cave-crickets, *Ceuthophilus* spp.

Our native cave-crickets, stone-crickets, or camel-crickets are usually found under bark, boards, stones, etc., or in cellars and holes during the day, emerging at night in search of food. Adults are most numerous out-of-doors in late summer and fall, but hibernating examples are not rare in favorable conditions. The genus needs thorough collecting in liquid preservative and complete revision.

54. Spotted Cave-cricket, *Ceuthophilus maculatus* Harris.

Our commonest camel-cricket, probably found throughout New England. Gregarious, under stones, logs, and in cellars.

55. Yellow Cave-cricket, *Ceuthophilus neglectus* Scudder.

Probably throughout New England in woodlands. Recorded from Jackman, Me., Plymouth, Vt., eastern Massachusetts, and Connecticut.

56. Woodland Cave-cricket, *Ceuthophilus neglectus* Scudder.

A common species in cool, moist woodlands and forests in Vermont and New Hampshire.

57. Short-legged Cave-cricket, *Ceuthophilus brevipes* Scudder.

Rare. Recorded from Grand Manan, N. B., and North Madison, Ct.

58. Black-sided Cave-cricket, *Ceuthophilus latens* Scudder.

Walden has taken this species at Lyme, Ct., under stones, in August.

59. Pale-footed Cave-cricket, *Ceuthophilus lapidicola* Burmeister.

(*C. pallidipes* E. M. Walker.)

Not common. Reported from New Haven, Ct., and Wellesley, Mass.

60. Slender-legged Cave-cricket, *Ceuthophilus gracilipes* Haldeman.

Captured in cellars and under bark of fallen trees in Connecticut by Walden in August and September. Half-grown young in cave at New Ashford, Mass., Dec. 22, (G. M. Allen). An example of the variety *stygius* Scudder has been taken at Beverly, Mass.

Family Gryllidæ, Crickets, Tree-crickets, Mole-crickets.

61. Common Field-cricket, *Gryllus assimilis* Fabricius.

Very common throughout New England especially in sandy areas. June till heavy frost. In southern New England a few nymphs hibernate.

62. Striped Grass-cricket, *Nemobius fasciatus fasciatus* DeGeer.

Abundant everywhere, probably throughout New England, in grasslands. July till late fall.

63. Sand Cricket, *Nemobius griseus* E. M. Walker.

Known in small numbers from sandy districts in Maine, Massachusetts, and Connecticut. August and September.

64. Little Spotted Cricket, *Nemobius maculatus* Blatchley.

New Canaan, Ct., Sept. 11, B. H. Walden. Extra-limitally it is said to live in low open woods in damp places.

65. Sphagnum Cricket, *Nemobius palustris* Blatchley.

Locally common in sphagnum-bogs at Orono, Me., in eastern Massachusetts and Connecticut. September and October.

66. Cuban Ground-cricket, *Nemobius cubensis* Saussure.

Doubtfully present in small numbers in Connecticut. A few specimens have been taken which seem to intergrade with the preceding.

67. Carolina Ground-cricket, *Nemobius carolinus* Scudder.

Locally common throughout New England. Damp soils, edges of woodlands, stream-sides, etc. August to November.

68. Snowy Tree-cricket, *Oecanthus niveus* DeGeer.

Recorded from vicinity of Portland, Me., and common throughout southern New England in shrubbery near houses, orchards, gardens, etc., from late August till October. Observation of its song should greatly extend its known range.

69. Narrow-winged Tree-cricket, *Oecanthus augustipennis* Fitch.

This species has been taken near Boston, Mass., and at various points in Connecticut between Aug. 14 and Oct. 20. It frequents orchards and fruit trees and even low thickets of sweetfern.

70. Davis's Tree-cricket, *Oecanthus exclamationis* Davis.

Recorded by Walden from trunks of trees, near New Haven, from August to October. On Long Island it is found on bur oak.

71. Four-spotted Tree-cricket, *Oecanthus quadripunctatus* Beutenmüller.

Widely distributed and locally abundant in southern New England, extending north as far at least as Woodstock, Vt., Hoxies and Brunswick, Me. Lives in weedy thickets of wild carrot, Joe-Pye-weed, raspberry bushes, etc. August till October.

72. Dusky Tree-cricket, *Oecanthus nigricornis* Walker.

Found in same places as last and nearly as common. Inhabits all the New England States.

73. Pine Tree-cricket, *Oecanthus pini* Beutenmüller.

Said to live only in pine-trees. Reported from Gloucester, Cape Cod, and Marthas Vineyard, Mass.

74. Two-spotted Tree-cricket, *Neoxabea bipunctata* DeGeer.

Known in small numbers from Connecticut: New Canaan, New Haven, and Portland, Aug. 14 to Sept. 11.

75. Striped Bush-cricket, *Anaxipha exigua* Say.

Walden reports this species at Westbrook, Ct., living in tangled vegetation on and near saltmarshes.

76. *Hapithus vagus* Morse.

An adventive exotic species which maintained itself for several years in the greenhouses of the Botanic Garden at Cambridge, Mass.

77. American Mole-cricket, *Gryllotalpa hexadactyla* Perty.

Probably occurs throughout New England but is very local and difficult to capture. Lives in meadows, along streams and about ponds, burrowing in the turf and muddy shores. Its call might easily be mistaken for that of a small frog.

78. European Mole-cricket, *Gryllotalpa vulgaris* Latreille.

Reported from Nantucket, where it was doubtless introduced with importations of plants from Europe. Whether established or not remains to be proved.

79. Pygmy Mole-cricket, *Tridactylus apicalis* Say.

Lives on and in the damp sand on the edges of ponds and streams. Recorded from Connecticut, and from Cambridge, Winchester, and Nantucket, Mass. Adults were common at the last-named locality on July 13; a few nymphs were found on the same date and on Sept. 10.

Family Acrididæ, Locusts.

Subfamily Acridinæ (Tryxalinæ *auct.*).

80. Bunch-grass Locust, *Pseudopomala brachyptera* Scudder.

Common locally in coarse grasses, especially *Andropogon scoparius*, on wild and uncultivated lands from southwestern Maine, southern New Hampshire and Vermont southward, including Marthas Vineyard and all of Connecticut. July to September.

81. Velvet-striped Locust, *Eritettix simplex* Scudder.

Rare. Walden records it from several points in southern Connecticut on light dry soil with but little vegetation, such as abandoned fields and dry pastures. Adults are recorded on Oct. 31 and from May 25 to June 30. They apparently hibernate.

82. Bicolored Locust, *Dichromorpha viridis* Scudder.

Common in southern New England (except southeastern Mass.) from late July onward, often locally abundant in Connecticut. Most plentiful in damp pastures and mowing-lands in dense succulent grass. It has decidedly increased in numbers in the vicinity of Boston within the last twenty-five years, apparently spreading northeastward.

83. Pasture Locust, *Orphulella speciosa* Scudder.

Found throughout the Transition and Austral areas of New England from Grand Lake Stream, Orono, and Norway, Me., southward, including Nantucket and Marthas Vineyard. Common locally, abundant southward. Generally distributed on dry soils. Adults appear early in July and are common until October.

84. Spotted-winged Locust, *Orphulella pelidna* Burmeister.

Widely distributed over southeastern third of New England on sandy soils. Abundant southward, especially coastwise, but unknown as yet from north of Massachusetts. Adults begin to appear a little later than the preceding species.

85. Saltmarsh Locust, *Orphulella olivacea* Morse.

Locally plentiful on saltmarshes on the Connecticut shore. Known from New Haven, Stratford, Stamford, and Greenwich, from August 11 to 28. Continued collecting coastwise will probably greatly extend dates of capture and New England distribution record.

86. Sprinkled Locust, *Chlœaltis conspersa* Harris.

Locally common throughout New England from late June onward, particularly in July in bushy pastures and along the edges of woodlands. Eggs are laid in wood-stumps, boards, rails, etc.

87. Meadow Locust, *Chorthippus curtipennis* Harris.

Common, often abundant locally, throughout New England. In damp places, meadows, saltmarshes, brooksides, ditch borders, wherever there is a thick and succulent growth of herbage. Adults from early June till mid-November.

88. Striped Sedge Locust, *Mecostethus lineatus* Scudder.

Locally plentiful in cold wet sedge meadows and bogs, probably throughout New England, at all elevations from sea-level to the summit of Katahdin. Adults have been captured from July 21 to Oct. 6.

89. Northern Sedge Locust, *Mecostethus gracilis* Scudder.

In the same habitats as the preceding but restricted to the northern tier of States and high elevations in Massachusetts. Locally common, July 12 to Sept. 6 and probably later.

90. Broad-winged Sedge Locust, *Mecostethus platypterus* Scudder.

A rare species having the same haunts as *lineatus*, recorded as yet (in New England) only from Sherborn, Mass., and Thompson, Ct., in August. It probably inhabits at least the southern half of New England.

Subfamily Œdipodinæ, Band-winged Locusts.

91. Autumn Yellow-winged Locust, *Arphia xanthoptera* Burmeister.

Locally common in dry pastures from late July to November in the warmer parts of the Transition zone, from middle New Hampshire (Scudder) southward, including Nantucket and Marthas Vineyard.

92. Spring Yellow-winged Locust, *Arphia sulphurea* Fabricius.

Common and widely distributed in dry bushy pastures and wild land in spring and early summer, from May till August. It is probably found throughout New England, though as yet not recorded from north of Deering and Norway, Me., Berlin Falls and Hanover, N. H. The young are active on warm days in winter.

93. Green-striped Locust, *Chortophaga viridifasciata* DeGeer.

Generally distributed throughout New England in pastures and mowing-lands. Adults appear in mid-April and linger till frost, though most plentiful from May till July; rarely, freshly matured individuals are seen in the fall. The young are plentiful and often conspicuous in their haunts on warm days in winter.

94. Dusky, or Clouded Locust, *Encoptolophus sordidus* Burmeister.

Common, often abundant, in weedy fields and pastures from late July till November. Inhabits the warmer parts of New England from Orono, Me., southward.

95. Clear-winged Locust, *Camnula pellucida* Scudder.

Dangerously abundant locally in dry fields and pastures throughout northern New England, maturing in June and active till late in the fall. It occurs in small numbers as far south as northeastern Massachusetts, northeastern and middle western Connecticut.

96. Coral-winged Locust, *Pardalophora apiculata* Harris.

Common throughout New England, especially in bushy pastures and wild land, from mid-April to July. Found from Nantucket to summit of Mt. Washington. The young hibernate and may frequently be found in mid-winter.

97. Wrinkled Locust, *Hippiscus rugosus* Scudder.

Recorded from Norway, Me., and eastern Massachusetts many years ago. No specimens have been taken in New England recently. It should be looked for in July and August on the sandy coastal plain.

98. Carolina Locust, Black-winged Locust, *Dissosteira carolina* Linné.

Very common throughout the Transition and Austral parts of New England on the bare soil of roads, gravel-pits, vacant lots, pastures, and sea-beaches, from early July till late in the fall.

99. Collared Locust, Scudder's Waste-Land Locust, *Spharagemon collare scudderi* Morse.

Common, even plentiful locally, in sandy districts in southern New England from Brunswick, Me., Ossipee and Manchester, N. H., and Vermont, southward to Nantucket, Marthas Vineyard and southern Connecticut. July till October.

100. Boll's Locust, *Spharagemon bolli* Scudder.

Generally distributed throughout the Transition and Austral areas of New England. Semi-sylvan, inhabiting bushy pastures on upland soil. July till October.

101. Ledge Locust, *Spharagemon saxatile* Morse.

Common on exposed ledges in eastern Massachusetts and throughout Connecticut, from July till October.

102. Marbled Locust, *Scirtetica marmorata* Harris.

Locally common in sandy tracts in southern Connecticut, Marthas Vineyard, the Cape Cod district (Dennis, Provincetown), and has been taken at Manchester, N. H. (Fogg). July till October.

103. Sand Locust, Long-horned Locust, *Psinidia fenestralis* Serville.

Very common and widely distributed on wind-blown sand, along the coast, inland river-beaches, sand-pits, dune areas, etc. Recorded from Brunswick and Norridgewock, Me., No. Conway, N. H., Grand Isle, Vt., and many localities in Massachusetts, Rhode Island, and Connecticut. June till November.

104. Seaside Locust, *Trimerotropis maritima* Harris.

Very common on sandy sea-beaches and adjoining dune areas from Old Orchard, Me., southward. Has been taken inland only at North Haven, Ct. July till November.

105. Snapping Locust, Broad-winged Locust, *Circotettix verruculatus* Kirby.

A boreal species, very common in the Canadian zone and extending southward at least as far as Gloucester and Palmer, Mass., Colebrook and Canaan, Ct. It frequents exposed rocks and ledges, and to a less extent bare earth and roadsides as well. July till October.

Subfamily Locustinæ (Acridiinæ), Spine-breasted Locusts.

106. American Locust, *Schistocerca serialis* Drury.

Does not usually breed in New England, but stray individuals occasionally reach southwest Connecticut by flight. A colony was found at Wollaston, Mass., in 1883 by F. H. Sprague.

107. Rusty Locust, Leather-colored Locust, *Schistocerca alutacea* Harris and

107a. *Schistocerca alutacea rubiginosa* Scudder.

Common locally from Manchester, N. H., southward in the coast-plain area of Massachusetts, Rhode Island, and Connecticut.

The unstriped form (*rubiginosa*) is more usual in the north and on upland stations; the striped form (*alutacea*) along the southern coast and in grassy swamps. Adults have been taken from Aug. 5 till Oct. 30.

108. White Mountain Wingless Locust, *Podisma glacialis glacialis* Scudder.

A strictly boreal species, locally common from sea-level in eastern Maine to subalpine thickets on the highest mountains of New England. It is found in shrubby thickets in cold bogs, moist woodlands, and at timber-line on mountains. Adults from July till September. It is found on the summits of Greylock Mt., Mass., Ascutney Mt., Vt., Chocorua and Pequaket, N. H.; bogs at Umbagog Lake, Orono, Cherryfield, and Roque Bluff, Me.; and many other points north of these.

109. Swamp Locust, *Paroxya clavuliger* Serville.

Locally common in swamps and marshes (both salt and fresh) of southern New England from vicinity of Boston southward. July till October.

110. Purple-striped Locust, *Hesperotettix brevipennis brevipennis* Thomas.

Rare and local. Has as yet been taken at but three points in New England: Wellesley, Dover, and Walpole, Mass., in bunch-grass (Andropogon scoparius). July till September.

111. Lesser Migratory Locust, *Melanoplus atlanis* Riley.

Dangerously abundant throughout New England, sometimes doing severe injury locally. Most plentiful on sandy loam. June till November.

112. Yellow-striped Locust, *Melanoplus bivittatus* Say.

Common throughout New England from sea-coast to mountain-top, frequenting especially the rank vegetation of meadows and springy runs. Sometimes does much injury locally. June to November.

113. Red-legged Locust, *Melanoplus femur-rubrum* DeGeer.

Probably our most generally distributed and injurious "grass-hopper," though sometimes outnumbered by *atlanis*. Prefers damper situations than *atlanis*. July to November.

114. Northern Locust, *Melanoplus borealis* Fieber.

A boreal species common from northern Massachusetts northward. Frequents the dense grass of moist meadows, bogs, sedgy swamps and mountain-tops. June to September.

115. Little Locust, *Melanoplus confusus* Scudder.

Common in grassy fields and pastures on sandy loam, from June till August, probably throughout the Transition and Austral areas of New England. Known from Fryeburg, Me., Jackson, N. H., Woodstock, Vt., and southward.

116. Broad-necked Locust, *Melanoplus luridus* Dodge.

A common, widely distributed, semi-sylvan species, appearing in late July and active till the ground freezes. Bushy pastures, edges of forests, open woodlands. Probably occurs throughout New England.

117. Pine-tree Locust, *Melanoplus punctulatus* Scudder.

Scarce, almost rare, but sometimes common locally, usually associated with groves or trees of white pine, on which it lives. The eggs are laid in holes made by borers in the trunk or bark. Recorded from Brunswick, Me., No. Conway, N. H., Vermont, and southward. Late July to November.

118. Banded Locust, Huckleberry Locust, *Melanoplus fasciatus* Walker.

Widely distributed and common locally, often in huckleberry thickets on sterile soil, from the sandy moors of Cape Cod and Nantucket to the highest mountain summits. June till September.

119. Dawson's Locust, *Melanoplus dawsoni* Scudder.

Rare in New England; known only from Manchester, N. H., Brunswick, and one other locality in southwestern Maine, and in the coarse grasses of dry fields among pitch pines on gravelly soil. July to September.

120. Smith's Locust, *Melanoplus mancus* Smith.

Widely distributed but very local. Found from eastern Maine to southern Connecticut, frequenting dwarf blueberry thickets on dry mountain summits and hill-tops. Dates of capture range from Aug. 8 to Sept. 6; these will probably be much extended by further collecting.

121. Scudder's Short-winged Locust, *Melanoplus scudderi* Uhler.

Locally common in southern New England in brushy thickets in August and September. It has been taken at Springfield and Wareham, Mass., and New Haven, Ct.

122. Green-legged Locust, *Melanoplus viridipes* Scudder.

Mr. C. W. Johnson has taken this species at five points along our western border: Bashbish Falls, Great Barrington, and Williamstown, Mass., Mansfield and St. Albans, Vt., all in June. It was found among low shrubby thickets on dry upland soil.

123. Large-headed Locust, *Phœtaliotes nebrascensis* Scudder.

Only one example is known from New England. This was taken at Needham, Mass., Aug. 23, 1908, in an abandoned field on sandy loam. The species is common in the West.

Subfamily Acrydiinæ, Pygmy Locusts (Tettiginæ, Grouse Locusts).

All the Pygmy Locusts hibernate in the adult stage. They rest on the bare earth instead of perching on vegetation.

124. Crested Pygmy Locust, *Nomotettix cristatus cristatus* Scudder.

Found everywhere on light soils, such as dry pastures and mowing-lands, probably throughout New England; abundant locally. Adults occur throughout the year but are most plentiful in April, May, and October.

125. Angulate Pygmy Locust, *Acrydium granulatum granulatum* Kirby.

Common throughout New England on the moist earth of meadows, especially on sandy soil, and the margins of swamps and streams. Adults are most numerous in April, May, August, and September.

125a. Broad-shouldered Angulate Pygmy Locust, *Acrydium granlatum incurvatum* Hancock.

A form described from the West, four examples of which have been taken at Moosehead Lake and in the alpine zone of the White Mt. region.

126. Ornate Pygmy Locust, *Acrydium ornatum ornatum* Say.

Lives in wet meadows and damp spots on upland soils throughout New England. Generally distributed, sometimes very common locally. Most numerous in spring and fall months.

127. Hancock's Pygmy Locust, *Acrydium hancocki* Morse.

Known from Randolph, N. H., and northern Maine, in July and August. Taken on damp spots on roadsides and in fields.

128. Obscure Pygmy Locust, *Acrydium arenosum angustum* Hancock.

Widely distributed and common locally from eastern Maine and northern Vermont southward. Found in the same haunts as the Ornate Pygmy Locust.

129. Hooded Pygmy Locust, *Paratettix cucullatus* Burmeister.

Common, even abundant locally, in Connecticut in late August. Lives as far north as Alstead, N. H., in the Connecticut valley, and is recorded by Scudder from the vicinity of Boston. It frequents the shores of ponds and streams, resting on sand, mud, or stones.

130. Sedge Pygmy Locust, *Tettigidea lateralis parvipennis* Harris.

Wet, sedgy meadows, springy runs, etc., throughout New England, in every month of the season. Common, sometimes plentiful, especially on sandy loam.

NOTES ON SOUTH AFRICAN PHORIDÆ (DIPTERA).

By Charles T. Brues,

Bussey Institution, Harvard University.

Dr. L. Peringuey of the South African Museum at Cape Town, recently sent me several specimens of Phoridæ belonging to the Museum collections, one of which is of considerable interest.[1] This is the female of the genus Conoprosopa which proves to be almost completely wingless and very highly modified. There is also a very distinct species of Paraspiniphora which is here described.

[1] Owing to the conditions brought about by the war and the impossibility of publishing the Annals of the South African Museum at the present time, Dr. Peringuey has kindly given me permission to have this short note published in an American journal.

Paraspiniphora armipes sp. nov.

♀. Length 4 mm. Black; head, except ocellar space, antennae, fourth segment of abdomen, apex of fifth and ovipositor bright ferruginous; palpi orange yellow; legs pale brownish yellow, the hind femora lined above with black; wings with a pale brownish cast, the venation dull piceous; halteres, extreme postero-lateral corners of mesonotum and extreme base of wing, including veins yellowish white. Front very slightly higher than broad, its bristles strong; post-antennal pair approximate, strongly reclinate; lower row strongly curved downward medially, the median pair considerably further from one another than from the laterals which are well removed from the eye; upper row straight, on the median line twice as far from the lower row as from the ocellar one, consisting of four equidistant bristles, the lateral ones close to the eye; surface of front with scattered minute hairs. Post-ocular cilia much enlarged at upper two-thirds. Cheeks each with a pair of large bristles directed downward and a single small one at the level of the antenna. Antennæ small, oval; arista less than twice as long as the front. Palpi large and stout, with strong bristles; proboscis heavily chitinized, hard and shining, as large as one of the palpi. Mesonotum rather elongate, its surface shining; one pair of dorsocentral bristles set at the posterior margin with a series of six small bristles forming a row between them; scutellum short and broad, with four large, equal bristles. Propleura hairy, with a pair of bristles near the base of the coxa and another pair below the spiracle; remainder of pleuræ bare except for an area of hairs on the mesopleura anteriorly above. Abdomen bare, except at apex, with the second segment distinctly, but not greatly elongated. Legs rather stout, the posterior femur about one-third as broad as long; front tibia with a bristle at the basal third and a series of five minute, but very distinct ones just before apex; middle tibia with a series of five bristles on the hind edge, the first near the base and the last almost at apex, also with two serial bristles externally near base and with a patch of comb-like hairs near apex; hind tibia with a series of four or five bristles along the hind edge beginning at the basal fifth and extending to the apical third; just outside these with a series of six, four on the basal half and two on the apical half; then with a third series of four on the front edge (*i. e.*, next the femur extending from just before the middle to the apical fourth; in addition with two spurs and an apical spine opposite these. All the tibial spines stout, but not very long. Wings large, but rather narrow; costal vein extending to the middle, with extremely minute, hair-like bristles; first section nearly four times as long as the second and third together; third vein with a single bristle at the base; fork of third vein scarcely perceptible as the second lies very close to it; fourth vein close to the costal margin, slightly curved on basal half and recurved equally toward apex; following veins straight, the seventh long. Halteres pale yellow.

Type from Durban, Cape Colony (Marley), April, 1915. Type in the South African Museum.

In the armature of the tibiæ this species differs from any other hitherto described from any part of the world and will be readily recognized by these characters alone.

Conoprosopa Becker.

1909 Bull. Mus. Hist. Nat. Paris, p. 113.
1910 Brues, Psyche, Vol. 17, p. 34 (*Coryptilomyia*).
1911 Becker Ann. Soc. Ent. France, Vol. 29, p. 30.
1912 Enderlein, Stettiner Ent. Zeit. p. 51 (*Metopotropis*).
1912 Brues, Psyche, Vol. 19, p. 135.

As indicated in the last reference above *Conoprosopa*, *Coryptilomyia* and *Metopotropis* are synonymous and the three type species are probably also identical. These three were all described from the male which is of very peculiar structure, particularly in the form of the head. The female has remained unknown,[1] but was presumably to be found not markedly different from the male. A pair taken *in copula* shows the female to be an almost wingless, highly modified, cockroach-like form similar to the females of several genera known from various parts of the world. Of none of the latter is the male definitely known although Platyphora of Europe and America is probably the male of Ænigmatias known also from these continents. Of Ænigmatistes, Ænigmatopæus Thaumatoxena, etc., from Africa only the apterous females are known.

[1] The sex of the types was mistaken by Enderlein and myself.

The female of Conoprosopa is most nearly similar to Ænigmatistes described from British East Africa by Shelford in 1908[2] and if the male should prove to be similar to that of Conoprosopa, the two might perhaps be considered as congeneric. *Conoprosopa* differs quite markedly from *Ænigmatistes* in the broader head which is much more closely applied to the thorax and to a lesser degree by its smaller antennal cavities and form of the lower side of the head. From Thaumatoxena, which it resembles more closely in the form of the head and thorax it differs in the multisegmented abdomen and the dorsal position of the antennal cavities.

A most interesting note accompanies the present specimens stating that when the pair was captured the male was carrying the female between its legs and flying about a lamp.

In the description that follows, I have used the specific name *armigera* as I am sure the male is identical with this species, although, as mentioned above, the three species of the genus are probably not distinct. In the latter case *C. scutellata* Becker would be the older name.

Conoprosopa armigera Brues (Fig. 1.).

Psyche, Vol. 17, p. 35 (1910) (*Coryptilomyia*) ♂.

Female. Length 2.2 mm. Broadly oval, much flattened, about half as wide as long, wings represented by minute, finger-shaped vestiges. Head seen from above crescentic and closely applied to the thorax; anterior margin sharply carinate, front and vertex sloping down rather sharply, without macrochætæ; face gently convex, almost horizontal, broadly curved behind and forming the underside of the head; its width about a fourth greater than its length; its lateral angles, which form the anterior corner of the antennal cavities, sharply and acutely angled. Antennæ small, the third joint rounded, with a bare arista; antennal cavities not visible from above, and the antennæ projecting but slightly, a part of the third joint being visible from above near the hind angle of the head. Palpi very short, bare, their tips visible from below between the antennæ and front coxæ. Eyes small, oval, placed at the extreme lateral angles of the head, not visible from below; thorax

[2] Journ. Linn. Soc. Zool., Vol. 30, p. 150

consisting of one segment,[1] very much widened behind and with nearly straight sides; prothoracic spiracles large, on the upper surface, not far from the anterior margin, but well removed from the sides; wing pads about half as long as the sides of the thorax,

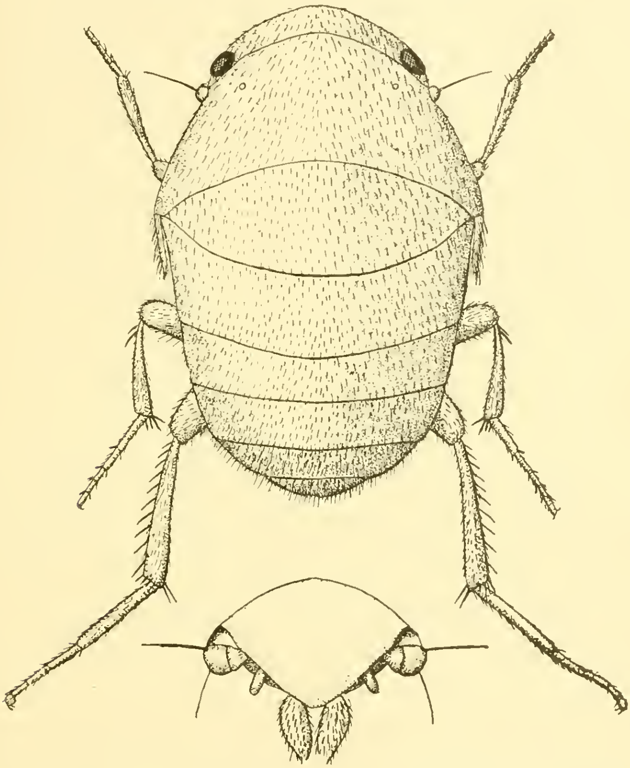

Fig. 1. *Conoprosopa armigera* Brues, female. Dorsal view and front view of head.

heavily chitinized at the base and along the anterior margin, but hyaline apically behind; clothed with fine hairs. Abdomen with six visible segments, the first nearly as long medially as the thorax, but contracted to a point laterally; second somewhat shorter and

[1] There is some doubt in my mind as to whether I have interpreted correctly the segmentation of the body. Shelford has considered the thorax of Ænigmatistes as consisting of three segments, but as all the wingless female Phoridæ of more normal body shape have the thorax much reduced, I assume such to be the case with Conoprosopa. Enderlein takes the same view in regard to Oniscomyia.

not narrowed laterally, with its margins strongly arcuate, but nearly parallel; third and fourth each only a little more than half as long as the second and but little narrower; fifth and sixth shorter and suddenly narrower. Legs rather short and not very stout; anterior tibiæ without bristles: middle tibiæ each with a pair of unequal bristles at the basal third and with two long spurs and several shorter bristles at the tip; hind tibia with a series of about ten strong bristles externally, about as long as the width of the tibia; these form a single row except at the base where three of them are in a second row anterior to the first one. Color: head, thorax and legs pale brownish yellow, the antennae and palpi lighter; abdomen fuscous, darker laterally and at tip; underside quite decidedly paler than the upper. Described from a single female from Natal, August, 1915. (B. Marley.) In the collection of the South African Museum.

FOSSIL CYNIPIDÆ.[1]

By Alfred C. Kinsey.

The following references to fossil Cynipidæ have been made regularly throughout the literature, but as here indicated no one of the references applies to a description or location of a true gall-wasp.

Schlotheim, E. F., 1820. *Die Petrefactenkunde.* Gotha. Page 43, merely names "Cynips" in a list of fossil insects *known*, mainly from amber.

Presl, J. S., 1822. *Deliciæ Pragenses Historiam Naturalem Spectantes.* Pragæ., Vol. 1, p. 195, has this: "Cynips succinea. Longitudo $\frac{3}{4}$ lineæ. Caput globosum, parvulum, rufescens; antennæ longæ, fere quater longitudine sua caput superantes, evidenter ex articulis minutis æqualibus compositæ. Thorax tergo atro, pectore rufescente. Abdomen ovale, stylo dependens, lucidum, fuscum. Alæ quatuor, anteriores obovatæ, latæ, corpore longiores fere tantum, quantum longitudo abdominis efficit, pellucidæ, inquibus decursus venarum non determinabilis quoniam alæ posteriores subtus jacent; alæ posteriores parum breviores

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 154.

anticis, margine interiori et anteriori longis ciliis obsitæ. Pedes teneri, mediocriter longi. Ab omnibus Cynipsibus hucusque notis longe differens."

This description has been the basis of the most persistent reference to a fossil Cynips. The *Deliciæ Pragenses* is rather rare, so it seems worth copying the description in full. I cannot see that it is possible to refer the above to a particular Hymenopterous family, much less to consider such a vague description as defining a species.

Gravenhorst, J. L. C., 1835. *Die in Bernstein erhalt. inseckt.* Page 92, merely includes "Diplolepis" in the list.

Menge, A., 1856. *Lebenszeichen vorweltlicher, im Bernstein engleschlossener Thiere.* Danzig. Page 25. Number five is described as a wingless animal, a male, with thread-like, 14-jointed antennæ, the 3rd joint incised; at the tip of the abdomen is a rather short projection, somewhat thickened at the tip. This may have been a true Cynipid, but still the description is too brief to define even the family, especially as I have seen a male Belytd with similar antennæ in Baltic amber, together with a wingless female belonging to the same family.

Scudder, S. H., 1886. *Bull. U. S. Geol. Survey, No. 31, p. 98.* Says that the Cynipidæ are "very abundant at Florissant and two or three galls have been obtained there." The Scudder collection is the source of two of the species described in the present paper; the galls are undoubtedly *not* Cynipid, though it is usually useless to attempt to decide on the nature of fossil galls.

Brues, C. T., 1910. *The Parasitic Hymenoptera of the Tertiary of Florissant, Colorado.* Bull. Mus. Comp. Zoöl. LIV, p. 1. Describes Andricus myricæ, a gall on a Myrica leaf. Prof. Cockerell has drawn my attention to the fact that this is obviously a synonym of *Cecidomyia* (?) *pontaniiformis* Cckll. (cf. Bull. Am. Mus. Nat. Hist. 1908, Vol. XXIV, p. 66.)

The species described in the present paper are, then, the first fossil Cynipidæ definitely characterized. It is noteworthy that the three species belong to one genus, or to two very closely related genera. Aulacidea differs from Aylax only in having a closed radial cell, and since only the third species shows that cell, the first two may belong to Aylax. In any event, the relationship of the three is close, which is the more remarkable because their places of origin were widely separated, both geographically and geologically. I expect to publish later data from a study of present-day species of gall-wasps; it points to Aulacidea as the most primitive Cynipid genus. It would be important to know something of the time and manner of origin of the more highly specialized, oak-gall-forming species with their complex biology. A careful search through collections of fossils would likely lead to the discovery of species that might supply further information on that question.

Aulacidea Ashmead

The characters of the first three antennal segments, and the size of the second abdominal segments of all the fossils are Aylax or Aulacidea characters. The straight apical branch of the subcostal vein, and the arcuate first abscissa of the radius shown in two of the species are rare characters among Cynipidæ outside of Aulacidea.

Aulacidea progenitrix sp. nov.

Female. Head: with the 1st and 2nd antennal joints stouter than the following joints, and the last joint longer than the penultimate. *Thorax:* with parapsidal grooves apparent. *Abdomen:* broadly oval, the second tergite half the length and little more than half the depth of the whole abdomen, with three other segments apparent, and the sheaths of the ovipositor extending to the dorsal line. *Length:* 3.5 mm.

Locality: Miocene, of Florissant, Colo.

Type: specimen number 2376 in the Scudder collection of fossils in the Museum of Comparative Zoölogy. (Fig. 1, A.)

This specimen has the head very much distorted, and traces of but fragments of the antennæ, legs, and wings. The second dorsal abdominal plate extends little beyond the dorsal line, and is smaller than in any other species of true Cynipid, likely indicating more primitive relationships.

Aulacidea ampliforma sp. nov.

Male. Head: with filiform antennæ, the second joint stoutest. *Thorax:* with parapsidal grooves apparent. *Abdomen:* broadly oval, the second dorsal plate extending half the length of the abdomen, and on the sides two-thirds to the mid-ventral line. *Wings:* with the apical part of the subcosta straight, the first abscissa of the radius arcuate, the areolet of moderate size; cubitus arising

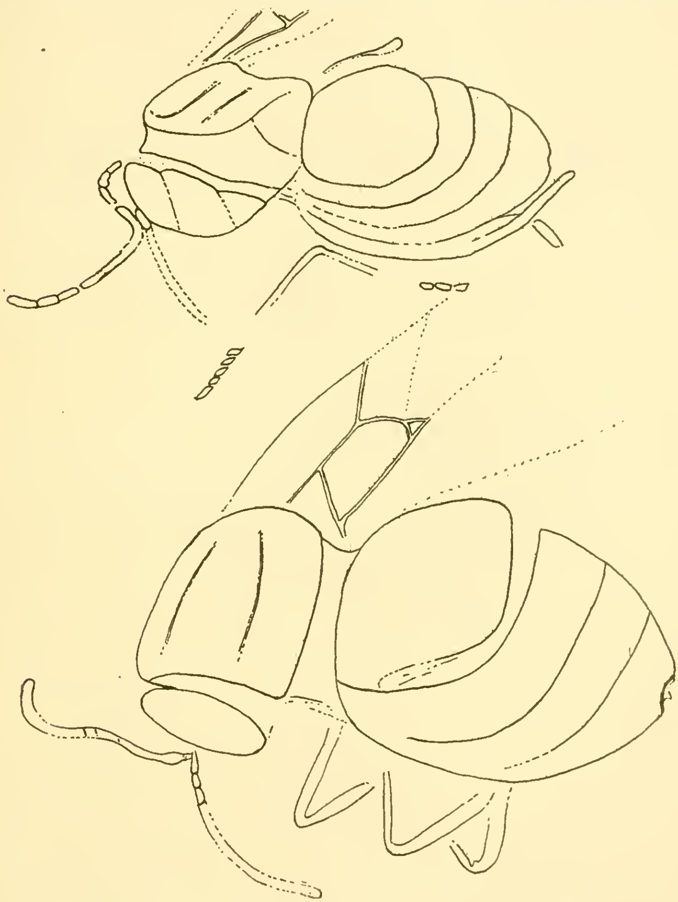

Fig. 1. Above: *Aulacidea progenitrix* sp. nov. Below: *Aulacidea ampliforma* sp. nov.

very much below the middle of the first cross-vein. *Length:* 5.5 mm.

Locality: Miocene, of Florissant, Colo.

Type: specimen number 2063 of the Scudder collection in the Museum of Comparative Zoölogy. (Fig. 1, B.)

This specimen is apparently a male, as indicated by the shape of the abdomen and the absence of hypopygium or ovipositor sheaths. The second dorsal abdominal segment in this species is relatively larger than in *A. progenitrix*, and the insect has a length 1.5 mm. greater than in any other known Aulacidea.

Aulacidea succinea sp. nov.

Female. Head: about as broad as the thorax; palpi 4 (?)-jointed; antennæ 14-jointed, the first joint obconical, elongate, the second globose, the third joint the longest, more slender than and

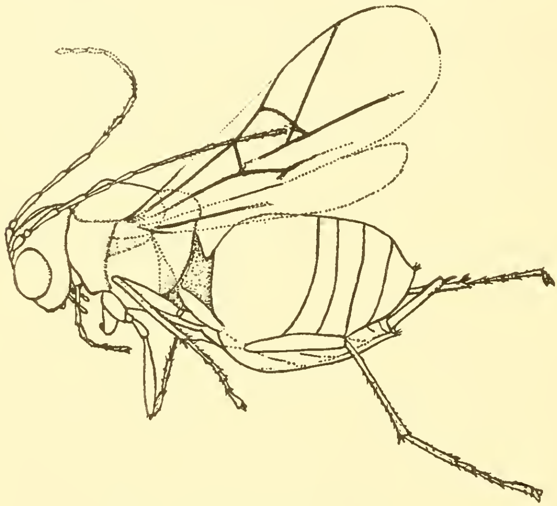

Fig. 2. *Aulacidea succinea* sp. nov.

as long as 1 plus 2, remaining joints diminishingly shorter to the 13th, 14th about as long as the 12th, and with a short pubescence absent only on the basal half of the antennæ; the antennæ originate about on the mid-line of the eyes. *Thorax:* distinct parapsidal grooves extending to the pronotum, converging slightly toward the scutellum; the scutellum longer than wide, with two large, broad, moderately deep foveæ. *Abdomen:* with plates 2–6 visible, the 2nd about one-half the total abdominal length, plates 3–6 subequal in length; hypopygium regular, abruptly ending, the tip pubescent. *Legs:* the tibiæ very slender; 1st tarsal joint almost half the total tarsal length, 4th joint the shortest; claws simple, broad; tarsi pubescent. *Wings:* radial cell slender, closed; apical portion of the subcosta straight; first abscissa of the radius arcuate; cubitus arising distinctly below the middle of the first cross-vein. *Length:* 3.5 mm.

Locality: Oligocene, in Baltic amber.

Type: A single specimen from the collection of the Königsberg Museum, and temporarily at the Bussey Institution, of Harvard University. (Fig. 2.)

This specimen is most remarkably preserved, exhibiting an almost complete set of specific characters.

THE OCCURRENCE OF WINGLESS PHORIDÆ ON THE FIJI ISLANDS.

By Charles T. Brues,
Bussey Institution, Harvard University.

Dr. William M. Mann recently gave me for examination some wingless flies which he reared from dead snails when in the Fiji Islands several years ago. There are numerous specimens of two species, and both appear to be identical with forms described from the Bismarck Archipelago. The first is *Chonocephalus dorsalis* Wandolleck and the second *Puliciphora lucifera* Dahl, of which there is also a winged male. Chonocephalus is known from various localities in the tropics of both hemispheres where it is represented by several species. In addition to the form mentioned, another has been found in the South Seas, *C. depressus* De Meij. from Sumatra, and I have an undescribed one from New Guinea. Puliciphora is represented by numerous species, nearly all confined to the tropics.

It may seem strange that these species should be found on such widely separated islands, but they breed in decaying animal and plant matter of various kinds, in common with some other Phoridæ, and have great opportunities to be distributed on shipboard.

A NEW SUBSPECIES OF *APHAENOGASTER TREATÆ* FOREL.

By William Morton Wheeler.

Aphaenogaster treatæ subsp. **harnedi** subsp. nov.

Worker. Differing from the typical *treatœ* in having the lobe at the base of the antennal scape much shorter and narrower, not more than $\frac{1}{6}$ as long as the scape (about $\frac{1}{5}$ as long in the type), and in sculpture, the thorax, petiole, postpetiole and basal half of the first gastric segment being opaque and densely punctate and the puncturation of the head denser and coarser, so that its occiput and sides are opaque. The petiolar node is less compressed antero-posteriorly, with shorter peduncle, and the postpetiole is more evenly rounded above in profile. The color is like that of the typical *treatœ*, but the head is not infuscated above.

Described from ten specimens taken by Prof. R. W. Harned at Caesar, Mississippi. Seven specimens taken by myself at Denton and Montopolis, Texas and an equal number taken by Father J. Schmitt at Donophan, Missouri, are also referable to this subspecies though they have the lobe of the antennal scapes as long and broad as in the typical *treatœ*, which ranges from South Carolina to Long Island. The var. *ashmeadi* Emery from Georgia and Florida and the subsp. *wheeleri* Mann from Naushon Island, Mass., are darker and the former has very short antennal lobes, a transversely rugose epinotum and opaque, coarsely rugose mandibles, the latter long antennal lobes, coarse, rugulose cephalic and thoracic sculpture and horizontal epinotal spines. Both of these forms have the first gastric segment smooth and shining as in the typical *treatœ* or punctate only at the extreme base. The females of *treatœ* and of the subsp. *wheeleri*, however, have the basal half of the first gastric segment opaque and punctate as in the worker *harnedi*.

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Wanted: Insects of any order from ant nests, with specimens of the host ants, from any part of the world; also Cremastochilinæ of the world. Will give cash or Coleoptera, Hymenoptera and Diptera from the United States.—Wm. M. Mann, U. S. National Museum, Washington, D. C.

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CONTENTS.

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A PROPOSED NOMENCLATURE FOR THE PARTS OF THE POSTERIOR RESPIRATORY APPARATUS OF DIPTEROUS LARVÆ AND A MICRO-PROTRACTOR USEFUL IN THEIR DESCRIPTION.[1]

By C. L. Metcalf

It has been pretty generally recognized that the most serviceable diagnostic character for the specific determination of Dipterous larvæ of certain families is the posterior respiratory apparatus, which varies endlessly in the different genera and species, but appears to be very constant within the species. So superior are the characteristics drawn from this part of the larva, that I regard most descriptions which omit consideration of them as practically worthless. For in most cases the general features of shape, color, etc., may be found to apply almost equally well to other species. The most available, absolutely diagnostic characters are to be found on the posterior stigmata.

This apparatus consists, in many species, of three pairs of spiracles, generally more or less elongate or linear, and a fourth pair of circular structures (usually present) referred to in literature as "buttons" or "circular plates."[2] This respiratory organ varies in the different families, genera and species in height; in width; in extent of elevation above the surface of the segment which bears it; in the ornamentation of the interspiracular spaces (*vide infra*); in length and width of the slit-like spiracles, which may be straight, curved, sinuate or denticulate, and variously arranged with respect to the median line and to each other; in the presence or absence of the circular plate, its position and diameter; and in many other ways.

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 160.

[2] In those rarer cases (as *e. g.*, *Œstris ovis*) where the three pairs of spiracles appear to be wanting, only a part of the following characteristics will be found to be applicable.

The need of a satisfactory and uniform nomenclature of these parts is evident. Mr. Nathan Banks,[1] Mr. M. E. MacGregor,[2] and Professor W. B. Herms,[3] especially, have emphasized the value of these structures with reference to the larvæ concerned in myiasis; the writer[4] has for several years been applying this method to the larvæ of Syrphidæ; and indeed many investigators in recent years, have recognized the necessity of figuring the stigmal plates of the larvæ described in a number of Dipterous families. I have no doubt that many of the groups of amphineustic larvæ can be specifically diagnosed in the same way. In the various publications touching on this subject a variety of terms have been used. It is with the hope of acquiring uniformity of terminology in the various groups and by subsequent investigators that I have herein compiled and described such of these terms as have come to my attention.[5]

The spiracles, together with the adjacent surface of the segment which bears them are called *the stigmal field.* The right and left halves of the respiratory organ, which are especially heavily chitinized, are each called a *stigmal plate.* The diagnostic points of chief importance, so far as my observations have gone are as follows:

(1) *Whether the stigmal plates are sessile* on the caudal surface of the last segment, *or stalked, i. e.,* elevated at the end of a shorter or longer (sometimes tremendously elongate) tube.

(2) *Whether the two stigmal plates are contiguous or separated.*

(3) *If separated, the distance between the plates:* the minimum transverse distance intervening. (MacGregor, Herms.)

(4) *If stalked, or sessile and contiguous, the width of the posterior respiratory organ:* the maximum transverse measurement from lateral margin of one stigmal plate to lateral margin of the other.

(5) *If separated, the width of one stigmal plate* may be more satis-

[1] Banks, N., The structure of Certain Dipterous Larvæ with special reference to those in Human Foods, Bull. U. S. Dept. Agr. Tech. Ser. 22, Jan. 10, 1912.

[2] MacGregor, M. E., The Posterior Stigmata of Dipterous Larvæ as a Diagnostic Character: with Especial Reference to the Larvæ Incriminated in Cases of Myiasis; In Parisitology, Vol. VII, No. 2, June 19, 1914, pp. 176–188, 3 ppl.

[3] Herms, W. B., Medical and Veterinary Entomology, The Macmillan Co., 1915, pp. 259, 260.

[4] Metcalf, C. L., The Syrphidæ of Ohio, Ohio Biol. Sur. Vol. I, Bul. 1, June, 1913; Me. Agr. Exper. Sta. Bul. 253, Oct. 1916; and do Bul. 263, Oct. 1917.

[5] I am indebted to Professor Charles T. Brues for assistance with the literature on this subject.

factorily used, and in this case the easiest measurement to make appears to be the maximum, strictly transverse diameter.[1]

(6) *If stalked, the length of the posterior respiratory organ or tube:* the elevation of the stigmal plates above the general surface of the segment which bears them.

(7) *The height of the stigmal plate or respiratory organ:* the maximum dorso-ventral (sometimes apparently cephalo-caudal) measurement.

(8) *The presence or absence of the circular plate or button.* (Banks.)

(9) *The position of the button, whether on the circumference of the stigmal plate* ("ring" of MacGregor) *or within it.* (MacGregor.)

(10) *The diameter of the circular plate or button:* a strictly transverse measurement through its center.

(11) *The distance between the mesal margins of the two circular plates.*[2]

(12) *The length of the slit-like spiracles.*

(13) *The width of the spiracles.*

(14) *The shape of the spiracles,* which are for convenience of further description named dorsal, median and ventral. It is necessary to note that the several spiracles on the same stigmal plate may vary greatly in shape and it is often necessary to refer specifically to them.[3] See figure 1.

(15) *The ornamentation of the stigmal plate* with spines, tubercles,

[1] Professor Herms (*loc. cit.*) has used "the diameter of the stigmal plate, the space occupied by one stigmal plate on a line drawn through the center of both; (2) length, when slits are absent, the space occupied by a plate on a line drawn dorso-ventrally through the center of the plate; or when slits are present the space occupied by a plate along a line drawn from the lower edge of button (or space if button is absent) through the longest slit (middle slit) to the margin of the plate; (3) width, along a line drawn at the middle of the plate at right angles to the length line." These are so defined as to be a little difficult to measure,—requiring an estimation of such features as "the center of the plate," and a line at right angles to another. They are to this extent apt to lead to error, and will, I believe, be adequately supplanted by the more readily determinable features suggested above in paragraphs 5 and 7.

[2] MacGregor suggests measuring from center to center of buttons, which complicates the matter by necessitating an estimation of the central point of each plate. Point 11, in connection with point 10 will give the same result more easily.

[3] MacGregor (*loc. cit.*) attempts to divide the forms of posterior stigmata into two main types: the *schizotreme*-type especially characterized by possessing three pairs of slit-like spiracles; and the *ptychotreme*-type, possessing instead "a convoluted chain" (*e. g.*, *Musca domestica, Stomoxys calcitrans, Hæmatobia serrata*, etc.). But he, himself, points out that there are usually two ("three," *loc. cit.*, p. 181) breaks in the chain. I think there is no sound basis for such distinction. Both of these forms have three pairs of spiracles; the convoluted spiracle and the slit-like one are fundamentally homologous, differing only in shape; and all possible intermediate grades of convolution and complexity are to be found. In cases of very great complexity, it is true, the spiracles may run together so that it is difficult to determine the limits of each, but I believe such forms have the same origin.

carinæ, simple, branched or plumose hairs, etc. This ornamentation arises usually between the spiracles, and for descriptive purposes, I have numbered these inter-spiracular *spaces*, 1, 2, 3, and 4, beginning with the one mediad of the dorsal spiracle. See figure 1.

(16) *The nature of the delicate chitinous bars crossing the slit-like spiracles* (MacGregor); a point undoubtedly of very great importance, but in many species too difficult of determination to be practically useful.

(17) *The nature of the chitinous ring surrounding the stigmal plate;* whether heavy or light, complete or incomplete; the last condition usually associated with the absence of the button or circular plate (MacGregor).

The most casual student could not but note the great diversity in position of the slit-like spiracles with reference to each other and to the median line of the body. Banks uses in his synopsis of the groups (*loc. cit.*, p. 15) such characters as "slits arranged radially," or "sub-parallel to each other" or "rather transverse to body." MacGregor mentions "the orientation of the stigmata with reference to the . . . longitudinal axis of the larva" and the position of the slits with respect to each other and to the median sagittal plane of the body.

But, so far as I am aware, no attempt has hitherto been made to use for specific description

(18) *The accurately-measured angle of divergence between the several spiracles*, and

(19) *Their divergence from the median line.*

However, from my observations in the Syrphidæ and myiasis-causing species, I am convinced that much more can profitably be made of these points; and in the case of very closely related species, I believe this may at times prove to be the only reliable means of separation. These characters are, of course, available only in those cases where the spiracles are straight, or nearly so, so that their main longitudinal axis is readily determinable.

I was much surprised, when I conceived the notion of using this method of description, that I was unable to find anywhere on the market the apparatus by which such angular measurements could readily be made under the microscope. I finally designed a *micro-protractor*,[1] for use in the ocular of the microscope, by means

[1] Made by The Bausch & Lomb Optical Co., Rochester, N. Y., who guaranteed its accuracy to within half a degree.

of which it is very easy to gauge the angle of divergence of these parts. The micro-protractor (see figure 2) is a simple glass disk, 21 mm. in diameter, ruled in angles so designed and arranged that by using different combinations of adjacent larger and smaller angles as indicated by the concentric lines in figure 2, it is possible to measure very accurately any angle from 5° to 360° by 5° intervals. Even single degrees of divergence may be estimated with considerable accuracy by this method.

In order to use these points it is only necessary to place the quiescent (killed or paralyzed) larva or the puparium under the microscope in such position that the plane of the stigmal plates is perpendicular to the axis of vision. The ocular with the micro-protractor resting on its diaphragm is then revolved until some combination of its measured angles exactly coincides with the angle of divergence of the spiracles to be measured.[1]

The amount of divergence of the dorsal spiracles from each other I have called *angle A* (See figure 1). In cases where the two stigmal plates are widely separated it may be easier to measure the divergence of either dorsal spiracle from the median line and this may be designated $\frac{angle\ A}{2}$. The amount of divergence between the dorsal and median spiracles on either side is *angle B:* that between the median and ventral spiracles on either side is *angle C;* and that of the right and left ventral spiracles from each other is *angle D*. Here again the divergence of a ventral spiracle from the median line may be designated $\frac{angle\ D}{2}$. *In all cases where the outer (peripheral) ends of two spiracles are closer together than their inner (central) ends, the fact is indicated by designating the corresponding angle a minus one.* This is often the case with *angles A* and *D* in the Syrphidæ.

In addition to its use as described above, I believe the micro-protractor may prove useful to biologists in many lines of work where it is desired to measure the angles of microscopic objects.

[1] Whenever it is possible to do so, much better results will be achieved by preparing the stigmal plates with 10 per cent KOH solution, as described by MacGregor and Herms in the papers cited above.

Explanation of Plate I.

Fig. 1. Diagrammatic figure of the posterior respiratory organ of a dipterous larva indicating the several diagnostic characters. *Diameter of circular plate. 1, 2, 3, 4, first, second, third and fourth interspiracular spaces of left stigmal plate. I, II, III, dorsal, median and ventral slit-like spiracles, respectively, of right stigmal plate. IV, the left circular plate or "button."

Fig. 2. The micro-protractor showing arrangement of ruled angles. The various possible combinations from 5° to 360° indicated by the concentric lines.

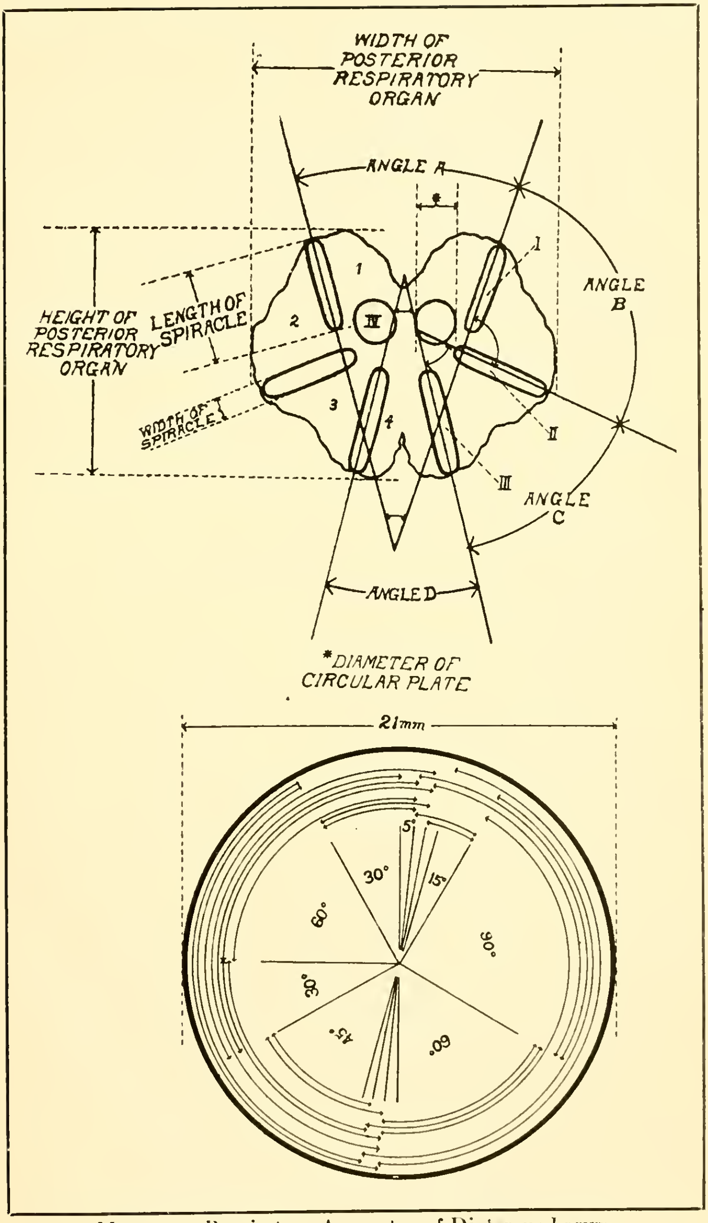
A PHYLOGENETIC STUDY OF THE MESOTHORACIC TERGA AND WING BASES IN HYMENOPTERA, NEUROPTERA, MECOPTERA, DIPTERA, TRICHOPTERA AND LEPIDOPTERA.[1]

By G. C. Crampton, Ph.D.

In several papers dealing with the phylogeny of insects, the Hymenoptera, Neuroptera, Mecoptera, Diptera, Siphonaptera, Trichoptera, Lepidoptera and their allies were grouped in a superorder called the "*Panneuroptera*." A portion of the evidence for such a grouping, based upon the study of the genitalia of males, has already been presented in Psyche, Vol. 25, p. 47, and in the Proc. Ent. Soc. Washington, Vol. 21; and in the present paper, I would briefly review the evidences of relationships indicated by the nature of the mesothoracic terga and wing bases in these insects. The terminology here adopted is that previously applied to the terga and wing bases of the Embiidæ, Plecoptera, Coleoptera and Dermaptera (Psyche, Vol. 25, p. 4), the Blattidæ, Plecoptera and Neuroptera (Jour. N. Y. Ent. Soc., Vol. 24, p. 1), the Orthoptera (Ann. Ent. Soc. America, Vol. 11, p. 347), and the Hymenoptera and Diptera (Jour. N. Y. Ent. Soc., Vol. 22, p. 248).

In the lower insects, the metathorax is subequal in size to the mesothorax, and in a few instances is even larger than the mesothorax. In the insects here considered, however, the mesothorax is usually the larger of the two, and since the metathorax becomes

[1] Contribution from the Entomological Laboratory of the Massachusetts Agricultural College, Amherst, Mass.



Metcalf—Respiratory Apparatus of Dipterous Larvæ.

reduced to a narrow transverse band in the tergal region of the Diptera, I have restricted the present discussion to the mesonotum alone, since it is usually well developed in most of the insects of this group.

In the mesonotum of the insects here discussed, there is a tendency for the prescutum ("psc," Figs. 1, 3, 5, and 6) to become prolonged further backward into the scutal region "sc," thereby becoming longer than broad, while in the lower insects it is frequently broader than long. On the other hand, the scutellum, "sl," which may become very narrow and prolonged far forward into the scutal region, "sc," in such lower insects as the Blattidæ, etc., in the insects here discussed tends to become somewhat broader than long. The mesothoracic postscutellum, "psl," is usually undeveloped in such lower insects as the Blattidæ, Mantidæ, Acrididæ, Dermaptera, Coleoptera, etc., but in the Embiidæ and Plecoptera it is quite well developed, as in the insects under consideration. The mesothoracic tegula "t" is frequently quite large in the insects under discussion, and is usually developed only in the mesothorax, while in the lower forms, it is usually small, or not developed in the mesothorax, although in some cases it may be developed in both meso and metathorax in the lower insects. The sclerite labeled "a" in Figs. 1, 2, 4, etc., is usually not well developed in lower insects, while in many of the higher insects it is quite large, its better development in the latter insects being probably correlated with the superior powers of flight in the higher forms. I have not observed the middorsal suture "ms" in many lower insects (excepting the Plecoptera and Embiidæ), while it appears to be present in many of the higher insects, although it is not present in all of them.

As may be seen from the accompanying diagrams (Plate II) the general plan of the sclerites is relatively simple, and is adhered to quite closely by most of the insects here shown. It is thus a much simpler matter to compare the different insects together in attempting to trace their paths of development than is the case with the wing venation, where the complex and intricate patterns, with their bewildering array of modifications, make it very difficult to trace out the paths of development followed by the different groups of insects, unless one has practically all of the intermediate stages; and even then he may be led astray by the study of only one set of structures, unless it be confirmed by an examination of many others from different parts of the body, since insects which are primitive in respect to one particular feature, may be relatively highly specialized with regard to certain other features, and the same set of structures is not always equally well developed in all insects. On this account, it has been a source of great surprise to me that those who attempt to trace the lines of development of insects confine their attention almost entirely to the difficult wing venation, neglecting other no less vital features (which due to their simpler arrangement are much easier to study), and they are apparently unmindful of the fact that, due to the different degree of development of a set of structures in different insects, no *one* set of structures can be relied upon for such a study, since the evidence must be drawn from *all available sources*, the evidence drawn from one source merely serving to check that drawn from other sources. On this account, I would present the evidence furnished by a study of the terga and wing bases as merely a portion of the evidence of relationships based upon the study of as many and as widely differing structures as possible, in an effort to determine the lines of descent and the interrelationships of the insects comprising the superorder "Panneuroptera."

The Neuroptera appear to be as primitive as any of the insects here considered, and a study of their structures may therefore be taken as the basis for that of the other forms, although the Neuropteron shown in Fig. 5 is not as primitive as the Sialidæ, etc., and was chosen largely to illustrate the tendency among certain Neuroptera toward the development of the type of tergum and wing base occurring in some Mecoptera and Diptera. In the Neuroptera (Fig. 5) the prescutum "psc" and scutellum "sl" tend to assume a triangular outline, and the apices of the triangles approach each other near the middle of the tergal plate in which these sclerites occur. The same tendency is apparent in the sawflies (Fig. 1) and in both sawflies and Neuroptera the prescutum "psc" (Figs. 1 and 5) is divided by the middorsal suture "ms" into two symmetrical halves.

As is indicated by the extent of the broad black line bounding the stumps of the cut off wings in Figs. 1, 2 and 4, the base of the wings is comparatively broad in the sawflies, Trichoptera, Lepidoptera, and lower Neuroptera, although in the Neuropteron shown in Fig. 5 this is not the case, due to the fact that it was chosen to illustrate the tendency in some Neuroptera for the wing base and tergum to approach the condition occurring in certain Mecoptera and Diptera. In both the Trichoptera (Fig. 2) and the Lepidoptera (Fig. 4) there is a marked tendency for the tegula "t" to become large—a tendency which is somewhat less developed in the Hymenoptera (Fig. 1) and in certain Neuroptera, although there are evidences of it in these insects as well. The tegula, however, is best developed in the Trichoptera and Lepidoptera, and in these insects the region labeled "s" (Figs. 2 and 4) is very similar in outline, as is true of the incision in the margin of the region immediately behind that labeled "s." In both Trichoptera and Lepidoptera (Figs. 2 and 4) the alar ossicle labeled "n" is comparatively well developed, as is also true of the sclerite labeled "a"; and in both Trichoptera and Lepidoptera, there is a marked tendency toward the formation of a membranous area "ma" (Figs. 2 and 4) in the postscutellar region "psl."

The above-mentioned similarities between the Trichoptera and Lepidoptera are in full accord with the evidence of close relationship drawn from other sources, such as the presence of a coiled proboscis in such Trichoptera as *Plectrotarsus gravenhorsti*, the lepidopteroid character of the venation and wing-outlines of certain Trichoptera, the similarity in the antennæ, legs, genitalia, outline of the abdomen, and other features which point very clearly to a community of descent, or a merging of the lines of descent of the Lepidoptera and Trichoptera as they are traced back to their point of origin; and (as has been pointed out in a paper soon to be published in the Trans. Ent. Soc. London, dealing with the phylogeny and interrelationships of the higher insects) these anatomical features of the adult insects, as well as the study of larval characters, clearly point to the Trichoptera rather than the Mecoptera as the stem forms from which Lepidoptera have sprung, despite the efforts of Handlirsch and Tillyard to emphasize the mecopteroid character of the venation of the lepidopterous wing. The Mecoptera are also related to the Lepidoptera, but less closely than the Trichoptera are, and I am more inclined to regard the lines of descent of the Mecoptera, Trichoptera, and Lepidoptera as springing off from a common point of a stem resembling the Neuroptera very closely, though the lines of descent of the Trichoptera and Lepidoptera appear to merge in a single line as we trace them back to this common point of origin.

The mesothoracic terga and wing bases of tipulid Diptera and the *Bittacus*-like Mecoptera are strikingly similar (Figs. 3 and 6). In both of these types of insects, the mesothoracic terga become very elongate, and the wing bases become shifted backward by the elongation of the prescutal region "psc" (Figs. 3 and 6). The wing bases are also rather narrow or constricted in these insects, as is indicated by the extent of the broad black line bordering the cut off wings in Figs. 3 and 6. A similar tendency is shown in the Neuropteron depicted in Fig. 5, and it is quite possible that the nemopterid Neuroptera resemble the common ancestors of Mecoptera and Diptera in some respects, especially in the evident tendency toward the elongation of the head region and the reduction of the hind wings to narrow ribbon-like structures, which is carried still further in the Diptera. The outline of the scutellum "sl" is very similar in the Dipteron and Mecopteron shown in Figs. 3 and 6, and the bulging region bearing the label "psl" in Fig. 3 apparently corresponds to the median region labeled "mt" in Fig. 6. The sclerites designated as "prt" in Fig. 3 probably correspond to those bearing the same label in Fig. 6. The prescutal region "psc" tends to assume a similar outline in both insects, the tegula "t" is small in both, and the alar ossicle "n" is not greatly developed in either of these insects. The outline of the tergum, and the nature of the wing bases as well as the features mentioned above would indicate a close relationship between the tipulid Diptera and the *Bittacus*-like Mecoptera, and this is borne out by the nature of the head, antennæ, mouthparts, legs genitalia and character of the abdomen in the two groups, so that the marked similarity in appearance between *Bittacus* and the lower Diptera is not merely a superficial resemblance, but extends to the more minute details as well. I would therefore maintain that the lines of development of the Mecoptera and Diptera merge as we trace them back to their common origin, and the Neuroptera appear to be as much like the common stock as any other insects, from which the lines of development of the Trichoptera and Lepidoptera, and the Mecoptera and Diptera, have sprung.

The tergum of the Hymenoptera (Fig. 1) is as much like that of the Neuroptera (Fig. 5) as any, and in general, the Hymenoptera seem to be quite closely related to the Neuroptera. The line of development of the Hymenoptera therefore probably arose near the base of the neuropteroid stem, though the Hymenoptera are in some respects intermediate between the Neuroptera and the Psocidæ. The Hymenoptera have many characters suggestive of affinities with the Mecoptera, although the Mecopteron shown in Fig. 3 is not so well suited as *Panorpodes* and other primitive Mecoptera for demonstrating this relationship. Since the mecopteron line of development originated at a point quite far down on the main neuropteron stem, it is merely to be supposed that the Mecoptera will show evidences of a rather close relationship to the Hymenoptera, which also occupy a position far down this main stem, and similarly, since the Trichoptera branched off from this main stem very near the point of origin of the Mecoptera, both Trichoptera and Mecoptera show indications of affinities with the Hymenoptera as well as with the Neuroptera; but the resemblances between the Hymenoptera, Mecoptera and Trichoptera are the most patent in the larval stages of these insects. Since the Hymenoptera resemble Mecoptera in some respects, and since the Diptera also resemble Mecoptera in many respects, it is to be expected that there will be certain points of resemblance between the Hymenoptera and Diptera also; but I do not consider that the Hymenoptera and Diptera are as closely related as MacGillivray and other students of the wing venation have been led to suppose, from their studies of this one set of structures alone. That the Siphonaptera (the fleas) were descended from Diptera-like ancestors is admitted by practically all recent investigators; but since these forms are wingless, it has not seemed advisable to include a study of their terga in a paper dealing largely with the wing-bases.

The evidence of relationships among the insects here discussed, as indicated by a study of the terga and wing bases, is in full accord with the evidence from other structures as well, and the conclusions here reached may be briefly summarized as follows. The Neuroptera are as primitive as any representatives of the superorder (the Panneuroptera), and probably have departed as little as any from the condition typical of the forms ancestral to the group as a whole. The Hymenoptera are also very primitive, and occupy a position far down on the main neuropteroid stem. The Mecoptera and Trichoptera arose from neuropteroid ancestors, and are also related to the Hymenoptera. The line of development of the Diptera merges with that of the Mecoptera, and the line of development of the Lepidoptera merges with that of the Trichoptera as all of these are traced back to the common neuropteroid stem. The Trichoptera are probably a little more closely related to the Neuroptera than to the Mecoptera, but their line of descent branched off from the common neuropteroid stem very near to the point of origin of the mecopteron line of development on the same neuropteroid stem. There are some reasons for regarding the Mecoptera as the stem forms from which the lines of development of the Diptera, Trichoptera and Lepidoptera have sprung; but the Neuroptera are on the whole as near as any, to the ancestral forms from which all of these insects are descended.

Abbreviations.

a. = Adanal process or ossicle (adanale).
j. = Juxtategula.
m. = Median ossicle (medipterale).
ma. = Membranous area of postscutellum.
ms. = Middorsal suture.
mt. = Meditergite.
n. = Notopteral ossicle (notopterale).
pa. = Prealar bridge (prealare).
pf. = Prescutal fontanelle.
po. = Posttergite.
prt. = Pretergite.
ps. = Parascutellum.
psc. = Prescutum.
psl. = Postscutellum.
pt. = Parategula.
ptg. = Postalare or pleurotergite.
s. = Suralare.
sc. = Scutum.
sl. = Scutellum.
so. = Scutal organ.
t. = Tegula.

Explanation of Plate II.

Fig. 1. Mesonotum and wing-base of the Hymenopteron *Cephaleia.*

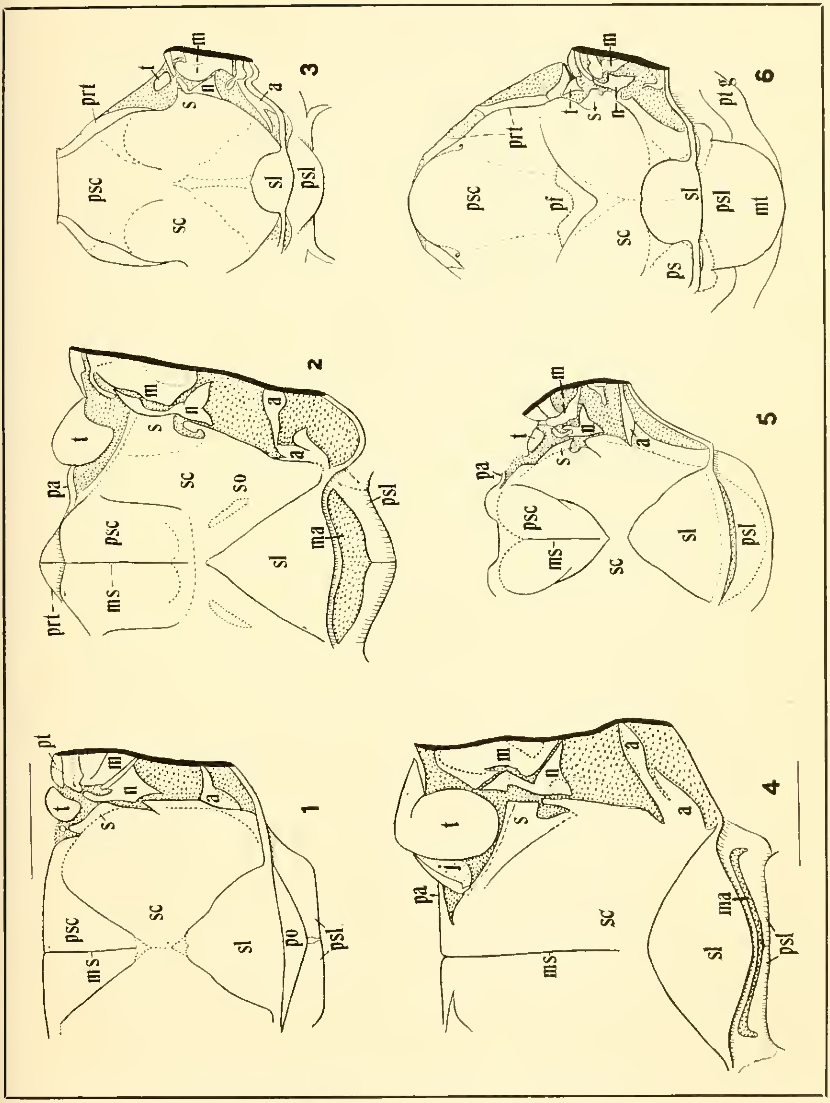
Fig. 2. Mesonotum and wing-base of the Trichopteron *Neuronia.*

Fig. 3. Mesonotum and wing-base of the Mecopteron *Bittacus.*

Fig. 4. Mesonotum and wing-base of the Lepidopteron *Phassus.*

Fig. 5. Mesonotum and wing-base of the Neuropteron *Nemoptera.*

Fig. 6. Mesonotum and wing-base of the Dipteron *Tipula.*



CRAMPTON—Mesothoracic Terga and Wing-Bases.

A LIST OF DRAGON-FLIES COLLECTED AT WAREHAM, MASS., DURING THE YEARS 1911 TO 1913 BY MR. OUTRAM BANGS.

By R. Heber Howe, Jr.
Thoreau Museum of Natural History, Concord, Mass.

The following rather remarkable list of Odonata is the result of my determination of a collection made by Mr. Bangs at Wareham, Massachusetts, and the material on which it is based is now distributed through the general collection of the Museum of Comparative Zoölogy, Cambridge, Mass. Access to the specimens was obtained through the kindness of Mr. Nathan Banks, and permission to publish the list secured from both Mr. Banks and Dr. Samuel Henshaw. Several duplicates are in the author's collection, and that of the Boston Society of Natural History.

Though Mr. Bangs is not familiar with the group Odonata his trained naturalist's eye made it possible for him to collect a very large percentage of the species that occur, and the list is deficient only in the Zygoptera or smaller Damsel-flies. Mr. Bangs has provided annotations of several interesting species.

Zygoptera.

1. *Agrion æquabile* (Say). "Occurs only, so far as I know, along Eagle hill river. I got one."
2. *Agrion maculatum* Beauv. June 2–9. Several specimens.
3. *Lestes eurinus* Say. June to July 30. Several specimens.
4. *Lestes unguiculatus* Hagen. One specimen.
5. *Lestes rectangularis* (Say). June 28 to July 30. Several specimens. I collected it at Monument Beach.
6. *Lestes vigilax* Hagen. July 30. One specimen. I collected it at Wareham in 1917.
7. *Lestes inequalis Walsh*. Aug. 12. One specimen.

Note: I collected *Lestes forcipatus* Rambur., in the nearby town of Monument Beach.

8. *Argia violacea* (Hagen). July 5 to Sept. 4. Several specimens. I collected it at Wareham in 1917.
9. *Enallagma durum* (Hagen) June to Aug. 3. Several specimens. This is the most northern station for this species.

10. *Enallagma traviatum* Selys. July 8. One specimen.
11. *Enallagma civile* (Hagen). I collected this species at Wareham in 1917, and Mr. Bangs has one doubtful specimen in his collection.
12. *Enallagma pictum* Morse. July 8 to 30. Two specimens. This is the second New England record for this species, and the most northern station for it.
13. *Enallagma signatum* (Hagen). Aug. 3. One specimen.
14. *Amphiagrion saucium* (Burm.). Aug. 3. Several specimens.
15. *Ischnura verticalis* (Say). June to July 10 Several specimens. I collected the species at Monument Beach in 1917.
16. *Anomalagrion hastatum* (Say). July 10. Several specimens.

Anisoptera.

17. *Cordulagaster diastatops* Selys. June 17. One specimen.
18. *Progomphus obscurus* Ramb. July 5 to 29. Several specimens. Not uncommon in the oak scrub Mr. Bangs tells me. This is the second New England Station for this species.
19. *Hagenius brevistylus* Selys. July 8. "Local, usually seen along cranberry bog ditches and brooks." This is the most southern latitudinal record for the species.
20. *Gomphus exilis* Selys. July 5 to 8. Two specimens.
21. *Dromogomphus spinosus* Selys. July 29 to Sept. 1. Several specimens.
22. *Boyeria vinosa* (Say). June to Aug. 15. Two specimens.
23. *Basiæschna janata* (Say). May 31. One specimen.
24. *Anax junius* (Drury). June 17 to Sept. 20. Several specimens
25. *Anax longipes* Hagen. "Seen three or four times always over ponds. Hard to catch." Mr. Bangs is sure that his determination is correct. This is the second New England station for the species.
26. *Æshna canadensis* Walk. Aug. 16 to 20. Several specimens.
27. *Æshna clepsydra* Say. Aug. 7. One specimen.
28. *Æshna umbrosa* Walk. Aug. 23 to Sept. 11. Several specimens.
29. *Epiæschna heros* (Fabr.). Sept. 20. One specimen.
30. *Macromia illinoiensis* Walsh. July 27. One specimen.

31. *Epicordulia princeps* (Hagen). July 3 to 26. "Common at times."
32. *Tetragoneuria cynosura* (Say). May 3 to Aug. 3. Several specimens.
33. *Tetragoneuria cynosura simulans* Mutt. May 3 to July 9. Several specimens.
34. *Dorocordulia lepida* (Hagen). June 28 to Aug. 3. Several specimens.
35. *Somatochlora tenebrosa* (Say). Aug. 2 to 7. Several specimens.
36. *Libellula* (*Ladona*) *exusta* Say. May 7 to July 9. Several specimens.
37. *Libellula auripennis* Burm. July 4 to 30. Several specimens.
38. *Libellula cyanea* Fabr. June 28 to Aug. 7. Several specimens. The females of the series approach very closely *L. flavida* Will.
39. *Libellula incesta* Hagen. July 6 to Aug. 5. Several specimens. One specimen shows a slight approach to *L. flavida* Williamson in the number of subtriangle cells.
40. *Libellula pulchella* Drury. June 20 to Aug. 8. Several specimens.
41. *Libellula quadrimaculata* Linn. May 31 to June 28. Several specimens.
42. *Libellula semifasciata* Burm. May 3 to Aug. 7. Several specimens.
43. *Plathemis lydia* (Drury). May 31 to July 5. Several specimens.
44. *Perithemis domitia tenera* (Say). July 18 to Aug. 9. Several specimens.
45. *Nannothemis bella* (Uhler). July 8. Several specimens.
46. *Erythrodiplax berenice* (Drury). July 8 to 10. Several specimens. Confined to salt marshes.
47. *Erythemis simplicicollis* (Say). July 8 to 30. Several specimens.
48. *Sympetrum costiferum* (Hagen). Aug. 6. One specimen.
49. *Sympetrum rubicundulum* (Say). June 17 to July 30. Several specimens.
50. *Sympetrum semicinctum* (Say). July 30 to Aug. 7. Several specimens.
51. *Sympetrum vicinum* (Hagen). June. One specimen.

52. *Pachydiplax longipennis* (Burm.). June 7 to Aug. 6. Several specimens.
53. *Leucorrhinia frigida* Hagen. June to Aug. 11. Several specimens. This is the most southern station for this northern species.
54. *Leucorrhinia intacta* Hagen. June 9. Several specimens.
55. *Celithemis elisa* (Hagen). July 26 to Aug. 11. Several specimens.
56. *Celithemis eponina* (Drury). July 8 to Aug. 16. Several specimens.
57. *Celithemis monomelæana* Will. July 8 to Aug. 14. Several specimens. This is the most northern and second New England record and station for this rare southern species.
58. *Celithemis ornata* Ramb. July 2 to Aug. 14. Several specimens.
59. *Pantala flavescens* (Fabr.). Aug. 9. One specimen.
60. *Tramea carolina* (Linn.). June to July 30. Several specimens.

NOTE ON THE GENUS LIOBRACON, WITH THE DESCRIPTION OF A NEW SPECIES (HYMENOPTERA; BRACONIDÆ).

By Charles T. Brues,

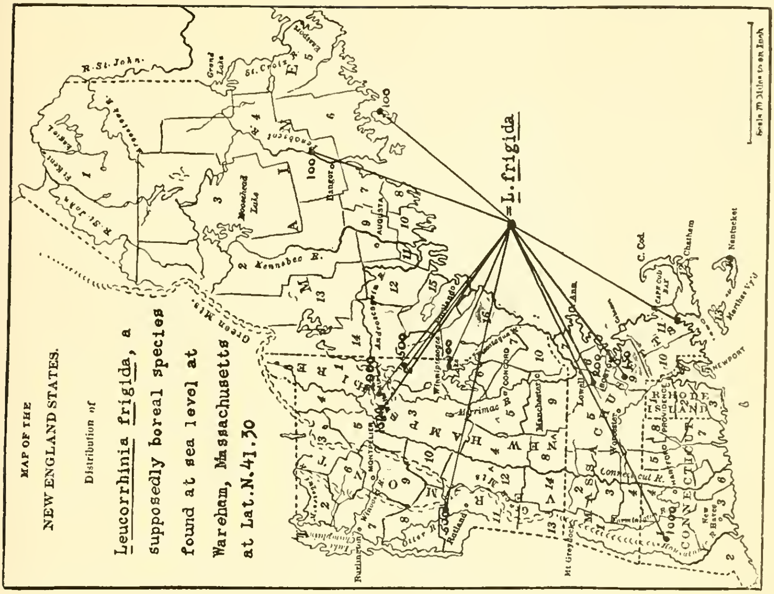
Bussey Institution, Harvard University.

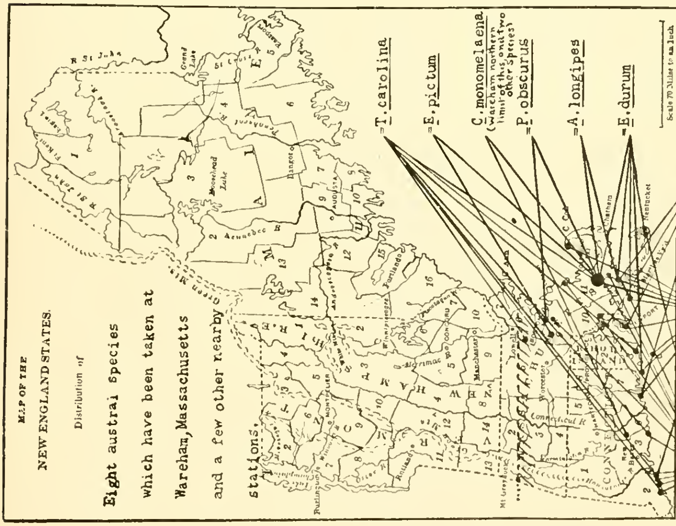
In a small collection of Parasitic Hymenoptera collected in Hayti several years ago by Dr. William M. Mann, I have found several specimens of the insect described by Cresson as *Bracon distinctus* in his "Hymenoptera of Cuba." This proves to belong to the genus Liobracon Szépligeti, to which several South American species have hitherto been referred. In addition there is a second species taken by Dr. Mann which is described below.

Liobracon Szépligeti.

Termes Füzetek, Vol. 24, p. 361. (1901.)
Gen. Ins., fasc. 22, p. 66. (1904.)
Type *L. macula* Brullé (*singularis* Szép).

The species may be distinguished as follows:





The dotted line across northern Massachusetts marks the northern limit of P.longipennis, E.simplicicollis, P.d.tenera.

HOWE—Dragon-Flies from Wareham, Mass.

1. Wings fuscous or black 3
 Wings flavous, marked with black 2
2. Wings with two black bands . . . . *geniculatus* Brullé
 Apical half of wing black . . . . *partitus* Enderlein
3. Stigma black 3
 Stigma yellow; legs red and black; scutellum bifoveate at base . 4
4. Pronotum and propleura smooth; thorax and middle of hind femora red; scutellum bifoveate at base. . . .*cressonii* D. T.
 Pronotum and most of propleura rugose-reticulate; thorax and legs entirely black; scutellum with a crenate furrow at base. . . . . *manni* sp. nov.
5. Antennal flagellum black; second suture of abdomen weakly crenulate. . . . . *macula* Brullé
 Antennal flagellum dark red; second suture smooth
 ruficornis Cam.

Liobracon manni sp. nov.

♀. Length 9 mm. Ovipositor nearly as long as the abdomen• Black, including the wings entirely; abdomen bright red; body clothed with long and very sparse white hairs. Head as thick as broad, distinctly, but not strongly margined behind; eyes prominent, temples broad, widened behind the eyes. Front impressed, the depression extending around the ocellar tubercle, with a median carina between and just above the antennæ, but without punctures. Head above smooth and shining; face rugose-reticulate at the sides, rugose below, with an elongate median smooth tubercle. Malar space half the height of the eye, without furrow; head behind with a few very fine punctures. Antennæ as long as the body; scape twice as long as thick, not noticeably swollen; flagellar joints all nearly three times as long as thick, first not noticeably longer than the second, following three or four scarcely decreasing in length. Pronotum rugose-reticulate with a transverse groove at the extreme posterior margin. Mesonotum smooth and polished except for a few coarse punctures medially behind; parapsidal furrows smooth, very deep, the median lobe strongly elevated anteriorly with its surface rising vertically behind the prothorax. Scutellum smooth, flat, at the base with a broad furrow composed of eight elongate foveæ. Propodeum covered with scattered round impressions; these are well-separated, of about equal size, each somewhat smaller than one of the ocelli; medially with two closely approximate, punctate, grooved lines. Prosternum with sparse, rather large punctures; mesosternum smooth. Propleura closely, irregularly punctate below, above which is a coarsely, transversely, striate impression; upper angle with some irregular, coarse sculpture. Mesopleura smooth, convex, except for a furrow next the tegula, a broader one not far below the first and a deep foveate impression at the middle just before the posterior edge. Metapleura with scattered, setigerous punctures; spiracle small, nearly round; subspiracular groove very finely impressed. Abdomen as long as the thorax, subacute at tip and much swollen at the middle; first segment with four short carinæ at base, the lateral ones close to the margin, its surface with a few poorly impressed large punctures, more noticeable laterally; median portion nearly flat; second and following segments entirely smooth; second with its middle portion, defined by a punctate line, broadly transversely oval, more than twice as wide as long; from the side of this an oblique punctate furrow extends backward to the margin and another one directly forward, these defining a large side piece and a small triangular depressed area at the anterior edge between the sidepiece and the central oval space; corners of following segments not distinctly separated; hind margin of third segment weakly sinuate. Legs very stout; middle and hind tarsi no longer than their tibiæ; tibial spurs very short; claws simple; front tibiæ with a row of stout spinules on the front side. Radial cell ending considerably before the wing tip, third section of radius nearly twice as long as the other two together; second more than twice as long as the first and scarcely longer than the second transverse cubitus; submedian cell longer than the median by nearly the length of the nervulus which is very slightly oblique; parallel vein originating at the lower corner of the third discoidal cell; recurrent nervure entering the first cubital cell far before the apex; second cubital with almost parallel sides and weakly narrowed above. Radial cell of hind wing without indication of a cross-vein, the discoidal vein (originating at the lower end of the basal vein) not transverse except at base, sharply bent and extending toward the apex of the wing.

Type from St. Marc, Hayti.

Although very similar to *L. cressonii*, this species differs noticeably in the sculptured pronotum and punctate furrows on the second abdominal segment, as well as in the plainly undivided radial cell and curved discoidal vein in the hind wing.

Liobracon cressonii D. T.

Cresson, Proc. Ent. Soc. Philadelphia, Vol. 4, p. 75. (1865.) (*Bracon distinctus.*)

Dalla Torre, Cat. Hym., Vol. 4, p. 264. (1898.) (*Bracon cressonii.*)

Dr. Mann took this species in Hayti at Cape Haytien, Grand Rivière and St. Marc.

SOME OBSERVATIONS ON THE WEBBING CLOTHES MOTH (*TINEOLA BISELLIELLA* HUM.).[1]

By M. T. Smulyan,
U. S. Bureau of Entomology, Melrose Highlands, Massachusetts.

Two larvæ, 7 and 11 mm. long, respectively, discovered working in the writer's overcoat October 25, 1917, were placed in a glass jar lined, except at the top, with a layer of gray felt, and placed in his sleeping room where his clothes-closet was located, for rearing and observation. The room was then receiving, and continued to do so until well into April, some furnace heat during the day, but was quite cool during the night and early forenoon, when it was freely ventilated. Owing to the writer's regular duties, most of the observations dealing with the behavior of the larvæ were made at the close of the day, by artificial light—which, as will be seen below, may have had a bearing on the behavior of one of them.

October 28, both larvæ feeding freely. November 1, the smaller within a substantial cocoon, at the bottom of the jar. November 2, had moulted—found the cast shell of the head just outside the cocoon, at one end, and the remainder of the skin just outside at the opposite end—but when the jar was brought closer to the light (gas) in order to verify the observation, the larva hurried out of the cocoon and crawled away. November 4, the same individual in the process of constructing another cocoon; the other—the larger—was still feeding freely. November 7, found the latter encased in a

[1] Identity of species verified by Mr. August Busck of the U. S. Bureau of Entomology, Washington, D. C.

cocoon at the bottom of the jar beneath the felt, next to the glass. The underside of the cocoon was incomplete and the larva was in part visible through the glass. November 11, conditions about unchanged. November 14, larva within cocoon beneath felt had moulted (skin disposed as in the case of the other); soon after it became comatose and remained so, as far as could be observed, until the following May. November 18, the remaining and active individual was still at cocoon-making, but this time in still another location—at the bottom of the jar beneath the felt. November 21, could not be located, but when jar was brought closer to the light to facilitate the observation it came out of one of the previously constructed cocoons. November 25, within a more or less incomplete new cocoon, close to the one which it forsook the 21st. November 28, had moulted again; came half way out of cocoon during observation but backed in again. December 2, left cocoon during observation. December 5, again within one of its former cocoons, and forsook it while observation was made. December 9, moving about freely. December 12, ditto. December 16, within a rather loosely-constructed cocoon on bottom of jar, beneath felt, like its comatose companion. December 19, cocoon more dense. December 24, had moulted once more—third time since its confinement. December 30, apparently comatose. Both larvæ, it should be said at this point, moulted once, in addition, after they had apparently become torpid, just when the writer cannot say, the cast skins, evidencing this, being found in the cocoons—at the hinder ends—the following spring, after the emergence of the adults. It is interesting to note that in the final moult the cephalic portion of the skin remains attached to the rest of the skin; the dorsal or upper surface of the former splits medianly and longitudinally and the larva either wriggles out, or else pushes the skin off over its anal end. The interior of the cocoons are lined with white silk.

The moth which developed from the more active larva emerged first and proved to be a male. It was first observed May 14 (1918). It died May 23. The other moth (female) emerged between May 24, and May 26. In both cases, the empty pupal skin projected in greater part beyond the end of the cocoon, as figured by Riley (Ins. Life, II, 1890).

Eggs were observed June 2, a. m., and they were numerous then.

None were observed May 31. Oviposition continued to June 8, p. m., at the latest, and the total number counted was 99—51 up to June 2, a.m., 41 between 2, a.m. and 4, p.m., 7 between 4, p.m. and 8, p. m. They were laid on the less compact or looser surface of the felt, and some were placed quite deeply among the loose fibers. Evidently they are not always placed singly, for in one instance a group of four was found, and several occurred in pairs. The moth died the evening of June 9. The eggs (infertile in this case) were white to the unaided eye and under an ordinary hand lens, but practically colorless when magnified more highly; oval to ovoid in shape, but a few were somewhat reniform, resembling a type of bean; surface somewhat roughened, marked with nearly spherical, squarish, or elongate shallow depressions, with very narrow intervening ridges. Whether the roughened surface, and the subreniform shape, was due to the age of the eggs—for on June 9, when they were examined, a large proportion had already collapsed—the writer cannot say, although, he might state, it did not appear so. Eighteen were measured and were found to be .49 to .66 mm. long and .27 to .34 mm. wide. The longest were generally the broadest.

The present record, it might be added, adds to the accumulating evidence, seemingly, that this species rather than *Tinea pellionella* Linn. (the case-making moth) is the more common species in the North.

How is the marked difference in degree of activity and sensitivity manifested by the larvæ to be explained? Is it a matter of individuality? Or, in view of the resulting difference in sex, is it a matter of sex?

ECOLOGICAL RELATIONS OF THE LEPIDOPTEROUS GENUS DEPRESSARIA (ŒCOPHORIDÆ).

By Miss Jay R. Traver,
Department of Entomology, Cornell University.

The members of a group of animals or plants, closely allied to one another in a systematic sense, may yet differ rather widely in their habits of life. While fitted for the same general type of environment, they nevertheless show considerable variation in their adaptations to certain phases of that environment. Especially is this true of the ways in which they obtain the two prime necessities of life—food and shelter. The genus Depressaria, of the Lepidopterous family Œcophoridæ, illustrates such variation of habits. As regards this rather large genus, many facts of a biologic nature remain still to be worked out. However, from the data available, some interesting ecological relations have been noted.

In treating this genus, the catalogues of Staudinger and Rebel for European forms, and of Dyar for North American forms, have been followed, with additions of such as have been described since these publications, and of such exotic forms as are given in a few other sources. From the British Museum Catalogue, seven species are listed for which no references could be found. These are *D. acerbella*, Africa, a doubtful member of the genus; *lewinella*, *melesella*, *sobriella*, *convictella* and *absumptella*, Australia; and *moderatella*, Tasmania. If these species have been transferred from Depressaria, no account of such transfer could be found. From Cotes and Swinhoe's *Moths of India*, seven species are listed, omitting *D. gossypiella*, which is no longer placed in this genus. One species is also listed from the Biologia Centrali-Americana.

The genus as here treated consists of two hundred and forty-nine species, distributed throughout most parts of the world, yet occurring mainly in Central Europe. The table of distribution is as follows:

North America	48	Russia and the North Countries	27
Central America	1	Japan	1
South America	3	China	1
British Isles	19	India	9
Central Europe	102	Rest of Asia	30
Southern Europe	59	Africa	11
Spain and Portugal	24	Australia	7

If the grouping be given for continents, Europe has by far the greatest number, and these are in the main located in central Europe. Stainton says: "Though most of the European species seem to be widely distributed, a few are restricted to the south, and some are peculiar to the north." It is evident that this statement still holds good, though the number of recognized species is now nearly three times that known by Stainton.

Of these two hundred and forty-nine species, the life-histories of ninety-four are recorded. H. T. Stainton has probably given us the most material, in a compact form but very comprehensive, in his *Natural History of the Tinenia.* In volume six of this work, he treats of the life-histories of twenty-four species, while in volume twelve he adds twelve more to the list. Chretien, likewise, among recent entomologists, seems to have devoted much time to life-history work among the smaller forms, and he has given us much valuable data of this sort for the genus Depressaria. Besides the thirty-six species treated by Stainton, fifty-eight others have been reared or otherwise studied by other workers, so that their habits are known. For one hundred and eighteen of the remaining species merely distribution and description, usually of adult alone, but occasionally of larva and pupa also, have been given. Complete references for thirty-three of these species were not available. The references to the rest of the species include likewise some mention of the food plant of the larva. That is to say, for 53 per cent. of the genus, something of the life-history and habits is known. Since an ecological study of a group depends mainly on such material as this, it is clearly impossible to give more than an estimate of that group, when so much remains to be determined. The tables given are, therefore, in no sense complete, but merely an arrangement of such biologic knowledge of the group as has been verified.

Ten of the species are known to be gregarious in their larval habits, a number of larvæ living together on the same leaf or in the same umbel. Twenty-two, however, are recorded as being solitary in the larval state, while no mention is made of the social habits of any of the others.

Of the seasonal distribution, no very definite facts could be learned. Several are known to pass the winter as imagos, a few as larvæ, and others in the egg stage. Mention is made by Chretien of one species, *D. halophilella*, which "lives during the winter in the interior of the stems, the shoots and the pulpy leaves of *Crithmum maritimus.*" It seems to be generally accepted that the genus is single-brooded and that the eggs do not hatch till rather late in the spring. In the case of those passing the winter in the imago form, it is several times noted that the adult insect is rarely seen in the fall, but more commonly in the spring after its hibernation.

Stainton writes of the adult insects: "The perfect insects of the genus Depressaria live very retired, and species may be excessively abundant, yet never seen in the perfect state. Many of the species hibernate in the perfect state, and some, which are seldom seen before hibernation, are comparatively common in the spring; but others do not show themselves either before or after hibernation." He further mentions that the adults may often be taken after dusk, on the food plants, when they are found crawling up the stems. "When dislodged from any place of retreat, they shuffle along with considerable rapidity till they have attained a fresh place of concealment." The adults are likewise mentioned by Stainton as being fond of sweets.

In the main the pupal state seems to be passed on or near the surface of the ground, usually under stones, dried leaves or other rubbish. Thirty-nine are reported as pupating thus, usually within a light silk cocoon. But there are others that remain in the top of the plant for pupation, either in the umbels or in the silken webs in which they found shelter as larvæ; seventeen are recorded in this category. One of these remains within a silken gallery which it spun inside a leaf, the outer edges of which were drawn up and securely fastened. Still a third type of pupal habit is known, that of pupating within the stem of the plant. Three species belong here. One of these has been described as burrowing into the stem for a short distance, then up, after which it erects, across the hollowed stem and above the entrace hole, a silken platform, upon which the pupal state is passed.

The habits of the larva are perhaps of greater interest, as these are determined mainly by the need for food and shelter. Their methods of providing themselves with shelter may be considered first. Twenty-four are leaf-rollers, usually rolling part of the leaf and securing it with bands of silk, thus forming a shelter for themselves when they are at rest. Twenty-three are makers of tubes, either wholly of silk, or more often partly of leaves or flower heads and partly of silk. Within this tube they find safety. Still others, fifty-seven of which are recorded, may be called web spinners, since they form irregular webs, and with these silken strands draw leaves of a shoot or flower-heads in an umbel more or less together; or perhaps merely parts of a leaf are thus held and fastened. Some larvæ are both web spinners and tube makers or leaf rollers. Three are known to be leaf miners, at least in the earlier stages of their larval life. Five others are stem borers during their lives as larvæ.

The majority of the larvæ feed upon the leaves of their respective food plants. Packard writes: "The larvæ are extremely active and feed on a variety of substances; some in rolled-up leaves of composite plants, some in the leaves and others in the umbels of umbelliferous plants." Sixty-seven are recorded as leaf-feeders. One feeds partly upon bark and twigs. Of the six which bore into stems, in only one case was mention made of the part of the plant fed upon; in this, the larva fed on the stem. Hence it is doubtful whether the other five may be considered to be stem feeders, or whether they merely obtain shelter from the hollowed stem, coming forth to feed upon other parts of the plant. Eighteen feed upon the buds or flowers, while four others feed upon the fruit also, after the flowers are gone. This distribution leaves practically no part of the plant, except the root, which members of this genus do not use for food.

Stainton writes: "The food of the larvæ is very various, some of them feeding on the leaves of composite plants, others, and by far the greater portion, in the umbels or on the seeds or leaves of different species of Umbelliferæ; again the larvæ of two species feed on the sallow, whilst the *Hypericum perforatum* affords a pabulum to another species." Sixteen different plant families are represented among the food plants of the larvæ of this genus. Of these, Umbelliferæ easily takes the lead, furnishing fifty-nine species of larvæ with food. Compositæ stands second only in favor among this group, with thirty-three larvæ feeding upon it. Leguminoseæ are fed upon by eleven species, Cupuliferæ by four and perhaps five. In one instance note was made of the fact that the imago was taken from an oak, which probably means that the larvæ of that species feed upon the oak. Five are known to feed upon Rutaceæ, two upon Euphorbiaceæ, two upon Hypericaceæ, two upon each of the families of Salicaciæ and Coniferæ, while the families Cistaceæ, Lythraceæ, Rosaceæ, Burseraceæ, Malvaceæ, Rhamnaceæ and Polygonaceæ are likewise represented, one species of larva being recorded from each of these families.

Only three of the genus are known to be of economic importance, *D. heracliana* is known as the parsnip web-worm, and an account of its depredations, with methods of control, may be found in

Sanderson's Insect Pests (p. 417). *D. groteella*, feeding upon hazel and *D. robiniella* upon locust, are both at times injurious to forest trees. Accounts of these may be found in Packard's Insects Injurious to Forest Trees, with methods of control should the larvæ become a pest.

The following is a summary of what is now known of the habits of the genus:

Social habits.

Gregarious	10
Solitary	22

Hibernation.

As egg	3
As larva	4
As adult	19

Feeding habits.

On leaves	67
On buds or flowers	18
On bark or twigs	1
On stem	6
On fruit	4

Economic importance.

D. groteella	on hazel
D. robiniella	on locust
D. heracliana	on parsnip

Methods of obtaining shelter.

Leaf rollers	24
Tube makers	23
Web spinners	57
Leaf miners	3
Stem borers	5

Pupation.

On ground	39
In umbels or leaves	17
In stem	3
In gallery	1

Food plants.

Umbelliferæ	59
Compositæ	33
Leguminosæ	11
Cupuliferæ	5
Rutaceæ	5
Euphorbiaceæ	2
Hypericaceæ	2
Salicaceæ	2
Coniferæ	2
Cistaceæ	1
Lythraceæ	1
Rosaceæ	1
Burseraceæ	1
Malvaceæ	1
Rhamnaceæ	1
Polygonaceæ	1

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NOTES ON THE EARLY STAGES AND LARVAL LOCOMOTION OF *LEIA BIVITTATA* SAY[1] (DIPTERA).

By Harry B. Weiss,
New Brunswick, New Jersey.

Several specimens of this fungus gnat were bred during the last of March from the partly decomposed fruiting bodies of *Lenzites betulina*, which had been collected during February on an old stump at New Brunswick, N. J., and kept in a warm room. It is evidently a well distributed species as it was described by Say from Indiana, and Johannsen[2] records it from Connecticut, Rhode Island, North Carolina, Wisconsin, Illinois, Kansas, Minnesota, Iowa, Michigan and New York. In Aldrich's Catalogue of North American Diptera it is listed as *Neoglaphyroptera bivittata* Say, and Smith[3] records it under the same name from several points in New Jersey.

Full grown larvæ under observation averaged about 13 mm. in

[1] Kindly identified by C. W. Johnson.

[2] Fungus Gnats of North America, Part III, p. 290, Maine Agric. Exp. Sta. Bull. 196.

[3] Insects of New Jersey, N. J. State Mus. Rept. 1909.

length and 1 mm. in width, each being apodous, subcylindrical, elongated, slightly tapering toward anterior and posterior ends, twelve-segmented, whitish, transparent showing tracheæ and alimentary canal, with dark brown or brownish-black oval head slightly retracted in first segment, and having eight pairs of spiracles protected by chitinized, conical projections, one pair on first segment and remaining pairs on first seven abdominal segments.

The pupa is about 5.5 mm. long, free, whitish, smooth, with legs applied to the breast and venter, the antennæ bent around the eyes and extending between the wings and legs and with six pairs of distinct abdominal spiracles and each prothoracic spiracle located behind the antenna and above the root of the wing. The pupa is suspended and surrounded by a network of threads which can hardly be called a cocoon. This stage requires only four or five days. Hibernation evidently takes place in the partly grown larval condition and the larvæ resume feeding and pupate during the spring. Both the larvæ and pupæ are very similar to those of many other members of the family Mycetophilidae as treated by Williston,[1] Johannsen[2] and Osten Sacken.[3]

The locomotion of the larva is peculiar and interesting. To begin with, the larva is completely clothed except for the head, in a transparent, elastic mucus-like, skin or film, which conforms to the shape of the larva and which is as a result somewhat like a tube or tunnel. When the larva desires to move over the fungus, it stretches its head forward and to one side and fixes the tip of a drop of viscous matter from its mouth to the surface of the fungus. The head is then withdrawn and raised somewhat, the withdrawal resulting in the drop of viscous matter being pulled out into a thread and the raising allowing the remainder of the drop in the larva's mouth to slide back along the outer lower side of the first segment to be added to the mucus envelope already covering its body. It then stretches its head to the other side, sometimes slightly more forward and repeats the operation. This is kept up as long as it continues to move, the larva thus covering itself with a mucus tube through which it slides and anchoring or mooring this tube to the surface over which it moves by somewhat elastic, lateral threads,

[1] Manual of North American Diptera.

[2] Fungus Gnats of North America, Parts I, II, III, IV, Maine Agric. Exp. Sta. Bulls. 172, 180, 196, 200.

[3] Characters of the Larvæ of Mycetophilidae, Proc. Ent. Soc. Philadelphia, 1862.

there being from five to nine placed on each side over every distance equal to its length. These threads are at times opposite each other but are more often somewhat alternate.

As the larva moves forward, the mucus tube collapses behind its posterior end and remains as a flat, glistening trail. This trail is more or less broken and ragged in places; sometimes the anchoring threads break and sometimes the empty tube breaks as the larva travels in and out and over and around obstructions, etc., in its path. In fixing its mooring threads and building or adding to its transparent covering the larva moves its head in a quick, jerky fashion and altogether can glide along fairly rapidly. Excrement, particles of fungus and other foreign matter which adhere to the tube as the larva works in the fungus remain stationary and the larva simply slides under them.

Sometimes, but apparently not often, the larva reverses its forward motion and slides backward for a short distance filling the collapsed portion of the tube again. When it reaches its desired position, it bites through the portion covering its head and starts off in a new direction. If, in its forward movement, it has misplaced its mooring threads, it bites through them thus releasing the anterior part of its tube. In this manner it travels over and in the fungus feeding as it goes.

Before pupating, larvæ under observation anchored their tubes in spaces between pieces of fungi in the cage using quite a few more supporting threads for this operation than they used in anchoring their tubes while moving and so placing them that the tube and later the pupa was suspended in a network and did not touch any part of the fungus. These threads were not numerous or close enough, however, to even slightly resemble a loosely built cocoon.

According to Perris[1] the larva of *Sciophila unimaculata* moves in a similar way. An interesting account of the habits of this species, which Perris found associated with the fungus *Polyporus versicolor*, together with descriptions and figures of the larva and pupa is given in his paper, "Note pour servir à l'histoire de la *Sciophila unimaculata* Macq."[2]

[1] Ann. Soc. Ent. France 2; 7; p. 341–50, 1849.

[2] Loc. cit.

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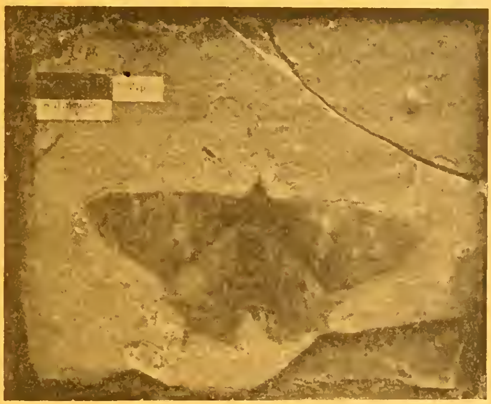

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VOL. XXVI AUGUST, 1919 No. 4

NOTES ON FOREST INSECTS.

I. ON TWO BARK-BEETLES ATTACKING THE TRUNKS OF WHITE PINE TREES.

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So little is known of the life history and habits of some of our common forest insects that even more or less casual or fragmentary observations are often of value and should be recorded in order to make them available for other workers. During the past few years the writer has accumulated a considerable amount of such data either in the way of more or less disconnected field observations, or in the course of work upon larger problems undertaken either individually or as joint problems with advanced student working in the laboratory. In the present paper are presented data upon several insects affecting the white pine, *Pinus strobus*. Part of the observations, especially the experimental data on *Hylurgops pinifex* Fitch and some of the field observations on *Ips longidens* Sw., were made by a former graduate student, Capt. A. J. MacNab, to whom we wish to make due acknowledgments.

Ips longidens Swaine.

Ips longidens was described by Swaine in 1911[1] (p. 214), but no later mention of it has been found in the literature except that by the same author (1918, p. 114).[2] The only host tree recorded is "Eastern Hemlock" and the distribution is given as New York State and Nova Scotia. Although not included by Blatchley and Leng (1916) among the Scolytidæ of northeastern North America, there can be no doubt as to the validity of the species. Indeed,

[1] Canadian Ent., Vol. XLIII, pp. 213–223.
[2] Dominion Canada, Dept. Agri., Ent. Br., Bull. 14, p. 114.

it is a rather common insect in central New York and is readily distinguished from its relatives not only by its structure but by its habits as well. Although Swaine (*loc. cit.*) mentions only hemlock (*Tsuga canadensis* Engelm) as the host tree, the writer has never been able to find it in this tree, but has observed hundreds of brood-burrows and thousands of specimens in all stages in the inner bark of white pine. This is especially unusual when we know that the type locality of this species is central New York (Ithaca) and our observations were made in the same general region of the state.

Ips longidens in central New York may work either as a primary or a secondary enemy of the white pine. It is found most commonly in the lower and middle regions of the trunks of trees in the pole stage—*i. e.*, from 4 to 8 inches in diameter. In larger trees, where it sometimes occurs, its brood-burrows are constructed in the middle and upper trunk regions and occasionally in the tops and branches. It is thus evident that the factor which determines the choice of location for breeding is the character of the bark. It prefers bark upon the older sapling or pole stage of white pine, the surface of which is roughened but which is still less than one fourth of an inch in thickness, although in a few instances the brood has been found successfully established in bark of a thickness as great as one half of an inch. On the other hand, the beetles have been induced to breed in captivity in limbs on which the bark is less than one eighth of an inch thick and the surface of which is smooth except near the origin of smaller limbs.

The brood of *Ips longidens* was found nearly exclusively in white pines of from 4 to 8 inches D. B. H. which were either dying or had been more or less weakened by overshading. The tops of these trees were small and ragged, the bark was thin, and the foliage scanty. Usually at the time when the beetles enter the trees the foliage has begun to turn yellow, but in some cases there are no indications that the tree is actually dying, but only of a weakened or suppressed condition. There can be no doubt that in many cases these bark beetles are the actual cause of the death of trees which would otherwise survive for may years. *Ips longidens* will also breed in felled pines in the pole stage and in the tops of larger trees.

The brood-burrows are always started in the new host tree by the males[1] which leave their old host several days earlier than the females of the same age. Their methods of working have been observed by the writer under a binocular microscope, and correspond very closely with those employed by *Pityogenes hopkinsi* Swaine, which have been recorded in detail elsewhere (Blackman, 1915,[2] pp. 16–32). When the brood-burrow is made in the trunk, as it is in the great majority of cases, the entrance gallery, which is cylindrical and of a diameter just large enough to accommodate the insect making it, extends through the bark diagonally upward at an angle of about 45 degrees. On reaching the surface of the wood the male excavates an irregular shaped nuptical chamber which lies partly in the bark and partly in the sapwood.

The burrow is now ready for the females of which there are usually several for each male. Each of these immediately after her entrance begins to excavate a separate egg-gallery. In the majority of instances these galleries run in a direction perpendicular to the grain of the wood (Plate IV, fig. 2), although occasionally some females follow a course parallel to the grain. There are from one to five egg-galleries to each engraving. The following tables present, in summary, various data derived from a careful study of the engravings of *Ips longidens*.

Number of Egg-galleries, Based on a Study of 118 Engravings.

Brood-burrows having one egg-gallery	10
" " " two "	54
" " " three "	37
" " " four "	15
" " " five "	2
Average number of egg-galleries in a brood-burrow	2.53

Length of Egg-galleries, Based on the Study of 50 Engravings.

	Average length.	No. of galleries studied.
Uniramous burrow	25.37	8
Biramous "	19.42	54
Triramous "	17.5	24
Quadriramous "	16.9	28
Average length all types	18.8	114

[1] Cf. Blackman, 1915 Tech. Pub. No. 2, N. Y. State Coll. Forestry, pp. 15, 16. Blackman & Stage, 1918 Tech. Pub. No. 10, N. Y. State Coll. Forestry, p. 46.

[2] *Loc. cit.*

The relation between fecundity and the proportion of sexes in the various types of burrows is shown by the following tables of data:

Number of Egg-niches in the Egg-galleries, Based on a Study of 40 Engravings.

	Average no. of egg-niches.	No. of engravings studied.
Uniramous engraving	23	6
Biramous "	41.04	23
Triramous "	48.9	11
Average number to engraving	40.5	40
Egg-gallery of uniramous engraving	23	6
" " " biramous "	20.5	46
" " " triramous "	16.3	33
Average number, all types	19.05	85

From the above it is evident that each female under monogamic conditions produces more eggs than under conditions of bigamy or polygamy; but just as with *Polygraphus rufipennis* Kirby and *Eccoptogaster piceæ* Swaine (Blackman and Stage, *loc. cit.*, pp. 45, 53), the greatest individual reproductive efficiency exists when the burrow is occupied by one male and two females.

The larval burrows at the start are at nearly right angles to the egg-gallery (Plate IV, fig. 2) and are entirely in the inner bark. As they proceed farther, however, they groove the sapwood deeper and deeper and show a tendency to become winding in their course. These larval mines end in oval pupal chambers excavated nearly entirely from the sapwood. The new generation of adults continue feeding in the old host for weeks or sometimes even months before reaching sexual maturity. If young adults, fully mature so far as coloration and general appearance are concerned, are removed from their larval host tree and confined with new pieces of pine they will usually not breed until they have fed on the inner bark for a week or more.

On March 20, 1915, a number of young adults, removed from their hibernating quarters, were confined with several suitable pieces of white pine. Within two days all but a few, which had died, had entered the cut ends of the material, all of them making simple cylindrical feeding burrows with no indication of a nuptial chamber. On April 1, all of the beetles were still in their feeding burrows, but by April 20, all but two or three had emerged and males and females were in newly established brood-burrows. On June 4, pupæ and callow adults of the new generation were obtained from these burrows. It is thus seen that, under laboratory conditions, callow adults of the new generation may be obtained from mature beetles in about 50 days, but these are not sexually mature until they have fed on the inner bark and sapwood for several weeks or a month. It is apparent that in central New York it is possible under field conditions for *Ips longidens* to complete two generations in an average year and in an especially long, warm season to increase this to two and one-half generations. Observations extending over a period of six years, however, convince the writer that ordinarily a single generation is the rule, although a partial second brood is by no means uncommon. There is thus a decided mixing of generations and new brood-burrows may be started at any time from May 15 (over-wintered adults) to September 15. Both adults and larvæ have been taken in the field on various dates including every month except December. The larvæ are as successful in withstanding winter conditions as are the young fully colored adults, and much more successful than are the callow beetles and pupæ.

The over-wintered adults leave their old hosts considerably later than do some other bark beetles. An instance of this was observed in the field by the writer in the spring of 1915. On April 24 of that year, the first individual of *Pityogenes hopkinsi* a male, was observed to have emerged and started its nuptial chamber in a new host near at hand. Within a week nearly all of the over-wintered males and many of the females had left this old host. On the other hand the over-wintered adults of *Ips longidens*, which occurred in the trunk of the same tree, did not leave their old host in any numbers until the middle and latter part of May.

Ips longidens has been found associated in the same tree; with a considerable number of other bark and wood boring forms. Those most commonly associated include *Ips pini* Say, *Pityogenes hopkinsi* Swaine, *Crypturgus atomus* Lec., *Graphisurus fasciatus* DeG., and *Monohammus scutellatus* Say. These occur very commonly in the same regions in which *Ips longidens* prefers to breed. Other forms, which have been found to be associated but not so commonly, include *Dendroctonus valens* Hopk., *Orthotomicus* (*Ips*) *cœlatus* Eich., *Dryocœtes americanus* Hopk., *Hylurgops pinifex* Fitch, *Gnathotrichus materiarius* Fitch, *Cossonus corticola* Say, *Monohammus confusor* Kirby, *M. titillator* Fabr., *Rhagium lineatum* Oliv., and *Pytho americanus* Kirby, occurring principally in the lower trunk region of the pine tree; while *Pityophthorus granulatus* Swaine, *Chrysobothris femorata* Fabr., *C. dentipes* Germ., *Pogonocherus mixtus* Say, are occasionally associated in the tops and limbs.

Two beetles known to be predaceous were found rather commonly associated with *Ips longidens*. These are *Phyllobœnus dislocatus* Say and *Hypophlœus tenuis* Lec. One parasitic Hymenopteron, *Cœlopisthus* sp. was taken alive from a pupal chamber and there can be little doubt that it is parasite on this bark beetle.

Hylurgops pinifex Fitch.

Hylurgops pinifex differs markedly in habit from the preceding in that it is a monogamic form. It attacks white pines by preference although Hopkins[1] 1899, p. 449, records it from other species of pine as well, and Swaine[2] 1918, p. 81, lists the hosts as "Pines, Spruce and Eastern Larch." Its burrows are constructed in the lower part of standing pines and especially in the stumps of recently cut trees. The burrows have never been found by the writer at a greater height than seven feet from the ground and are more commonly in the lowermost three feet of the base of large thick-barked trees. This region is often heavily infested and the brood very frequently extend their burrows through the bark of the main roots to a distance of 6 or 8 inches under ground. The factor which determines the choice of the bases of trees is not entirely the character of the bark in the region attacked but is apparently the clumsy flight of the adult beetles, for in a number of cases felled trees have been found infested at a distance of 30 feet from their bases in regions where the bark was relatively thin, and in the laboratory the beetles have been induced to breed in similar material.

The brood-burrows of Hylurgops are radically different from those of *Ips longidens* or other polygamous forms, the most striking

[1] West Virginia Agr. Exp. Sta., Bull. 56.
[2] *Loc. cit.*

differences being correlated with the difference in breeding habits. Hylurgops appears to be strictly monogamic. Typically the brood-burrow consists of a simple, nearly straight longitudinal chamber extending either downward or upward from the entrance

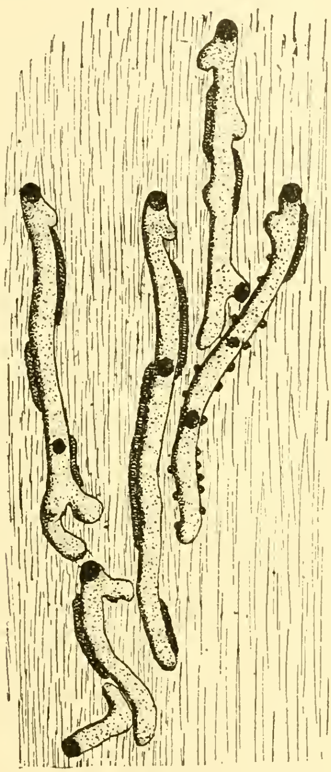


Figure 1. Burrows of *Hylurgops pinifex* in bark of white pine. Note the arrangement of the egg, either in niches or in grooves along the sides of the egg-gallery. Three-fourths natural size.

gallery (Fig. 1). Usually, just inside of the entrance there is a short branch or alcove, seldom greater in depth than the length of the beetle, which is used as a turning niche and also as a nuptial recess (Fig. 1; Plate 4, fig. 3). At or near the other end of the fully completed egg-gallery there is likely to be a somewhat similar recess which, however, instead of lying parallel to the surface of the wood extends outward part way through the bark. It doubtless is used by the female for reversing her position in the burrow. The remainder of the egg-gallery is a simple cylindrical mine which extends longitudinally, typically nearly straight, but frequently more or less curved. Its diameter is just great enough to allow convenient passage of the beetle. In length these egg-galleries vary from 50 to 85 mm. with an average of about 70 mm.

A number of instances have been observed where the same entrance gallery has been used in common by two or more pairs of beetles. That these are not cases of true polygamy is evidenced by the fact that each egg gallery arising from the common entrance has its own nuptial recess, and also by the fact that in all instances where the beetles were still present, the two sexes in these multiple burrows occurred in equal numbers.

The eggs are laid by the females either in niches or in longitudinal grooves along one or both sides of the egg-galleries, more typically in grooves. Most of the females appear to use the grooves entirely, a considerable number use both niches and grooves and none have been observed to use the niches exclusively. In the side grooves, the eggs are deposited in considerable numbers, often forming a layer several tiers wide, but when niches are used only from two to six are placed in one recess. In all cases the eggs are securely packed and the niche or groove closed with a layer of sawdust so that the opening of the gallery is of nearly uniform bore and the beetles may pass through it without endangering the eggs. No attempt has been made to count the eggs or larvæ of a single pair, but the number must be considerable as often the combined length of all of the egg-grooves of the two sides is equal to or greater than the length of the egg-gallery. In fact, the brood of Hylurgops is so numerous and their appetite so voracious, that it is very difficult to obtain brood-burrows fit for study unless the bark is stripped off before the larvæ have fed many days. Otherwise the feeding galleries of the larger larvæ and the young adults are carried back and forth over the egg-galleries until these become entirely unrecognizable.

The ability of the larvæ to live under adverse conditions is well illustrated by the following observations: On June 18, 1915, near Cranberry Lake, N. Y., several stumps of large white pine trees felled during the preceding winter were found to be heavily infested with *Hylurgops pinifex*, *Dendroctonus valens* Hopk., *Ips pini* Say, and *Orthotomicus* (*Ips*) *cœlatus* Eich. These stumps were still green and sappy and pitch exuded from all of the burrows, while those of D. *valens* had the characteristic pitch tubes. The burrows of Hylurgops were in all stages from those recently started to completed burrows containing recently hatched larvæ. In no case had these extended their burrows more than two centimeters, and in most instances eggs or larvæ just hatched occupied the egg-grooves in the sides of the galleries. The pieces of bark on being removed contained such good specimens of the early brood-burrows that a considerable number of them were taken to camp, wrapped in old newspapers, and shipped to the laboratory, no effort being made either to remove the brood or to preserve it from injury although specimens were taken. The boxes containing these bark specimens were not unpacked until September 2, when the writer was surprised to find large numbers of adults of the new generation burrowing into the bark or feeding upon its inner surface which was by then quite dry. These undoubtedly had developed from the young larvæ and eggs present on June 18. That the eggs then present had later hatched was readily established by an examination of the egg-grooves.

On October 20, 1916, numerous young adults found in their parent burrows, were brought into the laboratory and 46 of these placed in a celluloid box securely fastened to the rough bark of a section of the trunk of a recently cut, dying pine. Most of the beetles wandered about for the next few days in their enclosure, seeking a means of escape, some of them stridulating frequently. These latter were males. However, before the following morning several females had started burrows through the bark and within two days were observed to be casting out white chips, showing that they had begun to groove the sapwood. By October 25, all of the beetles except four had disappeared beneath the bark, many of them utilizing the entrance holes made by the first workers. One month later (November 25) a piece of bark near one of the entrance holes was carefully removed and eggs and young larvæ were found in considerable numbers. Some of the larvæ had burrowed for a distance of 35 mm. through the inner bark and were probably less than two weeks old. The eggs examined were oval in shape, slightly less than 1 mm. in their longest diameter, and contained well formed larvæ which hatched two days later.

The burrows made by the larvæ at first extend at right angles to the egg-gallery but soon become quite tortuous. They are rather extraordinary for their length frequently being from 25 to 30 cm. long and toward the last having a diameter of 4.5 to 5 mm. Before pupating, the full grown larvæ constructs a pupation chamber, which is often a more definite structure than is commonly made by scolytids. Ordinarily, pupation of those small beetles occurs in a simple cavity hollowed out of the bark or the wood. But in many cases *Hylurgops* builds a more elaborate structure somewhat similar to the hibernaculum of *Rhagium lineatum* and like this, consisting not only of an excavation in both bark and sapwood, but in addition surrounded by a wall made up of bits of wood, bark and excrement held together by a substance which acts as a glue (Plate IV, Fig. 4). The resemblance to the pupation chamber of *Rhagium* is still further heightened by the presence of a short passage-way made by the larva nearly through the outer bark. These pupal chambers are about 5 x 8 mm. in diameter. In several cases the larvæ had bored into the sapwood and made their pupal chambers entirely in the wood, sometimes penetrating the wood to a depth of nearly 5 mm. The entrance was plugged before pupation occurs and exit was had through a separate hole. Both of these sorts of pupation cavities should probably be considered as adaptations which serve to protect the tender pupæ from the larger larvæ and the young adults, which appear to have a very voracious appetite, and which extend their tunnels back and forth through the inner bark, often passing over and destroying egg-galleries and larval burrows alike.

Several full grown larvæ were taken from their pupation chamber and placed in Stender dishes in slightly moistened sawdust where they were kept under observation during all of the changes which ensued until they became fully colored adults. Briefly, the observations made are summarized below. The time required for the transforming of the larva to the pupa is about four and one-half hours. During most of this time the larva squirmed and wriggled and contorted its body nearly continuously with brief rests after each more violent effort. The effect here was, doubtless, the loosening up of the larval skin, and after about three hours of such efforts the skin appeared to be quite loose and something of the pupal form could be seen beneath it. Finally the larval skin split lengthwise along the back of the thorax and head as far as the base of the mandibles, and through this opening the head and thorax of the pupa was pushed. It then required only a few minutes for the pupa to free itself of the old larval skin except where it was continuous with the lining of the alimentary canal at the anus. At this point the larval skin often adheres very firmly and sometimes is not dislodged for several days.

The newly transformed pupa is colorless except for a faint tinge of brown at the points of the dorsal spines of the abdomen. During the succeeding seven days various parts of the body acquired pigment in about the following order:—the mandibles, the eyes, bases of maxillæ and labrium, joints of femur and tibia, coxæ, tarsi, base of antennæ, scutellar region. At the end of a week the pupæ are ready to transform. The mandibles are motile, the body form is more like that of the adult and the elytra are no longer folded around the body with their tips ventral as at first, but now are dorso-lateral in position.

The first indication of the moulting of the pupa is a loosening of the pupal skin in the head region. Later the skin here splits and is soon slipped down over the pronotum whereupon the mandibles are used to tear it and release the prothoracic legs. The rest of the process is rapid as the legs are now brought into play and the body soon freed of the loosened covering. In one instance where transformation was observed, the entire process of moulting required eleven minutes.

The newly emerged adult is by no means as helpless as is the case with many Scolytids, and seems to require a considerably shorter time in attaining its adult color. Adults 36 hours old are brown-ochre in tint with wing covers opaque and in less than a week are dark brown, nearly black in color. There is normally but one generation of *Hylurgops pinifex* per year in central New York but if the young adults which ordinarily feed in their larval hosts from late summer until the following June are removed from their feeding burrows, they will readily enter a new host and start new brood-burrows.

As Hylurgops usually occurs only in the lowermost trunk regions, the forms commonly associated with it are of limited numbers. Perhaps the most common is *Orthotomicus* (*Ips*) *cœlatus* Eich., which in central New York is nearly invariably found in the same stumps as Hylurgops. Other beetles frequently associated are *Dendroctonus valens* Hopk., *Dryocœtes americanus* Hopk., *Ips pini* Say, *Ips calligraphus* Germ., *Cossonus corticola* Say, *Monohammus confusor* Kirby, *M. titillator* Fabr., *Rhagium lineatum* Oliv., *Pytho americanus* Kirby, and occasionally *Gaphisurus fasciatus* DeG., and *Ips longidens* Swaine. Associates occurring in the feeding burrows of the young adults include *Glischrochilus sanguinolentus* Oliv., and several other unidentified nitulids and staphylinids.

Explanation of Plate IV.

Fig. 1. View of the inner bark of white pine showing the brood-burrows of *Ips longidens.* In the egg-gallery shown below, the plugs of white frass by which the eggs are retained in their egg-niches are still plainly visible although the eggs have hatched long since. About three-fourths natural size.

Fig. 2. Engraving made by *Ips longidens* on the surface of the wood of white pine. The nuptial chamber (a), two transverse, (b) and one longitudinal (c) egg-galleries with their egg-niches, larval burrows (d) and the feeding burrows (e) of the young adults are shown. About two-thirds natural size.

Fig. 3. Brood-burrow of *Hylurgops pinifex* in the inner bark of white pine. Note the entrance gallery (a), the nuptial recess (b), the egg-gallery (c) with the egg-groove along the right side, the turning niche (d) and the burrows of the young larvæ (e). About one-half natural size.

Fig. 4. Fragment of the bark of white pine showing the pupal chamber of *Hylurgops pinifex.* About three-fifths natural size.

Blackman—Bark-beetles.

THE ANT GENUS LORDOMYRMA EMERY.[1]

By William Morton Wheeler.

Lordomyrma is one of the few ant genera, like *Leptomyrmex* and *Opisthopsis*, which are confined to the Papuan and Australian regions. Although Emery established it as long ago as 1897 on *Podomyrma caledonica* Ern. André from New Caledonia and two species from German New Guinea, only a variety has since been added to the genus. It evidently comprises, however, two undescribed species in my collection, one taken by Mr. A. M. Lea of the Museum of South Australia on Lord Howe Island, off the coast of New South Wales and the other taken by myself in Queensland. Of the three species recognized by Emery only the worker is known. I have seen the male of the species from Lord Howe Island, but the females of all the forms still remain to be discovered. They are probably very similar to the female of *Podomyrma* and but slightly larger than the worker. I append descriptions of the genus and of the five known species, together with a table for their identification.

Lordomyrma Emery.

Emery, Természetr. Füzetek, 20, 1897, p. 591. ☿.

Worker. Small, monomorphic. Eyes small, elongate, rather flat, just in front of the middle of the head; ocelli absent. Mandibles triangular, with 3–4 apical and numerous small basal teeth. Clypeus well-developed, elevated in the middle behind, bicarinate, at least in most species, with entire anterior border, sinuate on the sides. Frontal area distinct, impressed; frontal groove absent. Frontal carinæ prolonged backward nearly to the posterior corners of the head as diverging ridge-like internal borders for flattened antennal scrobes, which are differently sculptured from the remainder of the head and bordered externally by a longitudinal ruga or carinula. Antennæ 12-jointed; funiculi with a distinct 3-jointed club as long as or longer than the remaining joints together. Thorax rather long and narrow, broadest through the pronotum, the humeri of which are dentate or sharply angular. There is no promesonotal suture, the dorsal surface of the two segments being rounded and convex. Mesoëpinotal suture very

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 158.

distinct, the mesonotum falling abruptly behind to the pronounced mesoëpinotal constriction, which is deep and narrow. Epinotum smaller and lower than the promesonotum, armed with acute teeth or spines both above and at the metasternal angles. Petiole and postpetiole much as in many *Leptothorax*, the petiole with a short peduncle and a high angular node, in one species produced into a spine, the postpetiole constricted behind, broader than the petiole. Gaster rather voluminous, broadly elliptical, somewhat compressed dorsoventrally, mostly formed by the first segment. Legs rather slender, the femora and tibiæ not conspicuously incrassated; middle and hind tibiæ without spurs.

Male. Smaller than the worker. Mandibles very small, vestigial, edentate. Cheeks short. Eyes moderately large; ocelli prominent, though small and rather far apart. Antennæ long, slender, filiform, 13-jointed; scapes long, nearly as long as the three basal joints of the funiculus, first funicular joint not swollen or enlarged. Thorax short; mesonotum with very feeble traces of Mayrian furrows; epinotum long, abrupt, somewhat concave, unarmed, without distinct base and declivity. Nodes of the petiole and postpetiole low. Genitalia small and retracted, the external valves simple, rounded at their tips. Wings hairy, with distinct pterostigma, a discoidal, a closed radial and a single large cubital cell.

Genotype: *Podomyrma caledonica* Ern. André.

This genus is very close to *Podomyrma*, but the species of the latter are larger ants, with 11-jointed antennæ in the workers and females, with more flattened, not bicarinate clypeus, with the epinotum unarmed or only feebly armed, the femora conspicuously incrassated and the petiole and postpetiole of a different shape.

Table of Species.

1. Apex of petiolar node produced into a spine above; epinotal spines very long, curved and diverging. Length 3.5 mm. *furcifera* Emery

   Apex of petiolar node angular, acuminate or acutely conical above; epinotal spines much shorter, nearly straight. . . .2

2. Antennal scrobe anteriorly divided by a short median longitudinal carinula into separate depressions for the scape and funiculus. Length 3 mm. . . . .*cryptocera* Emery

   Antennal scrobe not thus divided 3

3. Upper surface of head, except the cheeks and spaces between the eyes and frontal carinæ, smooth and shining. Length 4.5–5 mm. . . . . *caledonica* Ern. André
   Upper surface of head between the frontal carinæ rugose. Length 3–3.6 mm. 4
4. Epinotal spines rather short, metasternal spines long; antennal scrobes incomplete behind; gaster not coarsely punctate *leæ* sp. nov.
   Epinotal spines longer, metasternal spines short; antennal scrobes complete behind; gaster coarsely punctate *punctiventris* sp. nov.

1. **Lordomyrma caledonica** Ern. André.

Lodomyrma caledonica Ern. André, Rev. d'Ent. 8, 1889, p. 225. ☿.

"*Worker.* Ferruginous, shining; mandibular teeth, anterior border of head, femora, tibiæ and the two posterior thirds of the gaster, sometimes also the upper surface of the head with the scapes, more or less brown. Mandibles nearly smooth and shining, with a few, very scattered punctures; their terminal border armed with three teeth anteriorly and indistinctly denticulate behind. Head (without the mandibles) nearly as long as broad, slightly narrowed in front, strongly rounded at the posterior angles. Cheeks in front of the eyes, together with the spaces between the eyes and the frontal carinæ, longitudinally rugose, the rugæ becoming semicircular around the articulations of the antennæ; the remainder of the head, with the clypeus and frontal area, smooth and very shining. Antennæ 12-jointed; funicular joints 2–7 transverse. Thorax with coarse rugæ, transverse above, longitudinal on the sides; the sculpture rather effaced on the disc of the pronotum and the declivity of the epinotum. Pronotum convex, unarmed above, its inferior border much raised above the articulation of the anterior coxæ and terminating in front in a blunt denticle. There is a deep constriction between the mesonotum and epinotum; the latter, very narrow above, terminates at the juncture of the basal and declivous surfaces in two strong, acute teeth, which are very divergent and directed upward. Petiole surmounted by an acute cone, inclined forward; postpetiole transverse, armed with a small dentiform tubercle at its anterior angles; the petiole is transversely rugose above, the postpetiole nearly smooth, except behind, where there are a few more or less effaced rugæ. Gaster smooth and very shining. Coxæ very globular; femora only slightly swollen; four posterior tibiæ without spurs. Whole body, including the antennal scapes and legs bristling with long, yellowish, delicate and moderately abundant hairs. Length 4.5–5 mm.

"Nouméa (New Caledonia)."

2. Lordomyrma furcifera Emery.

(Fig. 1.)

Természetr. Füzetek 20, 1897, p. 591, Pl. 15, Figs. 32, 33. ☿.

"*Worker.* Fuscopiceous; mouth, antennæ, posterior half of thorax, femora, tarsi, petiole and ventral surface of gaster reddish ferruginous, very shining; smooth, sparsely covered with minute

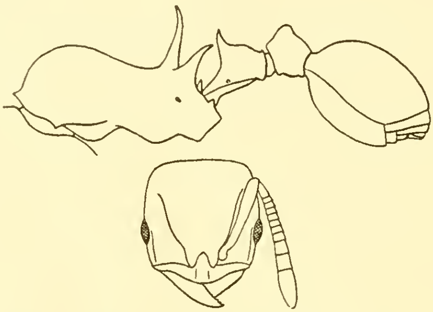


Figure 1. *Lordomyrma furcifera* Emery (after Emery) worker; *a*, thorax and abdomen in profile; *b*, head, dorsal view.

punctures bearing rather stout, fuscous hairs. Head oblong, with subparallel sides, broadly rounded behind. Eyes in front of the middle of the sides of the head. Cheeks striated. Frontal carinæ delicately prolonged backward, $\frac{3}{4}$ the length of the head, forming the inner borders of broad, shallow antennal scrobes which are open behind but bounded externally by a delicate carina. Clypeus bicarinate in the middle, its anterior border arcuately produced. Mandibles smooth, elongate triangular, with oblique apical margin, bidentate at the tip, irregularly denticulate basally. Antennal scapes reaching beyond the frontal carinæ but not to the posterior corners of the head; scape stout; club elongate, moderately thick, penultimate joint about half again as long as the antepenultimate, the last joint as long as the two preceding together but scarcely thicker than the penultimate. Thorax with the promesonotum very convex, subglobose, acutely marginate in front, the margin ending on each side in a tooth; metaëpinotum subselliform, with two very long spines, approximated at their bases, strongly diverging, curved outward and very acute; metasternal spinules minute, acute. Petiole a little broader behind than in front, with a high subconical node, bearing a short acute, erect spine, behind transversely rugose; postpetiole subrotund, obtusely acuminate above, bearing a minute tubercle on each side. Gaster subrotund, almost entirely covered by the basal segment. Legs long, femora flexuous. Length 3.5 mm.

"From the Lemien Forest near Berlinhafen [German New Guinea]; a single specimen [L. Biró]."

3. **Lordomyrma cryptocera** Emery.

(Fig. 2.)

Természetr. Füzetek 20, 1897, p. 592, Pl. 15, Fig. 34. ☿.

"*Worker.* Piceous; mandibles, antennæ, tarsi and articulations of the legs ferruginous; very shining, covered with minute, scat-

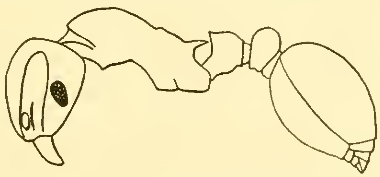


Figure 2. *Lordomyrma cryptocera* Emery, worker (after Emery), body in profile.

tered, piligerous punctures. Head longer than broad; its sides broadly arcuate, truncate behind, with rounded posterior corners, marginate on each side beneath. Eyes at the middle of the sides of the head. Frontal carinæ prolonged backward, forming the inner boundaries of a scrobe or fovea on each side and becoming arcuately confluent with a carinula that forms its lateral boundary. Cheeks, sides of head lateral to the scrobes and the lateral margin of the front anteriorly longitudinally striate. Clypeus anteriorly elevated and bicarinate, with rounded anterior margin. Mandibles smooth, with very oblique, denticulate apical margin. Antennal scape short, funiculus longer, slender at the base, but with joints 2–7 much thicker than long; club much elongated and only slightly incrassate; the last joint subcylindrical. Whole antenna accommodated in the scrobe which at the base has a longitudinal carinula separating it into two grooves, one for the scape and one for the funiculus. The funicular groove is prolonged anteriorly (for the apex of the club) between the clypeus and the base of the mandible. Thorax with the promesonotum subhemispherical, narrowly marginate on each side anteriorly, above and on the side with several separated rugæ, between the mesonotum and epinotum with a deep transverse groove, which is longitudinally striate, behind the groove with a transverse carina. Epinotum with sharp, arcuate rugæ between the moderately long, oblique, curved spines; pleuræ obliquely rugose. Petiole pedunculate at base, behind with a subrotund node, anteriorly acuminate but unarmed above, irregularly, transversely rugose. Postpetiole broader than petiolar node, ovate, a little broader than long, somewhat smooth. Gaster ovate, almost entirely covered by the basal segment. Legs shorter than in the preceding species; femora flexuous, incrassated in the middle. Length 3 mm.

"Collected with the preceding in the Lemien Forest near Berlinhafen [German New Guinea]; a single specimen [L. Biró]."

3a. **Lordomyrma cryptocera** var. **acuminata** Stitz.

L. cryptocera var. *accuminata* [*sic!*] Stitz, Sitzb. Gesell. naturf. Freunde Berlin. 1912, p. 504. ☿.

Agreeing with the description of the type except as follows: "The head is smooth, except for a few longitudinal striæ below the eyes and a fine longitudinal striation between the anterior borders of the frontal carinæ and the adjacent portion of the clypeus. The epinotum behind the shallow mesoëpinotal impression, which is longitudinally striate, is transversely rugose on the base and declivity. The epinotal spines are more slender. The petiolar node seen in profile has the form of an equilateral triangle and bears above a small, pointed but distinct tooth, which is lacking in the type though indicated in Emery's figure.

"Four workers. New Guinea (K. A. Fl. E. Bürgers)."

4. **Lordomyrma leæ** sp. nov.

(Fig. 3.)

Worker. Length 3.4–3.6 mm.

Head longer than broad, as broad in front as behind, with feebly rounded sides, nearly straight posterior border and broadly rounded posterior corners. Eyes in front of the middle of the head, small, elongate, rather flat and oblique. Mandibles rather convex, thin, with straight external borders; apical borders with three larger anterior and numerous minute basal teeth. Scrobes shallow, incomplete behind, about $\frac{4}{5}$ as long as the head. Antennal scapes extending to the posterior corners of the head; joints 2–7 of the funiculus narrow but broader than long; ninth and tenth joints distinctly longer than broad, together as long as the terminal joint. Clypeus high and convex in the middle, bluntly bicarinate, its anterior border broadly rounded and entire, feebly sinuate on the

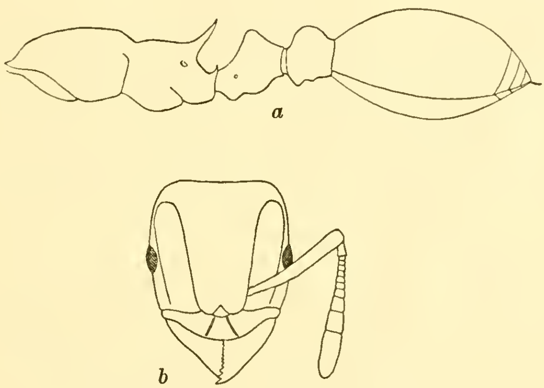


Figure 3. *Lordomyrma leæ* sp. nov. worker; *a*, thorax and abdomen in profile; *b*, head, dorsal view.

sides. Promesonotum gradually narrowed behind, rather straight above in profile, decidedly longer than broad, the humeri subdentate, the mesonotum behind falling abruptly to the pronounced mesoëpinotal constriction. Epinotum slightly longer than broad, a little broader behind than in front, its spines short, broad at the base, very acute; metasternal spines slender, acute and like the superior spines directed upward. Base of epinotum in profile feebly convex, longer than the sloping, flattened declivity. Petiole longer than broad, broader behind than in front, its peduncle short, the node in profile angular, its anterior slope slightly concave, its posterior slope slightly convex. Postpetiole broader than long and broader than the petiole, rounded above and on the sides, constricted behind, with a blunt, transverse anteroventral projection. Gaster rather larger, somewhat longer than the thorax. Legs not incrassated.

Shining, especially the mandibles, clypeus and gaster. Mandibles sparsely punctate, clypeus smooth, indistinctly rugulose on the sides. Head longitudinally rugose, the rugæ becoming coarsely reticulate on the occipital region. Scrobes and interrugal spaces indistinctly punctate-reticulate. Region of the frontal groove occupied by a smooth shining longitudinal streak. Thorax, petiole and postpetiole irregularly, their upper surfaces more transversely rugose. Declivity of epinotum smooth and shining. Gaster with sparse, piligerous punctures.

Hairs moderately long and abundant, erect or suberect, yellowish, bristly, covering all parts of the body, shorter and sparser on the legs and scapes, rather dense on the funiculi.

Dark piceous brown; thorax, petiole and postpetiole nearly black; mandibles, clypeus, cheeks, base and tip of gaster, legs, including the coxæ, first joint of funiculi and their clubs reddish brown.

Male. Length 3 mm.

Head as broad as long, broadly rounded behind, without posterior angles, somewhat flattened above, with very short cheeks. Clypeus much as in the worker. Pronotum visible from above, not overarched by the mesonotum which is as broad as long. Scutellum not very prominent. Epinotum sloping, simple, unarmed. Petiole fully twice as long as high and more than twice as long as broad, parallel-sided. Postpetiole from above broader, nearly square.

Head and thorax subopaque, rather finely and irregularly punctate-rugulose; mesopleuræ, a longitudinal streak on the front of the head, the petiole, postpetiole and gaster smooth and shining, the gaster with fine sparse piligerous punctures.

Hairs finer and more oblique than in the worker, very numerous on the antennæ and wings, which are unusually pubescent.

Dark piceous brown, nearly black; legs and antennæ paler; clypeus and mandibles yellowish. Wings opaque brownish, with brown veins and pterostigma.

Described from numerous workers and five males collected by Mr. A. M. Lea on Lord Howe Island.

5. **Lordomyrma punctiventris** sp. nov.

(Fig. 4.)

Worker. Length 3–3.2 mm.

Head subrectangular, a little longer than broad, with nearly straight posterior border and subparallel sides. Eyes small, elongate, placed obliquely a little in front of the middle of the sides. Mandibles like those of *leæ* but thicker, more deflected at the tips and with slightly concave external borders. Clypeus convex in the middle, with two strong carinæ, which do not reach the anterior border. The surface between them is concave. Antennal

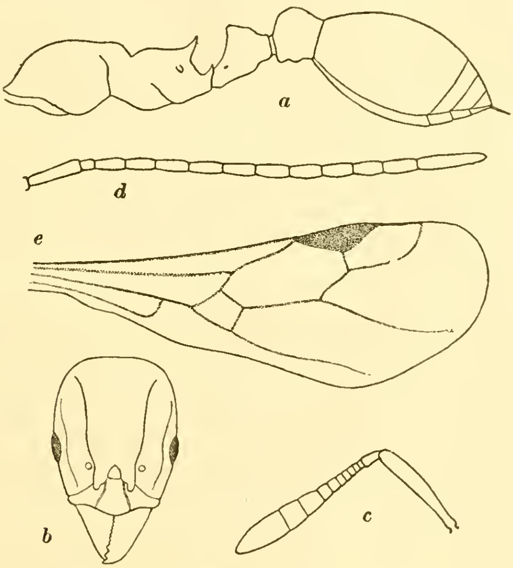


Figure 4. *Lordomyrma punctiventris* sp. nov.; *a*, thorax and abdomen of worker; *b*, head and *c*, antenna of same; *d*, antenna and *e*, wing of male.

scrobes more sharply defined and deeper than in *leæ*, complete behind, about $\frac{4}{5}$ as long as the head, the prolonged frontal carinæ more prominent. Antennal scapes stout, as long as head; funicular joints 2–7 very short and transverse, 9 and 10 together shorter than the terminal joint. Thorax more robust than in *leæ*, with dentate humeral angles, the pro- and mesonotum above rounded and slightly depressed, the latter falling less abruptly behind than in *leæ* to the pronounced mesoëpinotal constriction. Epinotum as broad as long, its spines less erect, longer, nearly as long as the rather convex base; metasternal spines very short, erect, acute. Petiole from above about $1\frac{1}{2}$ times as long as broad, broader behind than in front; in profile as high as long, with angularly pointed node, its anterior slope concave, its posterior slope straight. Postpetiole broader than long, broader than the petiole and somewhat broader in front than behind, dentate anteriorly on the ventral side. Gaster and legs as in *leæ*.

Mandibles shining, finely and very sparsely punctate; head, thorax, petiole and postpetiole subopaque evenly reticulate-rugose, the head in front and on the sides longitudinally rugose, the scrobes shining and finely, transversely rugulose. Gaster shining, covered with rather strong, transverse piligerous punctures. Antennal scapes very finely rugulose; legs smooth, sparsely and finely punctate.

Hairs yellowish gray, appearing blackish in some lights, moderately abundant, especially on the gaster, erect or suberect on the body, shorter and more oblique on the legs, reduced to pubescence on the antennæ.

Head, thorax, petiole and postpetiole rich castaneous; mandibles, antennæ and gaster pale orange brown; legs more yellow.

Described from twenty-one specimens, comprising nearly an entire colony, taken from a small cavity in a rotten log in the dark tropical "scrub" at Kuranda, Queensland. In life these ants are sluggish and timid, like the species of *Podomyrma*. The latter, however, nest in the trunks and branches of living trees and move about in the sunlight.

A NEW PAPER-MAKING CREMATOGASTER FROM THE SOUTHEASTERN UNITED STATES.[1]

By William Morton Wheeler.

More than thirty years ago the late Prof. George F. Atkinson described and figured a large, elongate elliptical paper nest which he took to be the work of our common acrobat ant, *Crematogaster lineolata* Say.[2] The structure, "about eighteen inches long by twelve inches in circumference at greatest diameter" was discovered by H. A. Brown in the marshes bordering Broad Creek, Hyde County, N. C., and was "built several feet from the ground on a bush." The material was "of a light gray color, much like that of the nest of the white-faced hornet," but was darker internally, almost black in some places. Atkinson believed that the *Crematogaster*, instead of building in its usual manner under stones or logs, where it not infrequently covers the walls of its chambers with a variable amount of dark-colored carton, had adopted the arboreal habit as a "singular adaptation" to living in a swamp. As I saw no reason to question the correctness of his identification of the ant, I have on two or three occasions expressed the same opinion.[3]

About a year ago Dr. E. F. Bigelow sent me a photograph and fragments of a large paper nest found by Mr. J. Willis Youngs at Fort Myers, Fla., together with some of the ants that had constructed it. Dr. Bigelow subsequently published the photograph with a few notes.[4] The nest as shown in the photograph is much damaged but must have been originally more than a foot in length. A study of the ants shows that they represent an undescribed species, closely related to *C. lineolata* but easily recognizable as distinct. I feel reasonably certain from an examination of the carton and a comparison of Atkinson's and Bigelow's figures that both nests were built by the same species of ant.

Very recently Dr. W. M. Mann sent me specimens of the same

[1] Contribution from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 157.

[2] Singular Adaptation in Nest-making by an Ant, *Cremastogaster lineolata* Say. Amer. Natural. 21, 1887, pp. 770–771, Pl. 26.

[3] The Habits of the Tent-building Ant (*Crematogaster lineolata* Say). Bull. American Mus. Nat. Hist. 22, 1906, p. 15; Vestigial Instincts in Insects and other Animals. Amer. Journ. Psychol. 19, 1908, p. 4.

[4] A Very Interesting Study of Ants. Guide to Nature 11, March 1919, p. 270.

Crematogaster from a paper nest found by E. S. Snyder on a willow tree, two feet above the ground, on Paradise Key, Fla., and on critically examining the large series of *Crematogaster* that have been accumulating in my collection for more than twenty years, I find specimens of the same ant and of a yellow variety from several localities in Florida, Georgia and North Carolina. Prof. J. H. Comstock gave me Atkinson's original photograph of the nest described from North Carolina. I reproduce it in the hope that the more modern half-tone process may bring out the texture of the carton even more clearly than in the original article. I also reproduce a photograph of the Paradise Key nest kindly loaned me by Dr. Mann.

The new *Crematogaster* and its variety are herewith described.

Crematogaster atkinsoni sp. nov.

(Fig. 1 *b*.)

Worker. Length 2.5–3.3 mm.

Similar to the typical *lineolata* Say, but smaller, the latter measuring from 3 to 4 mm., with the thorax, especially the pro- and mesonotum more slender, the promesonotal suture more indistinct, the mesonotum more flattened and with more indistinct longitudinal carina. Head smaller and proportionally narrower; the frontal groove much less distinct. Antennal scapes longer, reaching about twice their greatest diameter beyond the posterior border of the head. Epinotal spines decidedly longer, straight, more slender and more acute, longer than the base of the epinotum and as long as the distance between their insertions. They are widely divergent and directed less backward and somewhat more obliquely upward than in the typical *lineolata*.

Surface smooth and shining, the thorax above without traces of the distinct puncturation and rugulation of *lineolata*, except the base of the epinotum, which is longitudinally rugulose. Mesopleuræ opaque, finely and densely punctate. Epinotal declivity very smooth and shining as are also the upper surfaces of the petiole and postpetiole (opaque or subopaque in *lineolata*). Head and gaster highly polished, except the mandibles and cheeks which are subopaque and finely striate, and the clypeus, which is indistinctly striate and somewhat less shining than the front and vertex.

Pubescence much as in the typical *lineolata*, but the erect hairs are sparser, the appressed hairs on the legs shorter. The hairs on the antennal scapes, however, are longer, more abundant and oblique.

Color like that of the typical *lineolata*, castaneous with black gaster, the latter sometimes paler at the base; antennæ and legs more reddish brown, with the middle portions of the femora and tibiæ and the tip of the last antennal joint piceous or blackish.

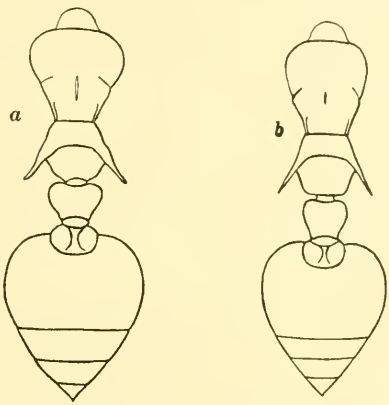


Figure 1. *a*, Thorax and abdomen of worker *Crematogaster lineolata* Say; *b*, *b*, *C. atkinsoni* sp. nov.

Some specimens have the head and thorax more blackish, with the mandibles, cheeks, clypeus, tarsi, articulations of the legs, thorax, petiole, and postpetiole reddish brown or deep red.

Described from several workers from Fort Myers, Fla. (J. W. Youngs) which may be regarded as the type-locality. I possess other specimens taken in the following localities in the same state: Titusville (Amer. Mus. Nat. Hist.); Crescent City (Van Duzee); Jacksonville (Mrs. A. T. Slosson); Paradise Key; (E. S. Snyder) and Tallahassee.

C. atkinsoni var. **helveola** var. nov.

Worker. Like the typical form of the species, except in color. Brownish yellow, legs slightly paler; posterior half of gaster and sometimes also the upper surface of the head pale brown.

Female (deälated). Length 6.5 mm.

Much smaller than the female of the typical *lineolata*, which measures 8–8.5 mm. Head more rectangular and fully as long as broad (broader in *lineolata*, with more rounded sides and posterior corners). Epinotal spines reduced to stout teeth as in *lineolata* but shorter and slightly more deflected. Metanotum (postscutellum) much less protuberant in profile.

Surface of body smoother and more shining, covered with fine, sparse, piligerous punctures; mandibles and anterior half of head longitudinally striate, mandibles rather opaque.

Hairs whitish, apparently less abundant than in *lineolata*, pubescence much the same. Hairs on the scapes shorter and less conspicuous than in the worker.

Colored like the worker, but the scutellum, an anteromedian and an elongate spot on each side of the mesonotum and the whole gaster brown; each segment of the latter with a narrow, transverse, dark brown band near the posterior margin. Mandibles red, with black apical margins.

Male. Length about 3 mm.

Smaller than the male of the typical *lineolata*, which measures 4–4.5 mm. Head blackish; thorax, petiole and postpetiole chocolate brown; antennæ and legs, mandibles and gaster brownish yellow, the dorsal surface of the gaster darker. Wings white, with colorless veins and stigma. Head and gaster somewhat shining, thorax more opaque. Pilosity much less developed than in the male of *lineolata*.

Described from several workers and males and a single female taken by Prof. J. C. Bradley in the Okefenokee Swamp, Ga. (type locality). The Rev. P. J. Schmitt sent me many years ago several workers which he had taken at Lake Worth, Fla., and Belmont, N. C.

C. atkinsoni is very closely allied to *C. ashmeadi* Mayr and to *lineolata* subsp. *læviuscula* Mayr. Both of these forms have the surface of the body smooth and shining, though in *læviuscula* and its vars. *clara* Mayr and *californica* Emery the thorax is distinctly sculptured. *C. ashmeadi* is, however, smaller than *atkinsoni* in both worker and female phases, and the worker has the epinotal spines reduced to stout distinctly incurved teeth. The epinotal spines of the typical *læviuscula* are shorter and more sinuate than in *atkinsoni* and the vars. *clara* and *californica* are larger, of a very different color and with much more opaque and sculptured thorax and pedicel.

After renewed study of the North American Crematogasters in my collection, and of most of the forms in the field, I incline to regard those that have been cited as subspecies of *lineolata* by Emery and myself, namely *pilosa* Pergande, *læviuscula* Mayr, *coarctata* Mayr and *opaca* Mayr, as worthy of specific rank. This is merely a return to the position of Mayr, who described the three latter forms as separate species. The complete list of Crematogasters known to inhabit America north of Mexico, and including the two described above, would run as follows:

C. lineolata Say.
  var. *cerasi* Fitch
  var. *lutescens* Emery
  var. *subopaca* Emery
pilosa Pergande
læviuscula Mayr
  var. *clara* Mayr
  var. *californica* Emery
coarctata Mayr
  var. *mormonum* Emery
opaca Mayr var. *depilis* Wheeler
  var. *punctulata* Emery
atkinsoni Wheeler
  var. *helveola* Wheeler
ashmeadi Mayr
vermiculata Emery
arizonensis Wheeler
victima Smith subsp. *missouriensis* Pergande
minutissima Mayr

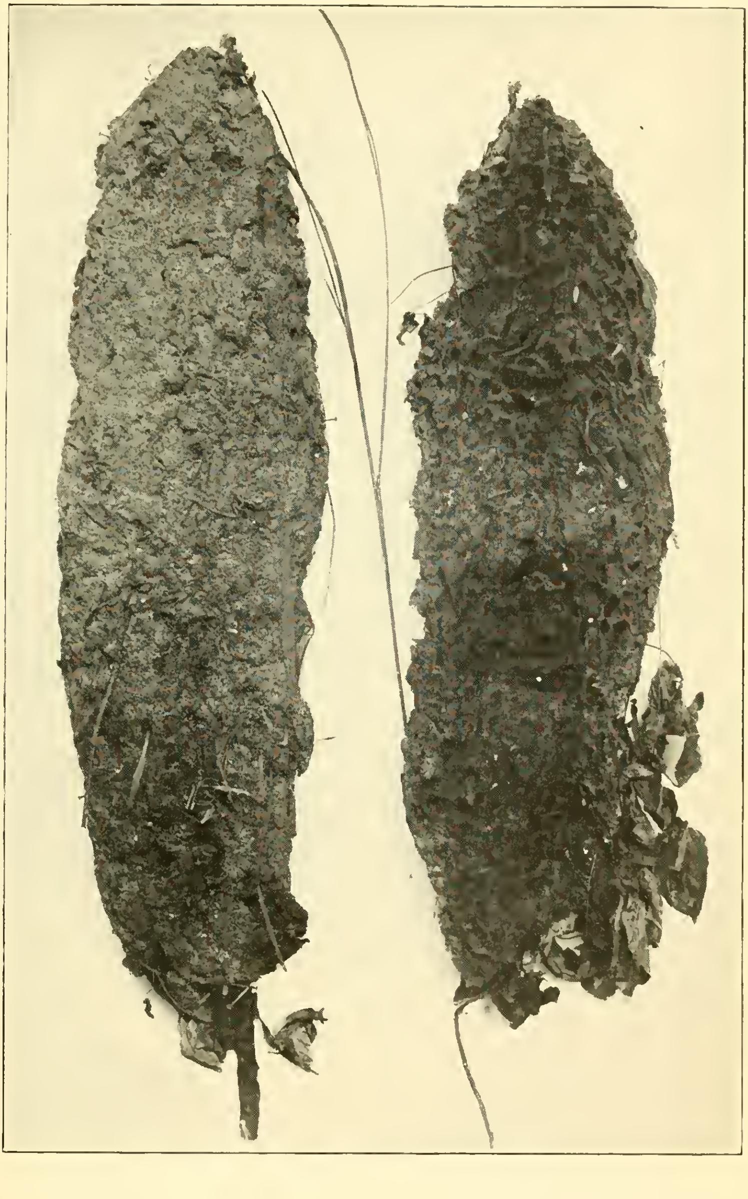
Additional data on the habits of *C. atkinsoni* would be of considerable interest. Consultation of the atlas shows that, with the exception of Belmont, N. C., all the localities cited for this ant and its variety are near the sea-shore, where the species seems to be confined to swamps, or, at any rate, to regions subject to periodic inundation. This may account for the fact that its nest has been so seldom seen, although the ant may be a rather rare relict of a time when the Southeastern States had a more tropical climate.

Be this as it may, we must now abandon the view that the large paper nests occasionally found in North Carolina and Florida are merely so many sporadic or local adaptations of *C. lineolata* colonies to living in flooded districts, and must regard them as the work of a peculiar species whose method of nidification is unlike that of any other Nearctic ant though very similar to that of many of the tropical species of *Crematogaster*.

Explanation of Plates V and VI.

Plate V. Nest of *Crematogaster atkinsoni* sp. nov. from the original photograph of Prof. G. F. Atk'nson published in 1887. (American Naturalist, Vol. 21, Pl. 26.)

Plate VI. Nest of *Crematogaster atkinsoni* sp. nov. from Paradise Key, Florida (Collection W. M. Mann).



Wheeler—Paper-making Crematogaster

THE ANTS OF TOBAGO ISLAND.

By William Morton Wheeler,
Bussey Institution, Harvard University.

During April, 1918, Prof. A. L. Treadwell of Vassar College collected such ants as he could find on the island of Tobago and sent them to me for identification. The island is situated only twenty miles northeast of Trinidad and is twenty-six miles long and seven and one-half miles broad. Though it might be expected to have a rich ant-fauna somewhat resembling that of Trinidad, Professor Treadwell succeeded in taking only the following eight species:

1. *Odontomachus hæmatoda* L. Numerous workers of the typical dark form from Spey-Side.
2. *Solenopsis geminata* Fabr. Numerous workers from Milford and Pigeon Point.
3. *Pheidole megacephala* Fabr. A few soldiers and many workers from Pigeon Point and some other localities on the island, "nesting in the sand of the seashore."
4. *Pheidole fallax* Mayr subsp. *emiliæ* Forel. A single soldier from Pigeon Point.
5. *Acromyrmex octospinosa* Reich. Two workers from Pigeon Point.
6. *Prenolepis* (*Nylanderia*) *longicornis* Latr. Several workers from Spey-Side.
7. *Camponotus* (*Myrmothrix*) *abdominalis* Fabr. Seven workers of the typical form of this variable species from Pigeon Point and St. Patrick's Cathedral, "nesting in a calabash."
8. *Camponotus* (*Myrmamblys*) *fastigiatus* Mayr. Eleven workers from Milford.

Four of these ants, namely *Odontomachus hæmatoda*, *Solenopsis geminata*, *Pheidole megacephala* and *Prenolepis longicornis*, are everywhere abundant "tramps" in the tropics of both hemispheres. The other four are common species of Trinidad and the adjacent South American continent. The introduction of *Pheidole megacephala* into so small an island as Tobago must have led to the extermination of any primitive or indigenous ant-fauna it may have possessed. The few forms taken by Professor Treadwell probably represent all or nearly all the species that are sufficiently resistant or aggressive to withstand the inroads of such a pest as *megacephala*.

EXCHANGE COLUMN.

Notices not to exceed four lines in length concerning exchanges desired of specimens or entomological literature will be inserted free for subscribers, to be run as long as may be deemed advisable by the editors.

Cynipidæ,—galls or the bred makers,—of the world desired for exchange or purchase. Will determine North American material. Address: Alfred C. Kinsey, Bussey Institution, Forest Hills, Mass.

Sarcophagidæ from all parts of the world bought or exchanged according to arrangement. North American material determined.—R. R. Parker, State Board of Entomology, Bozeman, Mont.

Wanted: Insects of any order from ant nests, with specimens of the host ants, from any part of the world; also Cremastochilinæ of the world. Will give cash or Coleoptera, Hymenoptera and Diptera from the United States.—Wm. M. Mann, U. S. National Museum, Washington, D. C.

Wanted: Old Series Entom., Bul. 1, 2, 3, 33; Technical Series 4, 6, 7; Insect Life vol. 4–6; Jour. Applied Microscopy I, N. Y. State Entom. Rep. 3, 4; Fitch Rep. 7, 8, 13.—Philip Dowell, Port Richmond, N. Y.

Wanted: Insects of the family Embiidæ (Isoptera). I would give insects of any order except Lepidoptera. I would like to correspond with persons interested in this family.—Raoul M. May, 2202 W. 10th St., Los Angeles, California.

Wanted: To exchange, or purchase for cash, specimens of the Genus Apantesis from any locality. Also to purchase rare Catocalæ.—Samuel E. Cassino, Salem, Mass.

Wanted: 19th Illinois Entomological Report; Coleoptera of Southern California, by H. C. Fall; Notes on Lachnosterna of Temperate North America, by J. B. Smith; Complete Works of Thos. Say, Le Conte edition.—J. S. Wade, U. S. Bureau of Entomology, Washington, D. C.

Wanted for cash: Lowest representatives of all families of insects, preserved in fluid.—G. C. Crampton, Amherst, Mass.

Wanted: Living larval material of Tabanidæ, obtainable by sifting the soil at edge of water.—Packing in wet material, not water, each larva separate. Will send collecting outfit. Exchange insects of any order, or cash.—Werner Marchand, 10 Dickinson St., Princeton, N. J.

For Sale: A large collection of Javanese butterflies. Letters with particulars regarding desired species and families may be addressed to G. Overdykink, Agricultural School, Soekaboemi, Java, Dutch East Indies.

Wanted: Syrphidæ (Flower-flies) from all parts of the world. Exchanges solicited. Will determine on the usual conditions. C. L. Metcalf, Ohio State University, Columbus, Ohio.

Wanted: Pupæ of *Lachnosterna fusca,* pupæ and larvæ of *Macrodactylus subspinosus,* imagoes, pupæ and work of *Saperda candida* and *calcarata; Zeuzera pyrina* ♀, pupæ or pupa shell and work. Ward's Natural Science Establishment, Rochester, N. Y.

CAMBRIDGE ENTOMOLOGICAL CLUB

A regular meeting of the Club is held on the third Tuesday of each month (July, August and September excepted) at 7.45 P. M. at the Bussey Institution, Forest Hills, Boston. The Bussey Institution is one block from the Forest Hills Station of both the elevated street cars and the N. Y., N. H. & H. R. R. Entomologists visiting Boston are cordially invited to attend.

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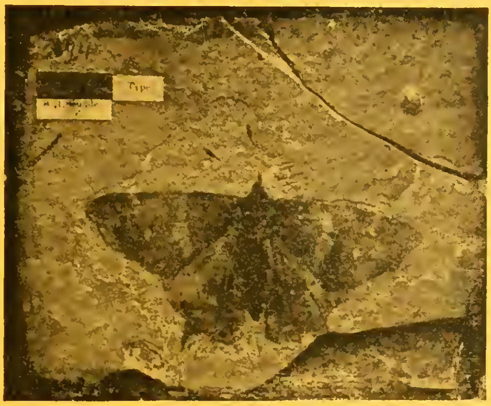

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CAMBRIDGE ENTOMOLOGICAL CLUB.

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THE NEARCTIC PSAMMOCHARIDS OF THE GENUS APORINELLUS BANKS.

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On one of the collecting trips made this summer with Prof. William M. Wheeler, in the vicinity of Boston, I collected a little Psammocharid which has proved to be an undescribed species of *Aporinellus*. In comparing this specimen with Mr. Nathan Banks' extensive collection of Psammocharids I have found another undescribed member of the same genus. Descriptions of both forms are given herewith, together with a brief review of the group. I am much indebted to Mr. Nathan Banks, of the Museum of Comparative Zoölogy, Cambridge, Mass., for the loan of rich material containing many types and for valuable bibliographic help.

The genus *Aporinellus* Banks[1] includes small Psammocharinæ with the propodeum smooth, emarginate behind when seen from above, its posterior angles conical, sharp or obtusely rounded at the apex. Thorax convex above, the pronotum not flattened and shorter than or about the length of the mesonotum. The head is feebly flattened antero-posteriorly; the anterior margin of the clypeus straightly truncate. Tarsal comb of the fore legs well developed; the tibiæ and tarsi otherwise feebly spinose. Claws with a tooth about the middle of their length. There are no long erect hairs on the cheeks, gula, coxæ and propodeum. Fore wings with two closed cubital cells; the transverse median reaches the media before the origin of the basal vein; in the hind wings the transverse median ends before or close to the cubitus.

Aporinellus is represented by several species throughout the United States and also exists in Mexico; whether the genus occurs in Canada is not known. It is, however, probable that its range

[1] Journ. New York Ent. Soc. 19, 1911, p. 223.

includes several other zoölogical regions. Indeed, the genus *Aporinellus* as defined above, agrees with Kohl's "Group 14 of *Pompilus* Fabricius"[1] and this identity was recognized by Sustera.[2] *Psammochares sexmaculatus* (Spinola) of which I have seen a ♀ from Corsica in Mr. Banks' collection, has the same structure of the propodeum as *Aporinellus*, but differs in the presence of a third, petiolate cubital cell in the fore wings; similar forms are apparently not known from the Nearctic Region.

Several of the species of *Aporinellus* have originally been described as *Aporus*. As shown by Banks the true *Aporus* Spinola is structurally very different and has thus far not been found in North America. I have examined two palearctic species, *Aporus unicolor* Spinola (the genotype) and *A. dubius* Van der Linden; in these the propodeum is not or scarcely emarginate behind and its lateral angles are not produced; the fore wings have two cubital cells and the transverse median ends on the media far beyond the basal. As suggested by Kohl, *Aporus* Spinola is more closely related to typical *Psammochares* Latreille (*Pompilus* Fabricius) with three cubital cells, from which it evidently has been derived. According to Banks, the true *Aporus* is also structurally close to the North American *Psammochares marginatus* (Say). On the other hand, Ashmead's genus *Aporus*[3] evidently possesses all the characteristics of *Aporinellus* Banks which are, however, not present in *Aporus unicolor* Spinola.

The wasps of the genus *Aporinellus* are not frequently met with; they are usually found while running about in search of their prey and seldom visit flowers. The nesting habits are only known of *A. fasciatus*, which was studied in Wisconsin by G. W. and E. G. Peckham.[4] The ethology of this wasp agrees with that exhibited by most Psammocharids. The prey consists of spiders belonging to various genera (*Phidippus*, *Attus*, *Mævia*) of the family Attidæ. The female first captures her spider which is slightly paralyzed, dragged to the nesting site and temporarily deposited on a leaf. She then makes a careful study of the locality to discover a suitable spot for her burrow. Often several burrows are started and abandoned before the final choice is made. "The one habit that this

[1] Verh. zool.-bot. Ges. Wien 34, 1884, p. 54.
[2] *Ibid.* 62, 1912, p. 212.
[3] Canadian Entom. 34, 1902, p. 87.
[4] Wisconsin Geol. Nat. Hist. Survey Bull. No. 2, 1898, pp. 55–57.

species can claim as peculiar to itself is that of filling up the partly made nests that it is about to abandon. We have never seen the sense of order carried to so high a point in any other wasp" (G. and E. Peckham). After digging is completed, the spider is dragged inside and the egg fastened to the side of the abdomen of the prey; the entrance is then carefully filled up. When finished the burrow is a small gallery running down obliquely for an inch and a half in the ground. The spider is only slightly affected by the poison of the sting, this wasp depending probably more upon packing her victim in tightly to keep it quiet.

The following key will aid in separating the females of the species known from the eastern and central states, all of which I have examined in nature. In addition there are several Californian species tabulated by Mr. Nathan Banks in a forthcoming paper.

1. Body almost entirely reddish; head except the clypeus, and antennæ beyond the second joint, black. Wings blackish at tip, the second cubital cell scarcely longer than broad. Face below, posterior margin of pronotum and apical fasciæ of the abdominal tergites feebly sericeous. Tarsal comb long. Length: 5 to 6 mm. (♂ unknown) . . . . **rufus** Banks.
   Not reddish throughout . . . . 2.
2. Legs, at least the hind pair, mostly reddish . . . . 3.
   Body and legs entirely black, with sericeous or silvery pubescence . . . . 5.
3. Body silvery, with distinct sericeous apical fasciæ on the abdominal tergites. Color black; the mandibles in their middle, the hind tibiæ and femora entirely and the basal joints of the hind tarsi partly, reddish. Head and tarsal comb as in *fasciatus*, from which this species differs in the second cubital cell being only $1\frac{1}{2}$ as long as broad. Length: 5 to 7 mm. (♂ unknown) . . . . **ferrugineipes** (Viereck).
   Body smooth, very feebly pruinose, not sericeous, the abdomen without silvery fasciæ. Second cubital cell $\frac{1}{3}$ to $\frac{1}{2}$ as long as broad . . . . 4.
4. First three abdominal segments and all the legs for the larger part reddish. Ocellar triangle little flattened, the lateral ocelli only feebly nearer to the eyes than to each other. Tar-

sal comb short, its bristles less than half the length of the fore basitarsus. Length: 7 mm. (♂ unknown). **wheeleri** sp. nov.

Black; apex of the first two abdominal tergites with a scarcely visible rufous tinge; hind tibiæ and femora entirely, and hind tarsi partly reddish. Ocellar triangle distinctly flattened, the lateral ocelli much farther from each other than from the eyes. Tarsal comb long, its bristles over half the length of the fore basitarsus. Length: 6.5 mm. (♂ unknown) **banksi** sp. nov.

5. Vertex as broad or slightly broader than the face below. Lateral ocelli nearer to the eyes than to each other. Second cubital cell over twice as long as broad. Abdomen with distinct silvery apical fasciæ. Length: 7–8 mm. (♂ unknown) . . . . **laticeps** Banks.

Vertex narrower than face below; lateral ocelli hardly nearer to the eyes than to each other. Second cubital cell about twice as long as broad . . . . 6.

6. Body, except the apical two abdominal segments, uniformly sericeous. Posterior emargination of the propodeum feeble, the lateral angles small. Length: 5.5 to 6 mm. **completus** Banks.

Sericeous pubescence interrupted by black cross bands, especially on the second to fourth abdominal tergites which have distinct silvery apical fasciæ. Posterior angles of the propodeum very pronounced, large. Length: ♀, 6 to 8 mm.; ♂, 4.5 to 6.5 mm. . . . . **fasciatus** (Smith).

Aporinellus wheeleri sp. nov.

Female. Length 7 mm.

Head distinctly broader than the thorax. Inner margins of the eyes subparallel below, feebly sinuate about the middle, then slightly converging towards the vertex which is much narrower than the face at the clypeus. Ocellar triangle very little flattened, almost equilateral; the lateral ocelli hardly nearer to the eyes than to each other. Clypeus straightly truncate at the anterior margin. Antennæ moderately slender; the third and fourth joints about of the same length and about as long as the scape. Pronotum convex, much shorter than the mesonotum when seen from above, its posterior margin broadly and evenly arcuate.

Propodeum with pronounced apical emargination and acute lateral angles. Legs slender as compared with *A. fasciatus*, the femora and tibiæ hardly swollen. Comb of the fore tarsi feeble, composed of 5 or 6 short bristles, the longest of which are less than half the length of the fore basitarsus and about the length of the second tarsal joint. Fore wings with the second cubital cell comparatively short, slightly over $1\frac{1}{3}$ as long as broad. Transverse median of the hind wings ending much before the base of the cubitus.

Head mostly and thorax entirely black; anterior margin of clypeus, mandibles except their apical teeth, and first antennal joint below, more or less reddish. Abdomen with the three first segments bright ferruginous red; the apical margin of the fourth tergite faintly reddish; the remainder black. Legs red; the coxæ, trochanters, extreme tips of femora and tibiæ, tibial spurs and larger part of the tarsi, black; the basitarsus and under side of trochanters on middle and hind legs suffused with red, and a red spot on the under side of the hind coxæ. Tarsal comb and erect bristles of tibiæ and tarsi black. Wings subhyaline; fore wings with a spurious cloud on the basal vein, their apical quarter infuscate.

Tegument impunctate, very shining. Body entirely without sericeous pile, clothed in a feeble grey pruinosity, which is a little more pronounced on the propodeum. No trace of abdominal silvery fasciæ. A few erect hairs on the clypeus, mandibles, and two apical segments of the abdomen.

Described from one female taken at Stony Brook Reservation, near Boston, Mass., July 12, 1919; it was sunning itself on a stony woodroad, after the usual Psammocharid manner.

This species is very striking in its coloration and its shining integument; its closest relative is undoubtedly the species described below as *A. banksi*.

Aporinellus banksi sp. nov.

Female. Length 6.5 mm.

Head comparatively broader than in *A. fasciatus*, much broader than the thorax. Inner margins of the eyes subparallel near the clypeus, curved outwardly about the middle of the face, then feebly converging towards the vertex which is distinctly narrower than the face below. Ocellar triangle distinctly flattened; the lateral ocelli much nearer to the eyes than to each other and about as far from the anterior ocellus as from the eyes. Clypeus straightly truncate at the apex. Antennæ slender, the basal joint (scape) about the length of the fourth, which is a little shorter than the third. Pronotum a little shorter than the mesonotum, strongly convex. Propodeum with pronounced apical emargination; its lateral angles sharp, spinose (in *A. fasciatus* these angles are obtusely rounded at the tip). Legs slender as compared with *A. fasciatus*, the hind femora and tibiæ feebly swollen. Comb of the fore tarsi long, its longest bristles about half the length of the fore basitarsus. Fore wings with the second cubital cell much shorter than in *A. fasciatus*, slightly over $1\frac{1}{3}$ as long as broad and not quite $\frac{2}{3}$ the length of the first cubital on the cubital vein. Hind wings with the transverse median ending much before the base of the cubitus; in *A. fasciatus* both veins are nearly interstitial.

Black. Mandibles except at base and apex, narrow anterior margin of clypeus, hind femora and hind tibiæ entirely, first two joints of hind tarsi partly, and spurs of the hind tibiæ, reddish brown. The apical margins of the first two abdominal tergites are very faintly suffused with brown. Wings subhyaline, with blackish veins, infuscated in their apical third.

Tegument impunctate. Body almost devoid of pubescence. A few erect hairs on the mandibles and clypeus and on the terminal segments of the abdomen. No sericeous pile; but a feeble, grey pruinosity covers the shining body and shows clearly that the specimen is in a very fresh condition.

Described from one female specimen collected by Mr. Birkman in Lee County, Texas, May, 1907.[1]

This species comes near the preceding (*wheeleri*) but is sufficiently distinct in the characters shown in the key.

List of Nearctic Species.

1. **Aporinellus apicatus** Banks, Journ. New York Ent. Soc. 19, 1911, p. 230.

   Aporus apicatus Banks, ibid. 18, 1910, p. 126, ♂.

   Type-locality: Claremont, Calif.

   In Mr. Banks' collection there are also specimens from

[1] Mus. Comp. Zoöl. Cambridge, No. 10757.

National City, Calif. (Van Duzee Coll.) and Felton, Sa. Cruz Mts., Calif. (Bradley Coll.).

2. **Aporinellus banksi** sp. nov., ♀.
Type-locality: Lee Co., Texas.

3. **Aporinellus californicus** Rohwer, Proc. U. S. Nat. Mus. 53, 1917, p. 240, ♀.
Type-locality: Alameda Co., Calif.

4. **Aporinellus completus** Banks, Bull. Mus. Comp. Zoöl. 61, 1917, p. 97, ♀ ♂.
Type-locality: Lone Tree, Yakima River, Wash.

Also recorded from Thorp, Kittitas Valley, Wash. I have seen in Mr. Banks' collection a ♀ from Boulder, Colo., September 8, 1908, on flowers of *Helianthus pumilus* (Rohwer Coll.).

5. **Aporinellus fasciatus** (F. Smith) Banks, Journ. New York Ent. Soc. 19, 1911, p. 231, ♀. Rohwer, Hymenoptera of Connecticut, 1916, p. 631.
Aporus fasciatus F. Smith, Cat. Hym. Brit. Mus. 3, 1855, p. 175, ♂. Cresson, Trans. Amer. Ent. Soc. 1, 1867, pp. 137, ♂ and 149, ♀; *ibid.* 4, 1872, p. 27, ♂; Synopsis Hym. Amer. 1887, p. 273. Birkman, Ent. News 10, 1899, p. 244. J. B. Smith, Insects of New Jersey 1910, p. 674.
Pompilus unionis Dalla Torre, Cat. Hym. 8, 1897, p. 330.
Type-locality: Warm Springs, S. C.

This is a widely distributed species being known from the following states: New York, Massachusetts, Connecticut, New Jersey, Virginia, North Carolina, South Carolina, Georgia, Texas and Colorado.

6. **Aporinellus ferrugineipes** (Viereck) Banks, Journ. New York Ent. Soc. 19, 1911, p. 230, ♀.
Aporus ferrugineipes Viereck, Trans. Amer. Ent. Soc. 32, 1906, p. 204, ♀.
Type-locality: Clark Co., Kans.

In Mr. Banks' collection from Bayville, N. Y. (Banks Coll.) and Fedor, Lee Co., Texas (Birkman Coll.). I have also taken a ♀ at Wharton, Wharton Co., Texas, June 24, 1917.

7. **Aporinellus intermedius** Banks, ♀. Will be shortly described in the Bull. Mus. Comp. Zoöl.
Type-locality: Owens River, Calif.

8. **Aporinellus laticeps** Banks, Journ. New York Ent. Soc. 19, 1911, pp. 230 and 231, ♀.

   Type-locality: Boulder, Colo.

9. **Aporinellus medianus** Banks, Bull. Mus. Comp. Zoöl. 61, 1917, p. 97, ♀.

   Type-locality: El Cajon, Calif.

   Also known from Los Angeles, Calif., and Mid. F. Kaweah R., Sequoia Nat. Pk., 1700 ft., Calif.

10. **Aporinellus rufus** Banks, Journ. New York Ent. Soc. 19, 1911, p. 230, ♀.

    Type-locality: Boulder, Colo.

11. **Aporinellus wheeleri** sp. nov., ♀.

    Type-locality: Stony Brook Reservation, Boston, Mass.

The following three Nearctic Psammocharids have been described under *Aporus;* since in my opinion they do not belong in *Aporinellus* Banks, their status may be briefly discussed.

Aporus magnus Banks, 1910,[1] is based on a ♂ from Fedor, Lee County, Texas. Mr. Banks has informed me that he has transferred this to *Pedinaspis*, and after examining the type specimen I fully agree with him. The pronotum is very long, as long as the mesonotum and distinctly flattened above; the posterior margin of the propodeum is deeply emarginate but the lateral angles are not spinose nor conical. There are three cubital cells in the fore wings, all broadly open on the radial vein. Length 12 mm.

Aporus minimus Cresson, 1872,[2] was based on a ♂ from Texas. I have not seen the type, but a ♂ taken by Mr. Banks at Falls Church, Va., agrees perfectly with Cresson's description. It is about 3 mm. long; the propodeum is very feebly emarginate behind, but there are no projecting lateral edges; the pronotum is convex. The venation of the fore wings is peculiar; the radial cell is long and narrow; there are two cubital cells, the second of which is scarcely half as long as the first, regularly trapezoidal, much narrowed on both sides on the radial vein; it receives the first recurrent vein near the first transverse cubital and the second recurrent about its middle. If this specimen represents the true *Aporus minimus* Cresson, the species will probably be placed in

[1] Journ. New York Ent. Soc. 18, p. 126.
[2] Trans. Amer. Ent. Soc. 4, p. 207.

the European genus *Aporus* Spinola; its exact position, however, cannot be decided upon till the female is discovered.

Aporus rufiventris Cresson, 1872,[1] is undoubtedly not an *Aporinellus* as can readily be seen from the description: it possesses three cubital cells in the fore wings and has the propodeum transversely wrinkled; the abdomen is entirely bright fulvo-ferruginous, sericeous. Mr. Banks, who once examined the type, informs me that it most probably belongs in *Pedinaspis*. It was described on a ♀ from Texas. Length about 7 mm.

Several of the Psammocharids described from Mexico undoubtedly belong to *Aporinellus* and in some instances may even be identical with some of the species known from the United States.

Pompilus tæniatus Kohl[2] from Orizaba, Mexico, certainly is an *Aporinellus*. There are two cubital cells and the author writes in the description: "Mittelsegment beiderseits zahnförmig ausgezogen und zeigt genau die Bildung wie bei *P. 6-maculatus*." The size, color and arrangement of the sericeous pubescence are similar to those of *A. ferrugineipes* (Viereck) with which this species is perhaps identical.

Pompilus (*Aporus*) *yucatanensis* Cameron[3] of North Yucatan, Mexico, is said to have "the median segment rather long; the apex oblique, at the sides projecting into stout teeth-like processes. . . . The fore wings with only two cubital cellules." Undoubtedly an *Aporinellus* and perhaps not specifically different from *A. fasciatus*.

Pompilus (*Aporus*) *decorus* Cameron, *P. monticola* Cameron, *P. flavomarginatus* Cameron and *P.* (*Aporus*) *smithianus* Cameron,[4] all of Mexico, apparently are not true *Aporinellus* though possessing two cubital cells in the fore wings.

[1] Trans. Amer. Ent. Soc. 4, p. 207.
[2] Verh. zool.—bot. Ges. Wien 36, 1886, pp. 315 and 336.
[3] Biologia Centr. Amer. Hymenoptera 2, 1893, p. 189.
[4] *Op. cit.* pp. 190–191.

A SINGULAR NEOTROPICAL ANT (*PSEUDOMYRMA FILIFORMIS* FABRICIUS).[1]

By William Morton Wheeler.

In his "Systema Piezatorum," published in 1804, Fabricius described a remarkable neotropical ant as *Formica filiformis*, in the single sentence: "Formica elongata, filiformis, flava, abdominis basi nigricante, petioli binodi." In a second sentence, after the citation of the locality: "Habitat in America meridionale. Dom. Smidt, Mus. Dom. de Sehestedt," he reworded the description, with the addition of the adjective "parvum." The description undoubtedly refers to a deälated female specimen and not to a worker, as stated by Dalla Torre in his "Catalogus Hymenopterorum" (Vol. 7, 1893, p. 56).

In 1855 Frederick Smith described all three phases of the same ant from specimens taken by H. W. Bates at Villa Nova, Brazil, but named it *Pseudomyrma cephalica*. Smith was greatly interested in the ants of the genus *Pseudomyrma* and the ant under consideration seems to have been a particular favorite with him, for he published more figures of it than of any other species. What interested him most was undoubtedly the very aberrant character of the female, especially of its head, for in all other species of *Pseudomyrma* the female is very much like the worker. Though brief his description of all three phases of *filiformis* is clear, and his drawings though schematic enable one to recognize the species without difficulty.

Since the time of Frederick Smith myrmecological literature contains no unequivocal reference to the worker of Fabricius' species either under the name of *filiformis* or of *cephalica*. This is because Forel, in the Biologia Centrali-Americana (1899–1900), redescribed and figured the worker from Guatemala as *Ps. biconvexa* and continued to cite it under that name till 1912 when he published the latest reference I have seen of the insect. I am certain of the specific identity of *biconvexa* with *filiformis*, because during the winter of 1911–1912 I found two fine colonies in Guatemala, each containing, not only numerous females and males

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 161.

agreeing with Fabricius' and Smith's descriptions of *filiformis* and *cephalica*, but also many workers agreeing perfectly with Forel's description and with a cotype of *biconvexa* which he kindly gave me many years ago.

The genus *Pseudomyrma*, owing to the great number and variability of its species is one of the most difficult of ant-genera. As a small contribution to the revision to which it must before long be submitted I give a fuller description of the worker, female and male of *Ps. filiformis*, with larger and more detailed and I trust also somewhat more accurate figures than those published by Smith.

Pseudomyrma filiformis (Fabr.).

Formica filiformis Fabricius, Syst. Piez. 1804, p. 405 ♀.
Leptalea filiformis Erichson, Arch. f. Naturg. 5, 1839, p. 309 ♀.
Pseudomyrma cephalica F. Smith, Trans. Ent. Soc. London (2) 3, 1855, p. 168, Pl. 13, Figs. 12–17, ☿ ♀ ♂; F. Smith, Cat. Hym. Brit. Mus. 6, 1858, p. 155, Pl. 10, Figs. 25, 26 ☿ ♀ ♂; Roger, Berlin, Ent. Zeitschr. 6, 1862, p. 289.
Pseudomyrma filiformis Mayr, Verhand. Zoöl. bot. Ges. Wien, 1863, p. 452 ♀; Roger, Berlin, Ent. Zeitschr. 1863, p. 24 ♀; Mayr, Sitzb. Akad. Wiss. Wien 61, 1870, p. 407 ♀; Dalla Torre, Cat. Hym. 7, 1893, p. 56; Forel, Sitzb. Bayr. Akad. Wiss. 1911, p. 278, ♀; Forel, Biol. Centr. Amer. Formicid. 1899–1900, p. 86 ♀.
Pseudomyrma biconvexa Forel, Biol. Centr. Amer. Formicid. 1899–1900, p. 95, Pl. 4, Fig. 10 ☿; Forel, Ann. Soc. Ent. Belg. 50, 1906, p. 229 ☿; Forel, Sitzb. Bayr. Akad. Wiss. 1911, p. 277 ☿; Forel, Mem. Soc. Ent. Belg. 20, 1912, p. 30 ☿.

Worker (Fig. 1). Length 4.5–5.8 mm.

Head about $1\frac{1}{2}$ times as long as broad, subelliptical, with straight posterior border and evenly convex sides, scarcely narrower in front than behind; eyes about half as long as the sides, in front of the middle, rather flat. Mandibles with convex external border, apical border with two large terminal and four small basal teeth, the basal border with three small separated teeth. Clypeus short, emarginate on each side, with a short, subrectangular median lobe. Frontal carinæ short, closely approximated; frontal groove absent. Antennæ short, scapes scarcely reaching the middle of the internal orbits; first and last funicular joints longer than broad, the remainder scarcely as long as broad. Thorax slender; pronotum distinctly longer than broad, scarcely broader in front than behind, submarginate on the sides posteriorly, with rounded humeri, in profile evenly convex above. Mesonotum circular, rather prominent, sloping to the mesoëpinotal suture, which lies in a rather deep impression bearing the metathoracic spiracles. Epinotum as long as the pro- and mesonotum together, broader in front than behind, somewhat compressed laterally, the base much longer than the declivity, in profile moderately convex and passing with an even curve into the declivity. Petiole more than twice as long as broad, the short peduncle passing gradually into the low rounded node which is only about $\frac{1}{3}$ as high as the length of the segment, a little more abruptly constricted behind, the sides scarcely compressed, its ventral surface with a small tooth anteriorly. Postpetiole

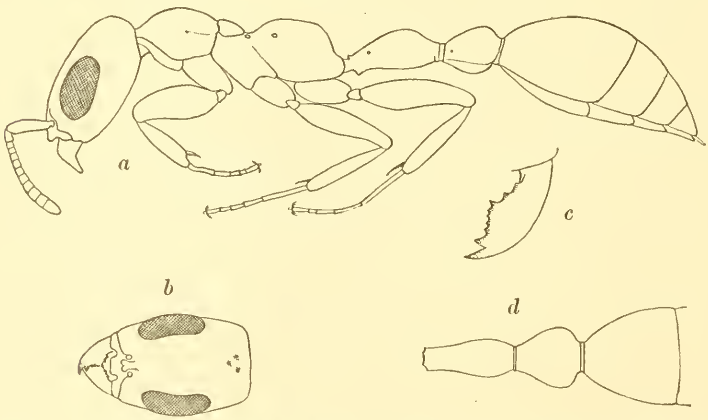

Fig. 1. *Pseudomyrma filiformis* Fabr. Worker. *a*, in profile; *b*, head from above; *c*, mandible; *d*, petiole, postpetiole and first gastric segment from above.

twice as broad as the petiole and about as broad as long, narrowed in front, subtriangular from above and laterally. Gaster rather long, first segment as long as broad. Legs moderately long, fore femora slightly swollen.

Subopaque or glossy; head more shining, especially above; mandibles striatopunctate; antennal scapes smooth and shining; body and legs very finely punctate, head and pronotum a little less densely than the remainder of the body.

Hairs and pubescence white, the hairs short and sparse, rather uniformly distributed on the body, absent on the legs; pubescence fine, dense and hiding the sculpture on the gaster, postpetiole, petiole, epinotum and legs, so that these parts appear pruinose, more dilute on the pronotum and especially on the head.

Head and pronotum yellowish red; mandibles, antennæ and clypeus lemon yellow; remainder of body fuscous; meso- and epinotum and petiole suffused with reddish; apical margin of first gastric segment and base and apex of succeeding segments, tarsi, trochanters, tips of coxæ, bases and tips of tibiæ and femora brownish yellow. Mandibular teeth and ocellar region blackish.

Female. (Fig. 2.) Length 6.5–7 mm.

Head nearly $2\frac{1}{2}$ times as long as broad, suboblong, with broadly excised posterior border and straight, parallel sides, the eyes flat, about $\frac{1}{4}$ as long as the head, their posterior orbits slightly behind its

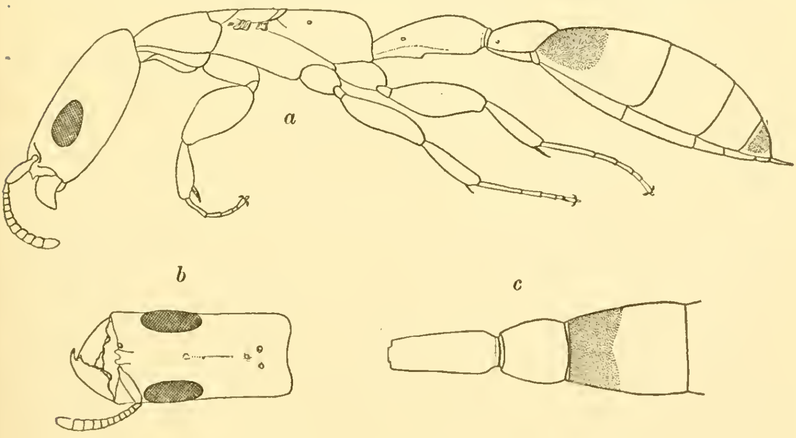

Fig. 2. *Pseudomyrma filiformis* Fabr. Female. *a*, lateral view; *b*, head and *c*, petiole, postpetiole and first gastric segment from above.

median transverse diameter. Ocelli small, only slightly larger than those of the worker. Mandibles and clypeus much as in the worker. Frontal carinæ very small and close together. Frontal groove represented by a shallow pit in the center of the head and a faint, impressed line running from it to the anterior ocellus. Antennæ shorter than in the worker, the scape scarcely reaching to the anterior orbit. Thorax very long and slender, nearly four times as long as broad, narrower than the head, the sides almost subparallel, the pronotum and epinotum each forming about a third of the dorsal surface, the remaining third being formed by the mesonotum, scutellum and metanotum; the mesonotum very small, scarcely broader than long. In profile the thorax is flattened above, rounded in front and behind, the base of the epinotum long and straight and passing through a strong curve into the short, vertical declivity. Petiole from above nearly four times as long as broad, but little broader behind than in front, with nearly parallel sides; in profile feebly and evenly convex from before backwards, ventrally compressed and with an elongate blunt tooth near the middle. Postpetiole twice as broad as the petiole, somewhat longer than broad, subtrapezoidal, somewhat broader behind than in front, with convex rounded sides. Gaster long and slender, the first and second segments longer than broad, the first but little broader anteriorly than the postpetiole. Legs short, femora, especially the fore pair, flattened and dilated. Wings very short, scarcely 4 mm. long.

More shining throughout than the worker, the fine punctures being less dense, even on the thorax and gaster.

Hairs and pubescence much sparser than in the worker, the pubescence very dilute; only the base of the first gastric segment somewhat pruinose.

Brownish yellow; mesonotum, scutellum and epinotum sometimes a little darker; a broad spot at the base of the first gastric segment and nearly the whole dorsum of the fourth segment fuscous, or blackish; the middle and hind femora slightly infuscated; a minute spot in front of the insertion of the fore wing, one at each ocellus, and the teeth of mandibles black. Wings grayish hyaline, strongly iridescent, with pale brown veins and dark brown pterostigma.

Male. (Fig. 3.) Length 4.6–5 mm.

Head slightly longer than broad, subelliptical, with straight posterior border and behind the eyes with straight sides converging to the posterior corners. Eyes rather convex, about half as long as the head; ocelli large. Cheeks very short. Anterior clypeal border sinuately excised on each side, its middle produced as a distinct, bluntly pointed lobe. Mandibles convex, their apical borders finely and indistinctly denticulate. Frontal carinæ short, much more widely separated than in the worker and female.

Frontal groove distinct. Antennæ long, filiform, 12-jointed; scape short, about twice as long as broad, first funicular joint as broad as long, remaining joints cylindrical, the second distinctly longer than the third. Thorax elongate; mesonotum prominent, with distinct Mayrian furrows. Petiole and postpetiole shaped somewhat as in the worker but less convex dorsally, the former without a ventral tooth. Gaster long and narrow. Legs long and slender, the femora not dilated.

Finely punctate, but the punctures more distinct than in the female, so that the surface of the body is somewhat less smooth and shining; mandibles smooth, sparsely punctate.

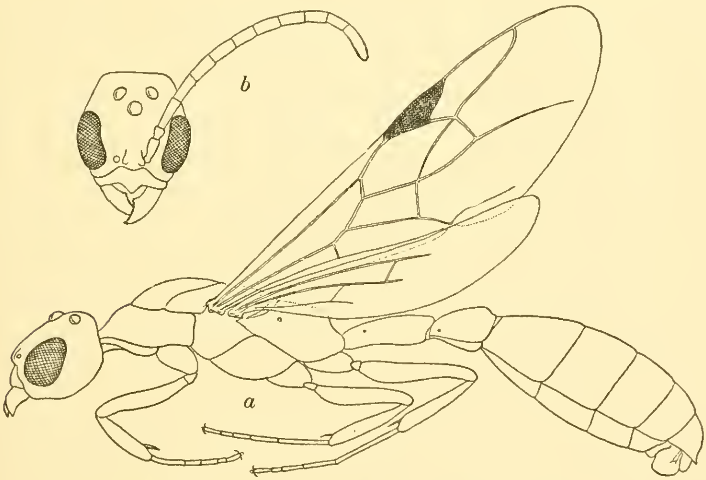

Fig. 3. *Pseudomyrma filiformis* Fabr. Male. *a*, lateral view; *b*, head of same, dorsal views.

Hairs whitish, short and very sparse; pubescence rather long and abundant, uniformly investing the body and appendages.

Brown; mandibles, clypeus, scape and first funicular joint, articulations and sutures of the body and legs dull ivory or brownish yellow. Wings a little darker than in the female.

Type-locality: "South America" (Smidt).

Brazil: Villa Nova (H. W. Bates).

Trinidad (Urich).

Colombia: Santa Marta (A. Forel).
Panama: (Stretch); Bugaba and Caldera (Champion).
Costa Rica (Tonduz).
Guatemala: (Stoll); Pantaleon (Champion); Zacapa and Patulul (Wheeler).

According to Frederick Smith "all the sexes of this species were found by Mr. H. W. Bates in their formicarium, the chambers of which were excavated in dead twigs." The colonies which I found at Zacapa and Patulul were nesting in dead branches lying on the ground in shady places. These branches, 5 to 7 feet long and 1 to 1½ inches in diameter, together with their twigs, had been tunnelled throughout by the ants. The colonies were very populous, comprising hundreds of individuals and therefore larger than those of most species of *Pseudomyrma*. *Ps. filiformis* seems also to differ from many species of the genus (*sericea*, *triplaridis*, *arboris-santæ*, *belti*, *spinicola*, *flavidula*, etc.) in preferring to live in the cavities of dead instead of living plants. There can be little doubt that *filiformis* is a rare or sporadic species. Dr. W. M. Mann, who collected ants assiduously in Brazil in the region explored by Bates, failed to find it, and although I found numerous colonies of many species of *Pseudomyrma* in Central Ameria I saw only two of *filiformis*. It seems to me not improbable that the slender, smooth, aberrant female of this ant may start her colony as a temporary parasite on some other species of *Pseudomyrma*, presumably *Ps. flavidula*, which she so strangely resembles in color.

In his paper on the classification of the Myrmicinæ (Intorno alla classificazione dei Myrmicinæ, Rend. R. Accad. Sc. Bologna, 1914, p. 34) Emery states that the males of the tribe Pseudomyrmini have 13-jointed antennæ. This is certainly an error. All the numerous males I have examined of the various genera of the tribe, *Pseudomyrma*, *Tetraponera* (=*Sima* auct.), *Pachysima* and *Viticicola* gen. nov. (genotype *Sima tessmanni* Stitz of West Africa) have 12-jointed antennæ like the workers and females.

Forel has described the following variety, which I have not seen, as a variety of *Ps. biconvexa:*

Pseudomyrma filiformis var. **longiceps** Forel.

Ps. biconvexa var. *longiceps* Forel, Ann. Soc. Ent. Belg. 50, 1906, p. 229. ☿.

"*Worker.* A little larger than the typical form. The head especially is perceptibly longer, more than $1\frac{1}{2}$ times as long as broad, with subparallel sides. In other respects identical with the typical form."

Santa Marta, Colombia (A. Forel).

NOTES ON *EUSTROPHUS BICOLOR* FABR., BRED FROM FUNGI (COLEOPTERA).

By Harry B. Weiss,
New Brunswick, N. J.

This species, which according to Smith[1] occurs throughout New Jersey from September until the following June, was recently bred from larvæ found feeding in *Pleurotus sapidus*[2] at Monmouth Junction, N. J., on May 30 and in *Polyporus squamosus*[2] at Union, N. J., on May 20. The larvæ collected at Monmouth Junction became full grown during the first week of June and pupated, this stage requiring about one week. The infested fungi which were kept in glass beakers dried out considerably and the larvæ left them and pupated in the bottoms of the containers. It is, therefore, not known where pupation takes place under natural conditions. As the fungi were more or less destroyed by the larvæ, it seems likely that the quiescent stage is passed in the soil or under bark.

Pleurotus sapidus which belongs to the family *Agaricaceæ* is a common saprophytic form occurring on dead, deciduous wood and is one of the edible species closely resembling *Pleurotus ostreatus*, the oyster mushroom. *Polyporus squamosus* is a member of the family *Polyporaceæ* and occurs on living, deciduous trees according to Overholts[3] and on dead parts of living, deciduous trees according to Stevens.[4] Stevens also states that the mycellium causes a white rot of nut, ornamental and fruit trees particularly maple, pear, oak, elm, walnut, linden, ash, birch, chestnut and beech.

In the case of *Pleurotus sapidus*, the larvæ fed on the context and stipe, completely riddling them. In *Polyporus squamosus* both the context and tubes were eaten. Other species of fungi on which adults only were found are *Polyporus betulinus*, Princeton Junction, N. J., April 24; *Polyporus versicolor*, Riverton, N. J., May 5; and *Dœdalia confragosa*, Kingston, N. J., May 8; all belonging to the *Polyporaceæ*. Up to the present, however, larvæ have been found only in the two species mentioned in the first part of these notes.

[1] Smith, J. B., Insects of New Jersey (N. J. State Mus. Rept. 1909).
[2] Identified by Mr. Erdman West.
[3] Overholts, L. O., Polyporaceæ of Mid. Wes. U. S. (Wash. Univ. Studies, III, I, 1, p. 17).
[4] Stevens, F. L., Fungi Which Cause Plant Disease (1913).

Eustrophus bicolor Fabr.

Full-grown Larva. Length 6 to 7 mm. Width 1.5 to 1.8 mm. Elongate, subcylindrical, sparsely hairy, whitish or sordid white except head which is dark and the dorsal surfaces of the thoracic and abdominal segments which bear dark brown to black subrectangular transverse areas giving the dorsal surface a banded appearance. Head large; antenna 4-segmented, each segment subcylindrical, basal segment widest, second segment shortest, third segment bearing the slender fourth segment and a minute spine. Maxillary palpus subcylindrical, 3-segmented, almost as long as antenna, first and second segments subequal in length, third segment one and one-half times length of first. Labial palpus subcylindrical, short, 3-jointed, joints equal in length. Abdominal segments one to eight slightly produced at sides. Ninth abdominal segment bears two dorsal, prominent, reddish-brown tubercles, each tipped with a chitinous hook slightly curved anteriorly. Bases of dorsal tubercles covered with minute, dark tubercles each bearing a hair. Legs well developed, sparsely hairy, anterior surfaces of femora well supplied with minute spines. Dorsal surface of head bears a subcircular, faintly impressed line. Faint, median, whitish line on dorsal surface of first and second thoracic segments sometimes continuing on abdominal segments. Spiracles on second thoracic and abdominal segments one to eight. Abdominal spiracles just below dorsal colorations.

Pupa. Length 5 to 6 mm. Width, 2 mm. Whitish, elongate-oval, rounded anteriorly, gradually tapering posteriorly. Head and thorax covered with minute tubercles, each bearing a long hair. Transverse patches of similar hair-bearing tubercles on dorsal surfaces of remaining segments. Ventral surface almost devoid of hairs.

Adult. This was described by Fabricius in 1798 (Ent. Syst. I, p. 497). Sharp[1] states that about 200 species of *Melandryidæ* are known, chiefly from temperate regions and that they frequent dry wood or fungi. He also says that the few described larvæ are varied in their details and cannot be generalized at present. Blatchley[2] writes that *E. bicolor* is common throughout Indiana, January 19 to September 20 and found beneath bark especially that of fungus covered logs.

[1] Sharp, D., The Cambridge Natural History, Insects, Part II, p. 265.
[2] Blatchley, W. S., Coleoptera of Indiana, 1910.

NOTES ON FOREST INSECTS.

II. NOTES ON SEVERAL SPECIES OF PITYOPHTHORUS BREEDING IN THE LIMBS AND TWIGS OF WHITE PINE.

By M. W. Blackman Ph. D.

Professor of Forest Entomology, New York State College of Forestry, Syracuse, N.Y.

Pityophthorus cariniceps LeConte.

Pityopthtorus cariniceps LeConte is one of the largest species of the genus *Pityophthorus* occurring in the eastern section of the country. It is found from Nova Scotia to West Virginia and westward as far as Michigan. For many years it has been known that it breeds in spruce (Hopkins,[1] 1893, p. 208) and white pine (Chittenden,[2] 1899) but it is still classed by Blatchley & Leng[3] 1916 as "quite rare." In the vicinity of Syracuse this species could hardly be classed as rare, although it is not as common as are several other species of scolytids. There is one pine grove about one and one-half miles from the college where the adults or brood can be found at any time during the spring or early summer breeding in the inner bark and sapwood of small limbs and twigs which have been storm-broken and have fallen to the ground during the previous winter.

On April 24, 1915, adults of *P. cariniceps* were observed starting their burrows in small storm-broken limbs and twigs of white pine in a dense pure stand of trees from 10 inches to 2 feet in diameter. The insects were working in limbs from $\frac{1}{4}$ inch to 1 inch in diameter and in nearly all instances the burrows were started near the axil of a smaller branch where the somewhat rough, folded outer bark furnished foothold for the little workers. Invariably it was the male which started the burrow. In a number of observed cases, groups of two or three beetles were found at these new burrows, the males working with part of their bodies in the recently started entrance gallery, while the others, which were

[1] W. Va. Exper. Sta. Bull. 32.

[2] U. S. Div. of Forestry Bull. 22.

[3] Rhynchophora or Weevils of N. E. America, Indianapolis, 1916.

females, lingered near and apparently took no farther part in the operations than occasionally to approach the working male and stroke him with their fore-legs and antennæ.

Some of the more advanced burrows opened at this time contained only a single male in the still uncompleted nuptial chamber, while in others the nuptial chamber was completed and occupied by the male and from one to three females. Some of these were preserved as specimens, while others were removed from their burrows and placed in jars with fresh pine limbs, into which the males immediately began burrowing. One of the new burrows thus started was examined nine days later (May 3) and was found to have three radiating egg-galleries containing eggs in the niches along each side. Several eggs, removed and preserved, were found to contain larvæ, the mandibles of which showed brown through the semi-transparent egg membranes. The remaining eggs—doubtless several days younger—when examined on May 6 were still unhatched, but on May 9, larvæ about one day old were found. On June 4, numerous apparently full grown larvæ and several pupæ were found although several of the parent adults were still alive in their egg-galleries.

Adults of the new generation emerged the following month during the writer's absence from the laboratory, and were numerous in the jars on his return July 2. It is thus apparent that several generations may occur during a single season and it seems probable that two broods per year are the rule in central New York. However, this depends very largely on the temperature and moisture conditions surrounding the particular branch in which the brood occurs. If this lies in a cool, shady spot where the sun never penetrates, the life processes are slowed up to such an extent that only one generation, or one and a half generations per year occur. In September, 1916, several branches, obtained where such conditions prevailed, contained young adults which from the character of their feeding burrows had fed as adults since midsummer. In other parts of the same woods, similar branches lying in places where the sun reached them during part of the day, had been long deserted by their brood and the feeding burrows showed that the young adults had remained in them a comparatively short time. The writer is certain that this difference is not entirely explained by the lengthened egg, larval and pupal periods, but that we have here to deal not only with the slowing up of the life processes of the insect in all of its stages, but also with a retarding influence which the relatively lower temperature and higher humidity seems to exert directly upon the young beetle, which prevents it from leaving its old host. These conditions simulate partially and in a milder way the climatic influences which in the fall prevent adults from emerging, although they are fully matured and will leave their old host in a few days if brought into the laboratory where they are under fairly warm and stable temperature conditions.

The brood burrows of *P. cariniceps* are constructed in small limbs and twigs from 5 mm. to 16 mm. in diameter. They form rather coarse engravings and are excavated nearly entirely from the sap-wood (Plate VII, fig. 1). The direction of the egg-galleries depends upon the diameter of the limb in which the insect works. In the smaller twigs they are necessarily mainly longitudinal, while in the larger material the direction is more likely to be diagonal. The nuptial chamber is rather large and very irregular, often with several short feeding galleries leading from it—probably made by the male—in addition to the true egg-galleries. The egg-galleries in the material at hand, vary in number from one to five to the engraving, with an average of three. They are wide and deep and vary in length from 5½ mm. to 65 mm. the average being about 24 mm. The egg-niches are irregularly arranged on each side of the gallery and are excavated nearly entirely from the wood, although the larvæ at first feed chiefly upon the bark. In the material studied the average number of niches in an egg-gallery is about 10, but varies from 1 to 37 in the individual galleries.

The insects found most commonly associated with *P. cariniceps* are *P. nudus* Sw., *P. granulatus* Sw., *P. puberulus* Lec., *Pitogenes hopkinsi* Sw., and an undetermined Thripid. Of these *P. puberulus* and *P. nudus* were associated only in the smaller twigs, while *Pityogenes hopkinsi* occurred only in those more than 1 cm. in diameter and here only rarely.

Pityophthorus canadensis Swaine.

Specimens of *Pityophthorus canadensis* Sw., which at the time were believed to be *P. cariniceps*, were taken by the writer on June 20, 1918, near Cranberry Lake in the Western Adirondack region of New York. On later examination these proved to belong to the closely allied species recently described by Swaine (1917[1]). The adults were obtained from storm-broken small branches of white pine and had but recently entered the bark at the axils of smaller twigs, where they were constructing their brood chambers. Usually one male and two or more females were obtained from each nuptial chamber. In a few cases the females had started egg-galleries and had deposited several eggs but most of the burrows were not so far advanced. As these beetles were believed to be *P. cariniceps* no observations on the latter stages of the brood burrows were made, but so far as observed, the breeding habits seem to agree very closely with the older species.

Pityophthorus granulatus Swaine.

The distribution of *Pityophthorus granulatus* Swaine is given by Swaine[2] as Manitoba, Quebec, and Nova Scotia, and the host trees as Jack Pine, White Pine and Balsam Fir. Specimens of this species in central New York breed very commonly in the thin barked region of white pine. They are most frequently found in the shaded-out limbs of larger pine trees and in the upper regions of small trees killed or dying by suppression. Small suppressed pines in the "red topped" condition are nearly sure to contain the brood of these small beetles and while they are occasionally found in broken limbs and in slash, they are much more characteristic of slowly dying limbs and tops. They breed by preference in thin-barked pine from 1 inch to 3 inches in diameter but are also found rather frequently in smaller limbs and twigs down to $\frac{1}{4}$ of an inch thick, in which material they are likely to be accompanied by *P. nudus* Sw.

The brood burrows of *P. granulatus* (Plate VIII, fig. 2, 3) differ considerably from those of *P. cariniceps* in several respects. They are, of course, much finer as would be expected from the smaller, more slender form of the beetles making them, but the most striking differences have to do with the larger number of egg-galleries in each engraving and the extraordinary length of these egg-galleries.

The nuptial chamber is often very small—so small that in many cases it seems to be merely the meeting point of a number of egg-

[1] Dom. Can., Ent. Br., Dept. Agr., Bull. 14, p. 24, 25.
[2] Dom. Can., Ent. Br., Dept. Agri., Bull. 14, p. 106.

galleries. It varies from 2 mm. to 4 mm. in diameter and is usually by no means large enough to accommodate all of the inhabitants of the burrow at one time. Radiating from this nuptial chamber are from three to nine egg-galleries, each made by a different female. These lie nearly entirely in the sapwood grooving this deeply and scoring the inner bark only slightly. Where the egg-galleries are numerous they start from the nuptial chamber in all directions, often being nearly symmetrical in their arrangement near their origin (Plate VIII, fig. 2), when the engravings are in the larger limbs or tops. However, those galleries which start transversely or diagonally to the grain of the wood, soon curve and are continued in a general longitudinal direction.

As has been stated, the egg-galleries vary in number from three to nine and in the material studied there was an average of nearly six (5.7) to the engraving. With such a great preponderance of females it might be expected that they would show a decrease in fecundity as compared with other bark beetles. Yet such is not entirely true for in 58 egg-galleries studied, the average number of egg-niches is 28, as compared with 19.05 in *Ips. longidens*[1] Sw., 19.89 in *Pityogenes hopkinsi*[2] Sw., 20.84 in *Polygraphus rufipennis*[3] Kirby and 30.65 in *Eccoptogaster picea*[4] Sw. But the most extraordinary characteristic of the engravings of these little beetles is the length of the egg-galleries. A study of a number of engravings shows that these galleries made by the females vary in length from 6 mm. to 250 mm. (10 inches), with an average of 89.6 mm. for sixty-two egg-galleries. When the small size (1.6 mm. long) of the beetles is taken into consideration, it is seen that the female whose egg-gallery is 10 inches long (Plate VIII, fig. 3) had actually mined through the sapwood for a distance equal to 156 times her own length. The extraordinary length of these galleries is also brought out by comparing their average length of 89.6 mm. with those of *P. hopkinsi*[5] (23.1 mm.), *P. rufipennis*[5] (24.55 mm.), *E. picea*[5] (27.36 mm.) and *L. longidens*[5] (18.8 mm.).

The egg-galleries of *P. granulatus* differ from those of most scolytids also in that they are not kept free of frass, but with the

[1] Blackman, 1919, Psyche, Vol. 26, p. 88

[2] Blackman, 1915, N. Y. S. Coll. Forestry, Tech. Pub. No. 2, p. 50.

[3] Blackman and Stage, 1918, N. Y. S. Coll. Forestry, Tech. Pub. No. 10, p. 45.

[4] *Op. cit.*, p. 53.

[5] *Loc. cit.*

exception of the first few millimeters, are packed full of the detritus derived from the excavation of the burrow. This doubtless is correlated with their unusual length. The egg-niches are spaced at considerably wider intervals than is common with other scolytids, seldom being closer together than 4 mm. and often being considerably farther apart. This is especially noticeable in the terminal portions of the longer burrows. It would seem that the female beetle continues to extend her burrows at about the same rate even after her egg laying is nearly or quite completed.

While absolute proof is not at hand, the evidence indicates that in the latitude of central New York there is but one generation of *P. granulatus* each year. It is doubtful if this insect is ever injurious. Usually, indeed, it should in my opinion be classed as beneficial from the standpoint of forestry, for by preference it attacks trees or limbs which are dying from suppression. In attacking dying suppressed trees, it hastens but little the death of trees which would inevitably soon be lost in any event. On the other hand, in attacking suppressed limbs, it completes the death of these and thus confers a benefit by hastening the natural pruning necessary for the production of good, clear timber.

Insects found associated with *P. granulatus* in white pine include *Chrysobothris femorata* Fabr., *C. dentipes* Germ., *Pogonocherus mixtus* Hald., *Leptostylus sexguttatus* Say., *Pityogenes hopkinsi* Sw., *Pityophthorus nudus* Sw., *P. cariniceps* Lec., *P. puberulus* Lec., and the predators, *Phyllobanus dislocatus* Say and *Hypophlœus tenuis* Lec. Cocoons of a small hymenopterous parasite have been found at the ends of the larval burrows but the writer has not succeeded in breeding these out.

Pityophthorus nudus Swaine.

Pityophthorus nudus Sw. is found in Quebec, Ontario and New York, and breeds in white spruce, *Picea canadensis* (Swaine, 1917, p. 30). It is very similar to *P. granulatus* not only in structure but also in habits. The writer has observed it in central New York breeding in small limbs of white pine where it is usually associated with *granulatus*, although it is here by no means as common as the latter. All our specimens of this species were obtained from limbs less than one-half inch in diameter, although it may occur in larger limbs and tops as well. The engravings made by the insects in breeding are very similar to those of *P. granulatus*, the chief difference being in the shorter egg-galleries apparently characteristic of *P. nudus*.

Insects derived from the same material and associated with *P. nudus* include *P. granulatus* Sw., *P. cariniceps* Lec., *P. puberulus* Lec., *Pityogenes hopkinsi* Sw. and the clerid *Phyllobœnus dislocatus* Say.

Pityophthorus puberulus LeConte.

Pityophthorus puberulus Lec. is apparently distributed over the eastern portions of the United States and Canada and according to Swaine 1918 (*loc. cit.*) breeds in pine and balsam fir. The writer has found it in central New York only a few times but whenever found it always seemed to occur in immense numbers. The beetles attack the terminal twigs and smallest limbs of diseased or dying white pine branches. Occasionally it also attacks healthy terminal twigs as well, but seems to prefer most of all the twigs of branches freshly broken from the trees.

The adults bore through the bark of the smallest twigs at the bases of the pine needles and eat not only the inner bark but also a considerable part of the wood (Plate IX, fig. 4, b, c, d, e, f). They often penetrate into the center of the twig and sometimes continue their feeding burrow in the pith for some distance. These burrows in the smallest terminal twigs are primarily feeding burrows, although not entirely so.

One peculiarity in the feeding of *P. puberulus* is their apparent fondness for pitch. As a rule scolytids, even species which have demonstrated their ability to live in burrows flooded with pitch, and to dispose of this by the construction of pitch-tubes, avoid pitch-pockets and pitch-sinuses when possible. *P. puberulus*, however, shows no such avoidance of the numerous pitch sinuses, which extend longitudinally in the inner part of the more or less abnormal bark of diseased or broken limbs. On the contrary, when the burrowing beetle taps one of these sinuses, it seems nearly invariably to continue its mine along the course of the cavity. This species seems to have solved the question of manipulating the pitch not by removing it from its burrow and building it up around the entrance in the form of a pitch-tube, but to a great extent at least by eating it. When a pitch-sinus is tapped and the pitch begins to flow into the insect's burrow, the beetle prevents the burrow from being flooded by partially plugging the opening into the pitch-sinus with bits of sawdustlike frass. The pitch-soaked frass is apparently used as food and that eaten is replaced with new bits of "saw-dust." This is continued until most of the more liquid pitch is drained from the sinus and then the sawdust plug is eaten away and the burrow continued along the pitch cavity. The foregoing is based on direct observation made with a binocular miscroscope.

The beetles breed not only in the terminal twigs (Plate IX, fig. 4, b, c, d, e, f), but also in the larger twigs from 4 mm. to 8 mm. in diameter (Plate IX, fig. 4, a). They nearly invariably enter at the axil of a smaller twig, constructing the nuptial chamber either on the surface of the wood or in the inner bark, depending upon the thickness of the latter. In the material at hand the egg-galleries are short and irregular both in diameter and in direction. In many cases the eggs are laid in piles or groups, and lie unprotected in one corner of the nuptial chamber or in a wide alcove extending from it. In still other instances the egg tunnels extend through the axis of the twig in the pith and the larvæ arising from the egg niches in the walls of the tunnel bore directly through the soft sapwood to the inner bark surrounding it, where they continue their burrows. The larval mines are broad and irregular and often coalesce so that it is not unusual, on removing the outer bark of larger twigs, to find a number of larvæ working in a common chamber excavated by their joint efforts. However, before pupating, each larva in such instances, constructs a short individual burrow ending in a pupation chamber. The larvæ also seem to eat pitch, as their burrows often involve pitch-sinuses and, indeed, individual burrows frequently follow one of the pitch-sinuses for some distance.

As regards the economic importance of *P. puberulus*, it will be seen at once that insects which possess to such a marked degree the ability to live in pitch, have the power to do considerable damage. However, according to the writer's observations, these minute beetles only occasionally attack perfectly healthy twigs. They seem much to prefer the twigs of freshly broken limbs, or of limbs which are undergoing suppression by shading, or which are unhealthy from other causes. Apparently, then, they are only occasionally injurious, and from the point of view of the forester, are perhaps as often beneficial in hastening natural pruning, and thus aiding in the production of clear timber. The rôle they play in hastening the reduction of broken twigs and limbs to humus is also mildly beneficial.

Pityophthorus cariniceps Lec. and *Pityogenes hopkinsi* Sw. are often associated with *Pityophthorus puberulus* in storm-broken limbs of white pine, while *Pityophthorus granulatus* Sw. and *P. nudus* Sw. frequently occur in the same suppressed pine limbs, and the work of all three combine in aiding in the death of such parts and thus hastening natural pruning. Other insects occurring in the larger portions of suppressed limbs, include *Chrysobothris dentipes* Germ., *C. femorata* Fabr., *Pogonocherus mixtis* Hald., and *Leptostylus sexguttatus* Say.

Explanation of Plates.

Plate VII.

Fig. 1. Brood burrows of *Pityophthorus cariniceps* in small storm-broken limbs of white pine. Note the coarse egg-galleries grooving the sapwood deeply and containing relatively few egg-niches. About four-fifths natural size.

Plate VIII.

Fig. 2. Section of upper trunk of a small suppressed white pine showing the characteristic engravings made by *Pityophthorus granulatus*. Note the long fine egg-galleries with rather sparsely placed egg-niches from which the larval mines originate. The brood burrow originating in the center has 7 egg-galleries while that near the bottom has 9. About five-sixths natural size.

Fig. 3. Two adjacent pieces of a smaller limb showing brood burrow of *P. granulatus* having 6 egg-galleries. One of these marked "a" reaches a length of 250 mm. (10 inches). About four-fifths natural size.

Plate IX.

Fig. 4. Brood burrows and feeding burrows of *Pityophthorus puberulus*. "A" brood burrows in small limb 6 mm. in diameter; b, c, d, e, and f burrows in the smallest leaf bearing twigs of white pine. All magnified about 2½ diameters.

BLACKMAN—FOREST INSECTS.

BLACKMAN—FOREST INSECTS.

Blackman—Forest Insects.

THE OCCURRENCE OF *ANOPHELES PUNCTIPENNIS* IN NORTHERN NEW ENGLAND.

By Charles T. Brues,
Bussey Institution, Harvard University.

On a visit to northern Maine during the past summer, I had the opportunity to collect the larvæ of several species of mosquitoes, including *Anopheles punctipennis*, which has, so far as I can ascertain, not previously been reported so far north as this district.

In eastern Massachusetts where I have examined many localities, *A. punctipennis* is the most abundant and widespread Anopheles, and it is listed from many localities in New England by Howard, Dyar and Knab.[1] These include several in southern New Hampshire and one in Maine, while it has been found over the Canadian border at Ottawa. The present specimens are from Telos Lake which lies well toward the northern part of Maine in the region of spruce and fir forests. It is a day's journey from the nearest railway on the east and a two days' trip from the railway to the south, so that there is no possibility of mosquitoes reaching the lake during the summer to become established temporarily, and any occurring there can be considered as permanent members of the fauna. I think there can be no reasonable doubt that the larvæ are actually those of *A. punctipennis*. Although not to be distinguished anatomically from *A. quadrimaculatus*, the habitat of the two species is rather constantly quite different.

Compared with Ottawa and Weld the position of Telos Lake is as follows:

Weld, Maine,	Lat. 44° 12′ North.
Ottawa, Canada,	Lat. 45° 25′ North.
Telos Lake, Maine,	Lat. 46° 7′ North.

In Europe the extreme northern limit of malaria, and probably that of Anopheles also, lies at from 63° to 69° latitude while in North America malaria is said to be endemic at scattered localities as far north as the forty-fifth parallel. This would mean, of course, the presence of *Anopheles quadrimaculatus*, the northern range of which would thus appear to be nearly coincident with that of *A. punctipennis* in New England at least.

At Telos Lake, I secured also larvæ of *Culiseta impatiens* Walker and *Culex restuans* Theobald, both species of general occurrence in this region.

[1] Mosquitoes of North America, Vol. IV, pp. 1013 (1917).

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Notices not to exceed four lines in length concerning exchanges desired of specimens or entomological literature will be inserted free for subscribers, to be run as long as may be deemed advisable by the editors.

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PSYCHE

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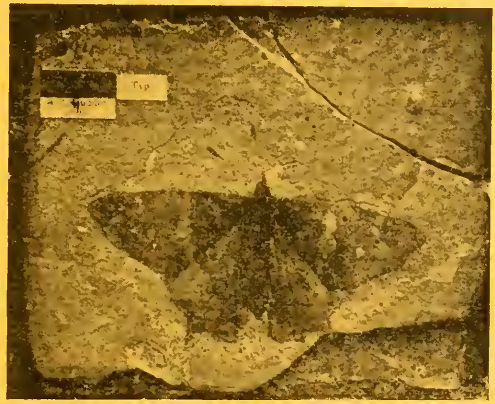

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PSYCHE

VOL. XXVI DECEMBER, 1919 No. 6

THE PHORESY OF ANTHEROPHAGUS.[1]

By William Morton Wheeler.

August 16, 1919, while collecting Hymenoptera near Colebrook, in northwestern Connecticut, I observed a worker humble-bee (*Bombus vagans*) behaving in an erratic manner on the flowers of a golden-rod. The insect was standing with straightened legs on the tips of its tarsi and repeatedly attempting to insert its proboscis into the flowers, but did not succeed because a small red beetle was firmly attached by its mandibles to the tip of the right maxilla and the tongue. The beetle, which proved to be a female of the Cryptophagid *Antherophagus ochraceus* Mels., did not release its hold in the cyanide jar, so that I am able to show it in its original position in the accompanying figure (Fig. 1). I failed to find any record of such behavior in our American Antherophagi (*ochraceus*, *convexulus* and *suturalis*), but a perusal of the accounts of the closely allied European species (*nigricornis*, *silaceus* and *pallens*) yields a satisfactory explanation of the peculiar activities described above.

In 1896 Lesne called attention to a number of small insects that habitually ride on larger insects. To this phenomenon he applied the term "phoresy" and showed that it is distinguished from ectoparasitism by the fact that the portee does not feed on the porter and eventually dismounts and has no further relations with the latter. The following year (1897) Charles Janet studied the known cases of phoresy somewhat more comprehensively, expanded the concept and distinguished no less than six different categories:

(1) Cases like that of the small flies of the genus *Limosina* which ride on the dung-beetle, *Ateuchus*, and represent phoresy in its typical form as conceived by Lesne.

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 162.

(2) Cases in which the portee is conveyed to the nest of the porter, like the triungulin larvæ of certain beetles (*Sitaris*, *Meloe*, etc.) and the triungulinids of the Strepsiptera.

(3) Cases like a few myrmecophilous beetles (*Thorictus*) which attach themselves to the antennæ of ants for the purpose of accompanying them on their peregrinations.

(4) Cases like the mites of the genus *Antennophorus* which are not only carried but fed by the ants. These and the cases under (3) might be referred to ectoparasitism.

(5) Indirect phoresy, as exhibited by certain mites that cling to the surfaces of ant larvæ and pupæ which are in turn transported by the ants.

(6) The cases of ants that carry in their mandibles their own young, other members of the colony or guests.

In 1911 Banks published a valuable list of some 17 cases of phoresy collected from the literature, and several others have been recorded by Warner (1903), Brues (1917a, 1917b) and Rabaud (1917). Among the cases cited by these authors are those of certain small parasitic Hymenoptera which attach themselves to the abdomens of Orthoptera or to the wings of Mantoidea in order to be on hand to oviposit in the eggs of their porters. Such cases really represent a seventh category of phoresy.

Among the cases cited by Lesne and Janet and apparently overlooked by Banks, is *Antherophagus*, which attaches itself to the legs, mouthparts or antennæ of humble-bees for the purpose of being transported to their nests. The earliest observation of this habit seems to have been made by the British Coleopterist T. J. Bold. This author's two references to *Antherophagus* (1856 and 1871) were kindly sent me from London by my friend, Mr. Horace Donisthorpe, after I had vainly endeavored to find them in the Boston libraries. The first reference runs as follows: "Mr. Smith, in his admirable work on British bees, records the finding of *Antherophagus glaber* in the nest of *Bombus deshamellus*. This season I met with an instance of the manner in which such insects may be transported thither. When hunting *Bombi* in September last, the peculiar motions of a neuter of *B. sylvarum* attracted my attention: it was clinging to a thistlehead, and wriggling and twisting its legs about in all directions. On getting hold of it I found that a large specimen of *Antherophagus nigricornis* had seized the tarsus of a hind leg between its jaws, and was holding on like grim Death. I put both into my bottle, and the *Antherophagus* retained its hold until both were killed by the fumes of the laurel." The reference of 1871 is to this same find and occurs

Fig. 1. *Antherophagus ochraceus* Mels. attached to proboscis of *Bombus vagans* Sm.

on page 60 of Bold's "Catalogue of the Insects of Northumberland and Durham."

Redtenbacher (1858) records having taken three adult *A. nigricornis* in a humble-bee's nest, together with a number of larvæ, which very probably belonged to the beetle. In 1863 Carus and Gerstaecker published the following note on the genus *Antherophagus:* "The species live on flowers, attach themselves to humble-bees and permit the latter to transport them to their nests, probably for the purpose of oviposition; at any rate, small larvæ resembling those of *Cryptophagus* are sometimes found among the beetles in the nests of humble-bees." Eichhoff (1866) after examining several *Bombus* nests states that *A. nigricornis* was nearly always present and that single specimens of *silaceus* and *pallens* occurred in the same situations. Gorham (1869) captured *A. pallens* together with certain species of *Cryptophagus* in a nest of *Bombus pratorum*. Perris (1869–'70), while collecting in the Pyrenees, took an *A. nigricornis* attached to the antenna of a *B. montanus*, and though he did not know of the observations of Bold and Carus and Gerstaecker he nevertheless drew the same inference from his observations as the two German authors. Bugnion (1869–'70) in a letter to Perris recorded the following observation: "While collecting at Angeiades (alt. 1900 m.) in the Alps of Vaud, in the month of August 1866, I took a *Bombus* which had an *Antherophagus pallens* Oliv. attached to its proboscis by the mandibles." Seidlitz (1869–'70), commenting on Perris' observations, records the occurrence in a museum collection of three *Bombi* each with an *Antherophagus* attached to an appendage. In 1875 Perris published a detailed description of the larva of *A. silaceus* taken from the nest of *B. sylvarum*. Hoffer (1883), Fowler (1889), Sharp (1899), Wagner (1907), Reitter (1911), Sladen (1912) and Reuter (1913) all give brief notices and Wagner publishes a figure of *A. nigricornis* attached to the bee's proboscis.

The accounts of the North American *A. ochraceus* though meager go back to 1864 when Packard recorded its capture by F. W. Putnam in several *Bombus* nests in Massachusetts and Vermont. Packard figured the beetle in this paper and the beetle and larva in two of his well-known books (1872, 1873). J. B. Smith (1909) and Blatchley (1910) mention the occurrence of *A. ochraceus* on various flowers and the former notes its occurrence in *Bombus* nests. Casey (1900) in his taxonomic revision of the Cryptophagidæ says nothing about the habits of the beetle, though he makes the following significant remarks on the genus (p. 87): "This is one of most isolated genera of the family and contains by far the largest species, *Haplolophus* being the only other which approaches it in this respect. The emargination of the clypeus, very deep in the male but feeble in the female is apparently a unique character in the family," etc.

The observations recorded at the beginning of this paper together with Packard's show that our species are very similar in habits to their European cousins. Though possessed of well-developed wings and able to fly about and take up their position on flowers, *Antherophagus* does not seek out the *Bombus* nests but compels the bee to carry it to the place in which its eggs and larvæ are to develop. As Sharp says, "we must presume that its senses and instincts permit it to recognize the bee, but do not suffice to enable it to find the bee's nest." The structure of the mandibles and the peculiar notch in the clypeus are clearly adaptations to firmly grasping the more or less cylindrical joints of the bee's appendages, and the red color of the integument and investment of golden yellow hairs, so very suggestive of conditions in many myrmecophilous beetles, may account for the fact that the *Antherophagi* live unmolested in the *Bombus* nests.

The feeding habits of the adult and larval *Antherophagus* seem not to have been actually observed by any of the authors mentioned in the preceding paragraphs. Packard (1864) believed it "probable from the fondness, which these insects manifest for the sweets of flowers, that they visit the nests of the bees for the purpose of consuming the honey stored up within them." In 1873, however, he inferred that the beetle "probably feeds upon the wax and pollen," a statement which seems to have been suggested by the generic name given by Latreille. The views of the various authors concerning the feeding habits of the larva are, with one exception, practically unanimous. Perris (1875) says: "The larvæ of *Antherophagus* probably play the same rôle in the humble-bee nests as do *Cryptophagus pubescens* and *scanicus* in the nests of wasps. I do not believe that they devour the honey stored up by the bees or that they attack the bee larvæ, not one of which showed the slightest lesion; I am convinced that they live on the feces of the inhabitants and that they are, properly speaking, merely scavengers." In the same paper he calls attention to the larva of *Cryptophagus dentatus* Herbst which lives under chestnut bark in company with the larva of *Dryocœtus villosus* and feed on its excrement. Lesne (1896) states that the *Antherophagus* larvæ "live as mutualists rather than as commensals in the *Bombus* nests." In contrast with this rather vague and colorless statement, Wagner (1907) paints a lurid picture of the activities of the beetle and its larvæ. After describing the transportation of the beetle on the bee's proboscis, he continues: "The humble-bee evidently feels decidedly uncomfortable if she does not actually suffer pain. She crawls over the combs of the nest, extrudes her proboscis and makes a series of movements for the purpose of getting rid of her burden, but in vain. Other bees come up, 'affectionately' palpate her with their antennæ and pass on without the slightest attempt to help their 'comrade,' without the feeblest movement towards assisting her to ward off the dangerous enemy. And dangerous the beetle certainly is for from the eggs it lays hatch larvæ which, by destroying both the wax and the cocoons, will cause enormous devastation in the nest." It is difficult to estimate how much of this is observation and how much is imagination. Subsequent writers return to the opinion of Perris and regard the *Antherophagus* larvæ as harmless scavengers. Thus Reitter (1911) asserts that they "probably live on the excrement of the inhabitants of the nest" and Reuter (1913) that they "live on all sorts of refuse." Sladen (1912), who has a very intimate knowledge of the humble-bees and their nest-mates, classifies the *Antherophagi* "among the smaller and less important inhabitants of humble-bees' nests." We may conclude, therefore, that the larvæ of these beetles are in all probability merely scavengers in the *Bombus* nests and hence closely resemble the larvæ of *Cryptophagus* in habits as well as structure.

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A NEW SPECIES CLOSELY RESEMBLING *DROSOPHILA MELANOGASTER.*

By A. H. Sturtevant,
Columbia University, New York City.

In the course of genetic experiments with *Drosophila melanogaster* Meigen a wild race was found that gave unexpected results. Examination showed that it was structurally different from typical *D. melanogaster.* The new form has been found to be common and widely distributed. Since it is evidently a distinct species that has hitherto been overlooked, and since it will certainly be extensively discussed in genetic literature in the future, the following name and description are presented.

Drosophila simulans, sp. nov.

Closely similar to *D. melanogaster* Meigen in size, color, shape, venation, chaetotaxy, and in the presence of tarsal combs in the male. The eyes are a little larger and the cheeks a little narrower than in that species; but these differences are not sufficiently well-marked to serve as diagnostic characters. The external male genitalia, shown in figure 2, are clearly distinct from those of *D. melanogaster* (figure 1): The most reliable differences here are in the size and shape of the posterior process (p) of the large anterior plate, and in the shape and vestiture of the smaller comb-bearing plate (c). In relaxed pinned material the two species may be separated by means of the posterior process. In *D. melanogaster* it appears as a small hook; in *D. simulans* it resembles a clamshell, since the basal part is not usually observable.

Living material shows several other slight differences, not definite enough to serve for purposes of classification, but observable in large series as average differences. *D. simulans* has a slightly darker mesonotum, often with a bubble beneath the surface in the mid-dorsal line. The abdomen is a little stouter, the wings a little shorter. The dark abdominal bands of the female are not quite as deep black as those of *D. melanogaster.* The egg has two filaments at its anterior end, that are somewhat longer, and less dilated at their tips, than those of *D. melanogaster.*

Type, allotype, and gonotypes: bred, in New York City, from stock collected at Lakeland, Fla. (C. W. Metz). Type deposited at the American Museum of Natural History, New York City. The gonotypes are not descended from the type, but the whole type series is known to be descended from a single female.

Other specimens examined: Randolph, N. H. (Miss H. Daniels); Cold Spring Harbor (C. W. Metz), Staten Island (F. Schrader), N. Y.; Rochester, Minn. (L. Huckfield); Richmond, Va.; Macon, Ga. (G. L. Carver); Palm Beach, Fla. (B. B. Horton); Kushla, Ala.; Fayetteville, Ark. (B. Schwartz); Port Limon, Costa Rica.

Examination of genitalia shows that *D. melanogaster* has at least the following range: Nova Scotia to Oregon, California, and Florida; Cuba, Porto Rico, Costa Rica, Panama; Holland; Australia.

D. simulans and *D. melanogaster* may be crossed, though only with difficulty. The hybrids so far obtained have apparently all been sterile. They are obtained most easily from the mating of *D. melanogaster* female by *D. simulans* male; and from this cross only females are ordinarily produced. It was the discovery of this fact

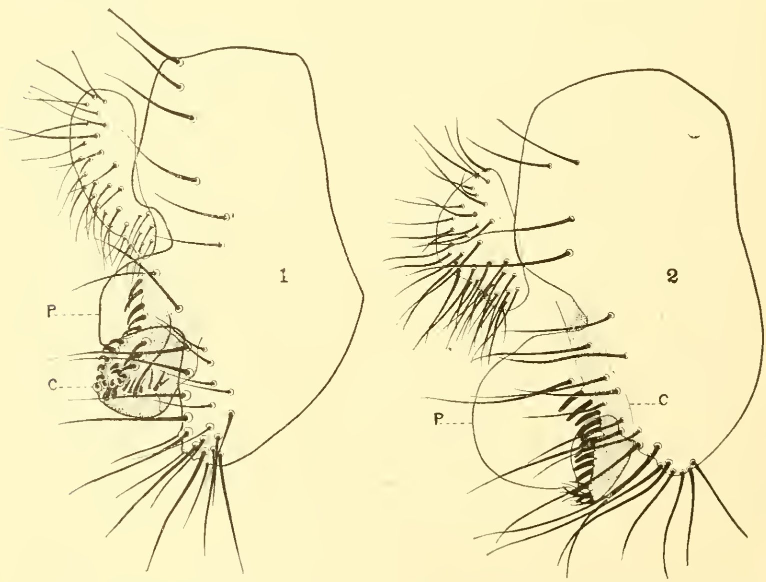

Fig. 1. 1, External male genitalia of *Drosophila melanogaster* Meig., from cleared material collected in Minnesota; 2, external male genitalia of *Drosophila simulans* sp. nov., from cleared material mounted in balsam. Gonotype.

by Mr. A. M. Brown that led to the identification of *D. simulans* as a distinct species. Males have, however, been obtained by using *D. melanogaster* females that give what are known to students of heredity as "non-disjunctional exceptions." A full account of these experiments and a description of the hybrids will be published later.[1]

DESCRIPTIONS OF NEW TRYPHONINÆ OF THE TRIBE CTENOPELMINI (HYMENOPTERA; ICHNEUMONIDÆ).[2]

By Miss Esther W. Hall,
Bussey Institution, Harvard University.

Polyblastus fulvilinealis sp. nov.

♂. Length 6 mm. Head wider than thorax, thickened behind eyes. Malar line equal to one-half the base of clypeus. Distance from ocellus to clypeus slightly longer than from eye to eye. Front protruding below antennæ, which are almost as long as body and composed of 28 segments. First flagellar joint slightly longer than scape and pedicel, four times as long as wide at apex. Fourteenth segment about twice as long as wide and one-half the length of first flagellar joint. Scutellum flat, margined. Pronotum prominent. Parapsidals present anteriorly. Areolation complete. Abdomen subsessile. Length of petiole two and one-half times width of base; width at apex twice that of base. Third segment twice as broad as long and one-fifth narrower than thorax. Carinæ with groove between and extending almost to apex. Base of hind coxæ to apex of femora longer than abdomen. Five teeth on claws. Wings large, areolet small, petiolate, rhomboidal. Head, except cheeks, finely punctate; thorax, except slightly rugulose propodeum, sparsely punctate; abdomen smooth.

Black. Rufous as follows: apical half of clypeus, collar, and lower pleuræ, propodeum, hind coxæ and femora, outside of four anterior femora. Antennæ and hind tarsi dusky. Mandibles except teeth, underside of pedicel, remainder of fore legs, hind

[1] It seems highly probable that the sterile "unisexual broods" of Drosophila reported by Quackenbush (1910. Science, n. s. 32; 183–185) were hybrids between *D. melanogaster* and *D. simulans*.

[2] Contributions from the Entomological Laboratory of the Bussy Institution, Harvard University, No. 167.

tibiæ except dusky apices, tegulæ, vein bases, lines between pro- and meso- and between meso- and metapleuræ, narrow lines on apex of second and third abdominal segments, whitish.

♀. Length 7 mm. Areola open anteriorly; face more coarsely punctate. Ovipositor bearing eggs. Thorax, except pronotum, and base of petiole rufous. Fore legs darker, otherwise like the male.

Male from Auburndale, Mass., and female from Riverside, Mass.

Polyblastus scopioroides sp. nov.

♂. Length 7 mm. Slight, head not so swollen, as wide as thorax. Claws slender, with 4–5 small teeth. Distance from eye to eye almost equal to that from ocellus to clypeus. Malar line equals one-half the base of clypeus. Antenna with 31 segments, 5–16th swollen. Tenth segment one-third again as wide and two-thirds as long as first flagellar segment which is three and two-thirds times as long as wide at apex and the same length as scape and pedicel. Parapsidal furrows faint. Pleuræ swollen. Basal transverse carinæ wanting. Abdomen sessile, carinæ extending three-fourths the length of the petiole, which equals, in length, the apical width. Third segment twice as broad as long and not as wide as thorax. Legs slender. Areolet rhomboidal, petiolate. Face densely, punctate, thorax rather coarsely so, abdomen sparsely so, except petiole, which is coarsely so at base and rugulose near apex.

Black. Rufous as follows: apex of clypeus, segments 2, 3, 4, apex of petiole, legs except apex of posterior femora, tibiæ, and tarsi which are dusky. Mandibles except teeth, bases of veins, spot on stigma, and, indistinctly, the trochanters, white.

In general appearance like *Scopiorus subcrassus*, Cress. but without transverse abdominal furrows.

Male from Woods Hole, Mass.

Polyblastus kaniacensis sp. nov.

♀. Length 8 mm. Head not so thick as in other species. Face protuberant. Distance from ocellus to clypeus one and one-third times the distance from eye to eye. Malar line one-half the basal width of mandible. Clypeus narrow with transverse ridge near base. Antennæ with 34–35 segments. First flagellar segment one-fifth longer than scape and pedicel. Apical 6 segments each as long as broad except the last segment which is one and one-half times the length of previous one. Scutellum flat, margined, sloping suddenly behind. No parapsidal furrows. Pleuræ rather flat. Basal carina wanting on propodeum. Abdomen sessile, carinæ extending to middle of petiole, apex of petiole one and one-half times the width at base and two-thirds the length. Third segment not quite as wide as thorax. Ovipositor short. Legs rather stout, claws pectinate. Face and propodeum coarsely punctate, rest of thorax sparsely so; abdomen finely punctate. Areolet rhomboidal, petiolate. Humeral cross-vein of hind wing broken at middle.

Black. Rufous as follows: apical part of clypeus, apex of petiole and remainder of abdomen, apex of trochanters, femora except black apices of hind ones and yellow tips of others. Coxæ and bases of trochanters black, rest of fore legs yellow-ferrugineous with last tarsal segment dusky; remainder of hind legs dusky. Bases of hind tibiæ yellow. Tegulæ, bases of wing veins, palpi and mandibles except teeth, yellowish-white. Tibiæ with a faint rufous annulus.

Female from Kaniac Butte, Washington, collected by Prof. A. L. Melander, I–IV, 1912.

Grypocentrus rufiterminalis sp. nov.

♀. Length 9–10 mm. Head large. Distance from eye to eye almost two-thirds the distance between ocellus and clypeus. Malar space one-third the width of clypeus. Face slightly convex. Clypeus wide, almost from eye to eye, with transverse ridge and short bristles at apex. Antennæ with 36 segments, extending to middle of abdomen; segments 9–25 thickened. Scape two-thirds the length of first flagellar segment, which is three times as long as width at apex. Middle segments and those beyond slightly longer than wide. Parapsidals present anteriorly. Scutellum rounded, sloping gradually behind. Pleuræ convex. Areola open anteriorly, propodeum otherwise completely areolated. Apex of petiole one-third wider than base, its length two and one-third times the basal width. Carinæ close together and extending almost to apex. Length of segment about the same as width at base. Legs robust; claws finely pectinate. Body covered with silver pile. Face very coarsely punctate except apex of clypeus which is sparsely so; thorax coarsely so; abdomen almost smooth. Ovipositor short and curved. Humeral cross nervure of hind wing broken at middle. Areolet rhomboidal, slightly petiolate.

Black. Rufous as follows: abdomen except base of petiole, apex of clypeus, mandibles, palpi, and tegulæ; apex of antennæ and underside of base and pedicel; legs, except tips of hind femora, tarsal segments and outside of hind tibiæ, which are dusky. Wing veins dusky except fulvous bases and spot on stigma.

Four females, collected by C. T. Brues at Petersham, Mass. VII, 1918.

Prinopoda media sp. nov.

♀ . Length 8 mm. Head large, thickened behind the eyes, front rather flat. Malar line one-third the basal width of mandibles. Distance from ocellus to clypeus one-fourth longer than from eye to eye. Front gradually and slightly convex. Clypeus with transverse ridge near base, emarginate at apex, and indistinctly bilobed. Antennæ with 39 segments. First flagellar joint longer than scape and pedicel; segments 5–25 thickened; twelfth segment three-fourths as broad as long and one-third wider than first segment. Parapsidal furrows faint. Scutellum rather flat, margined anteriorly. Pleuræ flat. Areola open anteriorly. Abdomen petiolate, first segment slightly wider at apex than at base; third twice as wide as apex of first and almost as wide as thorax. Parallel carinæ extending to apex of first segment. Ovipositor 2 mm., curved. Legs long, slender; claws with 4–6 long teeth. Areolet irregular, petiolate. Front finely punctured. Pronotum smooth. Lower meso- and metapleuræ coarsely punctate. Propodeum rugulose. Abdomen smooth, except petiole, which is faintly rugulose.

Black. Yellow as follows: mandibles except teeth, clypeus, tegulæ, all trochanters, anterior coxæ, tips of anterior femora, tibiæ, and tarsi except apices which are ferrugineous. Second and third abdominal segments, antennæ beneath, anterior femora, hind coxæ and hind tibiæ except apices, ferrugineous. Palpi, annulus on posterior tibiæ, spurs and bases of tarsal segments, white. Rest of hind tibiæ and tarsi black.

Female from Machias, Maine, VII, 1917.

Scopiorus plagosus sp. nov.

♀ . Length 4 mm. Head as wide as thorax, slightly protuberant beneath antennæ. Distance from eye to eye about equal to distance from clypeus to ocellus. Malar line two-thirds the basal width of mandible. Clypeus rather flat, but separated from face by groove. Antennæ extending to middle of abdomen, with 24 segments; 4–12 thickened; length of first flagellar joint four times its apical width and more than that of scape and pedicel; next joint three times as long as wide and 11th segment twice as long as wide. Parapsidal furrows indicated anteriorly. Basal transverse carinæ wanted on propodeum. Scutellum flat, triangular, and margined. Abdomen sessile, petiole one-fourth wider at apex than at base; third segment slightly wider than thorax. Carinæ of petiole extending to rugulose transverse groove near apex. Transverse groove on second segment clearer laterally. Claws thickly pectinate. Ovipositor curved. Areolet wanting. Humeral cross nervure of hind wings broken below middle. Face finely punctured; cheeks sparsely so; thorax coarsely so, except pronotum; first two segments of abdomen rugulose.

Black. Yellow-rufous as follows: base and apex of second and third segments, legs with the following exceptions which are black; claws, posterior coxæ, bases of other coxæ, hind femora (except apex) and outside of four front femora. Scape, mandibles except teeth, clypeus, face except clypeal suture and band from antennæ to clypeus, narrow line on apex of segments, 3, 4, and 5, yellow; tegulæ and bases of veins, white.

Female from Yellowstone Park, Continental Divide, 8200 ft., collected by Prof. A. L. Melander, August 8, 1919.

This is nearest to *Scopiorus expansus* Davis.

A NOTE ON THE HABITS OF *EPACTIOTHYNNUS OPACIVENTRIS* TURNER, AN AUSTRALIAN THYNNID WASP.

By Francis X. Williams,
Hawaiian Sugar Planter's Experiment Station, Honolulu.

During the winter of 1919, while engaged in entomological work on the Herbert River, North Queensland, for the Experiment Station of the Hawaiian Sugar Planter's Association, I made a few observations on this wasp. *Epactiothynnus opaciventris* is a moderately small species of the great Australian group of Thynnidæ. The male measures about 11 and the female 8 mm. in length. At the time of observation it was the most abundant of the few species of Thynnids then flying and its main food flower was Crotalaria sp., a common weed along roadsides and edges of fields.

I can find nothing in literature which relates to the egg and larval stages of any of the Australian Thynnidæ, though Froggatt (Australian Insects, 1907) has dug up cocoons which yielded a large species. He states that these wasps probably parasitize the larvæ of Lamellicorn beetles.

When females of *Epactiothynnus* were enclosed in a tumbler or shallow dish of soil with Lamellicorn grubs about 14 mm. long, and which were common in some of the cane fields, these grubs

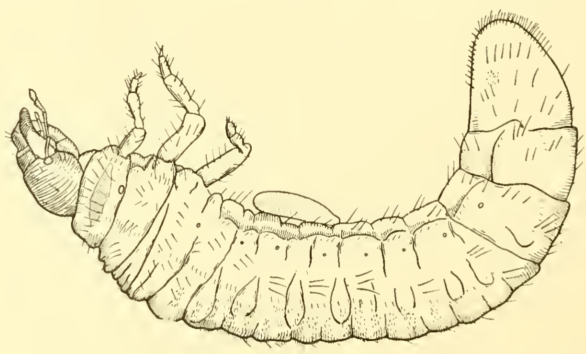

Fig. 1. Larva of one of the Scarabæid beetles, showing egg of *Epactiothynnus opaciventris* on its mid-ventral line. (X 4.25, North Queensland.)

were eventually stung to almost complete paralysis, just as the Scolias sting their prey. I did not observe the act of stinging, but a single Epactiothyunns would sometimes paralyze several grubs overnight. Something was wrong, however, perhaps the weather was too cool, for of the many grubs stung but one had an egg upon it, and that failed to hatch. The egg (Fig. 1) is deposited along the mid-ventral line of the larva. It is pearly white, somewhat arcuate, thicker at one extremity, and measures 1.85 x 0.40 mm.

Tachynomyia sp., a darker and somewhat larger Thynnid was found also to paralyze the same species of beetle larva that was offered to Epactiothynnus.

In the bulk of the Thynnidæ the strong-winged male, as he flies from place to place or feeds at flowers, carries his apterous and obese partner with him. In captivity, at least, two *Epactiothynnus* may remain paired for several days.

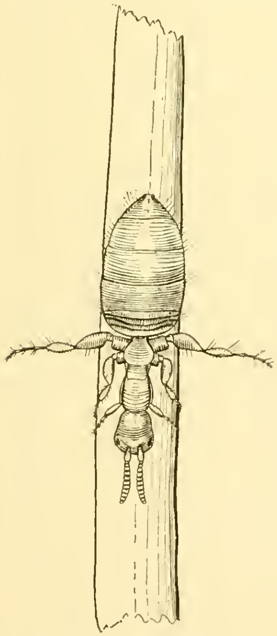

Fig. 2. Female Thynnid on reed; in such a position, she awaits the advent of the winged male, which carries her off. (X 6.7, Sydney.)

Fig. 2 is a drawing from life of a small species of Thynnid taken near Sydney. She was first observed crawling on the ground, then ascend a reed, place herself in an inverted position, with the abdomen inclined a little forward, and thus motionless to await the coming of the male. *Epactiothynnus* females had the same habit awaiting their mates in a conspicuous place. The circling males sometimes betrayed her whereabouts; as soon as located she was immediately seized and carried off.

Australia has perhaps the richest fauna of Scarabeid beetles in the world, so it is not surprising that the enemies of these often destructive insects are similarly numerous. The immense Thynnid population of several hundred species far outnumbers the Scoliidæ, and it may be affirmed with some degree of certitude that, like the latter, they prey essentially on Lamellicorn beetle grubs. The rather anomalous "blue ant," *Diamma bicolor*, is somewhat related to the *Methoca* group, and being a fierce and active insect of good size perhaps attacks caraboid beetle larvæ.

AN AFRICAN FIGITIDÆ.

By Alfred C. Kinsey,
Bussey Institution, Harvard University.

Aspicera africana sp. nov.

Male and *Female.* Body entirely black, except the antennæ and legs, which are rufous-brown. *Head:* black, ocelli yellowish, compound eyes silvery; front concave, coriaceous, with a few, short, wavy lines, bounded laterally by prominent ridges extending from the lateral ocelli to the base of the antennæ and beyond half way to the mouth; lower half of face irregularly rugosostriate, hairy; cheeks hairy; mandibles dark rufous; antennæ rufous-brown, darker toward the tips, in the ♀ 13-jointed, in the ♂ 14-jointed. *Thorax:* entirely black, finely coriaceous, the sides of the pronotum and the metapleuræ dense with white hairs; mesopleuræ with a large shining area; parapsidal grooves continuous, deep, cross-ridged, broad at the scutellum, curved sharply apart at the pronotum; a narrow, elevated median ridge extending from the pronotum half way to the scutellum; the depressed median groove from that point to the scutellum is two-thirds as wide as the distance between parapsidals; anterior parallel lines smooth, elevated, extending half the length of the thorax; foveæ very large, very deep, sparsely striate, with a fine, shallow ridge between; the spine of the scutellum about half the length of the whole scutellum, with 3 to 5 longitudinal ridges. *Abdomen:* piceous black, finely and regularly punctate, the 2nd segment dorsally about one-third the total length and reduced to a mere scale on the sides, 3rd segment reaching almost to the tip of the abdomen; abdomen in the male similar but more slender. *Legs:* uniformly rufous-brown, including the coxæ; with short hairs. *Wings:* very clear, without hairs; the subcosta, basal vein, and radius distinct, pale yellowish, the other veins hardly discernible; apical branch of the subcosta lacking; radial area open also at the distal end. *Length:* 3.0–3.5 mm.

Range. South Africa: Salisbury, 5050 ft. (F. L. Snow coll.).

Types. 1 female and 1 male cotype in the collection of the Kansas State Museum; and 1 male cotype in the author's collection.

One of the male specimens is marked as collected in June, 1900; the other male and the female in Dec. 1900. In *Das Tierreich*, in Dalla Torre and Kieffer's key the species would run down to *A. coriacea* from which it is distinct in having all parts of the thorax black and the legs uniformly rufous-brown. The genus has not heretofore been known from Africa south of the north coast.

ON THE VARIATION OF *TABANUS ATRATUS* FABRICIUS.

By Charles W. Johnson,
Boston Society of Natural History.

This species, in its distribution along the Atlantic coast from Maine to Florida, is subject to considerable variation, which fact was referred to by Osten Sacken in his Prodrome (Memoirs Boston Soc. Nat. Hist., vol. II). On page 455 he says: "Northern specimens, for instance those found around Boston, often have the wings pale brown, even yellowish brown toward the posterior margin." Professor Hine in describing this form as *T. nantuckensis* from Nantucket, seems to have overlooked this reference, for he says: "There is reason to believe that this insect has become isolated on the Island for it has not been taken elsewhere so far as I can find."

Tabanus atratus var. **nantuckensis** Hine

Tabanus nantuckensis Hine, Ohio Jour. Sci., p. 271, 1917.

At most this is only a variety of *T. atratus*, apparently confined to the New England coast. Its "smaller size" does not count, for I have typical *T. atratus* as small as *nantuckensis* (20 mm.). This leaves for consideration only the color of the wings—dark brown with the posterior half or more, yellowish brown, as a distinguishing character, which in a large series from along the coast merges into typical *atratus*. The series before me referable to *nantuckensis* show the following distribution:

N. H. Rochester, Sept. 8 (A. M. Wilcox).

Mass. Boston, July 10 (H. M. Parshley); Cohasset, July 24 (Owen Bryant); New Bedford and Horse Neck Beach, Aug. 9 (Dr. G deN. Hough); N. Tisbury, July 21 (Dr. J. A. Cushman); Tuckerneck, July 21 (Dr. G. M. Allen); Muskeget, July 7 (W. S. Brooks); Hyannisport, July 4, Woods Hole, July 25, and Wellfleet, Aug. 16 (C. W. Johnson).

R. I. Block Island, Aug. 28, 1891 (A. P. Morse).

In this same region, typical *atratus* has been taken at the following places: Brookline, Auburndale, Sherborn, Framingham, Falmouth, Chatham and Woods Hole, Mass.

Tabanus atratus var. **fulvopilosus** var. nov.

This is another interesting variety which Osten Sacken refers to as follows: "The most remarkable variety, however, I received from Florida (Indian River, E. Palmer; Haulover Beach, March 12–14, Messrs. Hubbard and Schwarz); the thorax on each side bears a fringe of golden yellow hairs, not a trace of which is visible in ordinary specimens. I have four specimens from Florida, and two from some other southern locality not nearer defined, which show this peculiarity."

Fine examples of this variety were collected by Mr. S. E. Cassino at Orlando, Fla., in April, and by the writer on Anastasia Island, St. Augustine, Fla., April 21, 1919. I also collected a specimen at Avalon, N. J., July 19, 1891. Another specimen was captured at Cold Spring, near Cape May, N. J., June 24, 1903, by Mr. H. L. Viereck. The specimens from New Jersey have wings of a uniform dark brown approaching *nantuckensis*. A specimen of *nantuckensis* (from Nantucket) shows a slight trace of yellow pile above the base of the wings and lower edges of the post-alar callosities.

Another interesting variation of the more typical *atratus*, represented by two males and a female from Anastasia Island, Fla., April 12–19, has the black of the wings confined to broad margins along the veins, leaving subhyaline spaces between, giving the wings a striped appearance. A male of *nantuckensis* from Muskeget is similarly marked on the anterior half of the wings.

These varietal names may seem perhaps unnecessary, but when one has already been referred to as a species by one of our leading authorities in this family, it shows how striking the variations are when isolated. There is a peculiar significance in the fact that these variations are apparently confined to the immediate seaboard, and their abundance there would indicate that they probably breed in the adjacent salt or brackish marshes. The question arises do these diversified conditions affect the species and give rise to these variations. On the other hand there is a similar though less pronounced variation in *Tabanus trispilus*. From New Jersey southward is found the typical form with dark brown wings, but to the northward the wings are much lighter in color, representing the var. *sodalis* Will. Another Tabanid, *Chrysops fuliginosus* or *plangens*, which is strictly a coastal species, distributed from Maine to Florida, shows considerable variation in the color of its wings, even in the same sex. Florida specimens have a distinct subhyaline streak dividing the apical spot from the crossband. Specimens from New Jersey northward have the brown of the wings more diffused and the streak less clearly defined.

A NEW SPECIES OF THE GENUS ULIDIA.

By Charles W. Johnson,
Boston Society of Natural History.

In a collection of Ortalidæ sent to me by Mr. E. P. Van Duzee for determination was the following apparently new species.

Ulidia similis sp. nov.

Head red, front punctate, each puncture bearing a short black hair, orbits pruinose, ocellar triangle black, one inner and one outer vertical and two post-vertical bristles, antennæ, palpi and proboscis reddish, arista blackish, thickened at the base. Thorax reddish, the disk black, covered with a grayish pollen and showing in a certain light two narrow dark vittæ, pleura red, between the front and middle coxæ blackish, two post-humerals, one pre-sutural, two supra-alar, one dorso-central, one notopleural, one mesopleural, and one sternopleural bristle, scutellum red, tips of the tarsi brownish. Wings hyaline, costal cell brown, stigma black, tip of the marginal, submarginal and first posterior cell clouded with dark brown. Halteres white. Length 5 mm.

The female closely resembles the male. The first segment of the ovipositor is red, the tip blackish. Length 6 mm.

Fourteen specimens, Los Banos, Merced Co., California, May 22, 1918, collected by Mr. E. P. Van Duzee. Holotype (No. 521), allotype (No. 522) and eight paratypes in the collection of the California Academy of Sciences. Four paratypes in the author's collection.

Similar to *U. rubida* Loew, but that species has a broader and smoother front, the scutellum and pleura are a brighter red and more polished, the abdomen is also more polished and the ovipositor entirely black, the wings are a whitish hyaline, the apical spot smaller, the inner edge straight, not sinuous, and the tip of the first posterior cell narrower.

NEW MOSQUITOS FROM PANAMA.

By C. S. Ludlow,

Army Medical Museum, Washington, D. C.

During the later months of the summer, in connection with the work at Army stations both in this country and abroad, some new forms belonging to different groups of mosquitos have been received at the Army Medical Museum, two of which are from Panama and the others from the A. E. F.-S. taken at four different stations in Siberia.

There have also been received from Siberia three species already described by Mr. Theobald, "*Culicida togoi*," "*Culicida nipponi*," and "*Culex osakaënsis*." These are Mr. Theobald's namings but some of these species have since been referred to other genera, by Mr. Edwards.

Some of the new species are described as follows:

Anopheles (*Stethomyia?*) **niveopalpis** sp. nov.

Female. Head: dark brown, practically black, covered with fine "tomentum," a frosty line around the eyes, a tuft of long slender white scales projecting forward between the eyes, white lanceolate and forked scales on the vertex, and black forked scales on the occiput; these, changing somewhat in shape extend well toward the sides of the head; brown bristles extending forward around the eyes; antennæ brown, basal joint brown, second joint with a few slender white scales, verticels brown, pubescence white; proboscis very dark brown, labellæ light brown; palpi dark covered with very dark brown or black scales, outstanding on the proximal third, the apical parts of the ultimate and penultimate joints broadly snowy white, only a narrow brown band or spot intervening, which may possibly very narrowly involve both sides of the joint, a few yellowish hairs at the apex; clypeus brown, nude; eyes black.

Thorax: prothoracic lobes well separated, mamillated, with a few brown bristles; mesonotum grey and brown, the median portion of about one-third the width of the mesonotum is greyish, and this widens so as to include the "bare" space, a median dark brown line extending about half the length of the mesonotum and laterally the membrane is a soft brown. The small hairs are diffuse over the greyish portion, a line of larger hairs in the median dark line, and at the junction of this grey with the brown lateral portions, which latter is almost nude save for a few longer bristles on the lateral margin and over the wing joint. There are a few narrowly lanceolate white scales and a group of brown bristles at the nape; scutellum brown with scanty brown hairs and brown marginal bristles; postnotum brown, nude; pleura brown shading to the white of the coxæ.

Abdomen brown covered only with brown hairs, and brown border bristles.

Legs brown; coxæ very light, practically white, with a few brown bristles, femora light at the very base and on the ventral aspect, otherwise the scaling of all the legs is dark brown, with a minute yellowish knee-spot on the hind legs.

Wings clear, heavily clothed with dark brown rather broadly lanceolate scales, tending to give golden reflections; fringe dark except at the apices of both forks of the second long vein and the apex of the third where the color is a yellow such as is given by the reflections on other parts of the wings. First sub-marginal a little longer and narrower than the second posterior, its stem about half as long as the cell, and the stem of the second posterior nearly as long as the cell; posterior cross-vein a little more than its length distant from mid-cross vein. Halteres with greyish stem and very dark knob.

Length about 3 mm. (body) proboscis 1.5 mm.

Taken July 28, Comacho Reservoir, Empire, Canal Zone, Panama.

Described from one specimen in good condition bred from larvæ taken at Comacho, and sent by Colonel H. S. Greenleaf, M. C., U. S. Army, Department Surgeon. A specimen which is probably the same was sent some time since, but was in such bad condition that, although it was believed to be a *Stethomyia* probably lying close to *nimba*, it was impossible to place. This I should also place as a *Stethomyia*, but hesitate to do so because the scales on the vertex are not true flat scales. However Theobald (Mono. Cul. Vol. IV, p. 59) divides *Stethomyia* into two groups and remarks "Group B has the cephalic scales not quite so flat as in A," and James and Liston in describing *Stethomyia culiciformis* speak of "a few white spindle-shaped scales in the middle line in front" (Mono. Ind. Anoph., p. 122, 1904), and it may be that the genus includes some in which these scales are not true flat scales. At all events it does not resemble *nimba* in the thoracic marking, and the palpal markings are very distinctive.

Trichoprosopon (Joblotia) shropshirei sp. nov.

Female. Head light brown, covered with flat brown scales, lighter at the sides, and a row of dark brown forked scales at the nape; antennæ brown, verticels and pubescence brown, basal joint brown; proboscis long and slender, sometimes a little swollen near the apex, covered with dark brown scales having a bluish iridescence, a few dark bristles at the base, labellæ small, brown; palpi short, about one-tenth the length of the proboscis, dark brown; clypeus dark brown, with a row of minute dark brown hairs, on the anterior margin; eyes brown.

Thorax partly denuded, prothoracic lobes not contiguous, covered with large dark brown flat scales, somewhat elongated, and dark brown bristles, the latter mostly on the cephalic margin; mesonotum pale brown, and lighter laterad, sparsely covered with rather broad flat brown scales, except at the angles of the shoulders where the scales are a shiny yellowish white and merge into the very broad flat shiny white scales of the pleura, which extend on the coxæ. There is a row of brown bristles on the lateral margin of the mesonotum and over the wing joint; scutellum almost yellow, with brown flat scales and a group of bristles on each lobe; metanotum light brown with a well marked bunch of dark bristles (7–15) on the median line on the caudad portion.

Abdomen covered with rich brown scales having a bluish-green reflection, and large yellowish white brilliant scales forming basal spots, and connecting with the light scales of the venter. The first segment has small lateral white spots, and the last segment has numerous dark bristles. The venter is light, but the narrow apical dark scales extending from the dorsum give it the appearance of being banded.

Legs: femora and tibiæ are light scaled on the ventral aspect almost to the apex, more markedly so on the hind legs, otherwise the legs are all a rich dark brown with rather bright yellowish reflections which is sometimes misleading as to a given joint or part of joint. Unguos simple.

Wings clear, slightly darkened and heavily clothed with large broad truncate dark brown scales, some of which are slightly asymmetrical, the lateral scales longer and not so broad. The first sub-marginal cell is somewhat longer and narrower than the second posterior, its stem about half the length of the cell, and the stem of the second posterior about three-fourths its length, the bases of the cell nearly on a line; the posterior cross-vein about its length interior to the mid-cross vein. The costal margin is "spinous."

Length—body about 3.5 mm., proboscis 2.5 mm., wing 2.5.

Taken July 23, at Camp Gaillard, Canal Zone, Panama.

Described from five females sent in the regular collections from the Panama Canal Department, and named for Mr. J. B. Shropshire, as a partial acknowledgment of his interest and care in collecting for the Museum.

The species is smaller than the others reported for this genus, and is very deceptive in appearance, for with these specimens was another, of practically the same general coloring which has curved scales on the head and thorax, no hairs on the clypeus, has rows of bristles on the mesonotum, and no hairs on the postnotum.

EXCHANGE COLUMN.

Notices not to exceed four lines in length concerning exchanges desired of specimens or entomological literature will be inserted free for subscribers, to be run as long as may be deemed advisable by the editors.

Cynipidæ,—galls or the bred makers,—of the world desired for exchange or purchase. Will determine North American material. Address: Alfred C. Kinsey, Bussey Institution, Forest Hills, Mass.

Wanted: Insects of any order from ant nests, with specimens of the host ants, from any part of the world; also Cremastochilinæ of the world. Will give cash or Coleoptera, Hymenoptera and Diptera from the United States.—Wm. M. Mann, U. S. National Museum, Washington, D. C.

Wanted: Insects of the family Embiidæ (Isoptera). I would give insects of any order except Lepidoptera. I would like to correspond with persons interested in this family.—Raoul M. May, 2202 W. 10th St., Los Angeles, California.

Wanted: To exchange, or purchase for cash, specimens of the Genus Apantesis from any locality. Also to purchase rare Catocalæ.—Samuel E. Cassino, Salem, Mass.

Wanted for cash: Lowest representatives of all families of insects, preserved in fluid.—G. C. Crampton, Amherst, Mass.

Wanted: Living larval material of Tabanidæ, obtainable by sifting the soil at edge of water.—Packing in wet material, not water, each larva separate. Will send collecting outfit. Exchange insects of any order, or cash.—Werner Marchand, 10 Dickinson St., Princeton, N. J.

For Sale: A large collection of Javanese butterflies. Letters with particulars regarding desired species and families may be addressed to G. Overdykink, Agricultural School, Soekaboemi, Java, Dutch East Indies.

Wanted: Syrphidæ (Flower-flies) from all parts of the world. Exchanges solicited. Will determine on the usual conditions. C. L. Metcalf, Ohio State University, Columbus, Ohio.

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PSYCHE.

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(All new species, new genera and new names are printed in bold face type.)

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NOTES ON FOREST INSECTS.

III. TWO NEW SPECIES OF PITYOPHTHORUS FROM COLORADO.

By M. W. Blackman, Ph.D.,

Professor of Forest Entomology, New York State College of Forestry, Syracuse, N. Y.

Pityophthorus bassetti sp. nov.

Reddish brown $2\frac{3}{4}$ times as long as broad.

Male—length 2.2 mm. The *front* with distinct elevated transverse carina at level of upper inner angle of eye; above carina coarsely punctured, somewhat rugose and shining; below carina slightly excavated, more finely and densely punctured with moderately short and fine hairs; epistomal margin bordered with longer, coarser hairs; *eyes* rather elongate oval, not coarsely granular, with anterior emargination as broad as deep; *antennal* club short oval with segments sub-equal, first suture straight, second and third procurved ventrally; outer part of funicle one third longer than pedicel.

Pronotum very little longer than broad, sides of basal half nearly parallel but widest at the middle and very slightly arcuate; front broadly rounded and rather weakly serrate on the margin; anterior half armed with moderately coarse, acute asperities which are often arranged in fairly regular concentric lines, with their bases often continuous; summit fairly prominent with slight but distinct transverse depressed area immediately posterior to it which is divided by a smooth slightly elevated median area and bordered laterally by fainter elevated lines; depression more deeply and densely punctate; punctures becoming finer and sparser posteriorly and finer laterally; basal marginal line fine but distinct, slightly sinuate. Ventral surface of prothorax grooved and smooth behind but distinctly punctured with fine hairs in front.

Elytra equal in width to the thorax; sides nearly parallel but slightly widest near middle, suddenly and strongly rounded behind origin of the declivity with tips sub-acuminate; strial punctures moderately large and deep, not entirely regular near suture; striæ not impressed; interstitial punctures very sparce and of moderate size; nearly glabrous above but with a few fine

Fig. 1. 1, Dorsal view of male paratype of *Pityophthorus bassetti, sp.* nov., magnified 11 diametera; 2, lateral view of male, magnified 12 diametera; 3, front view of head of female, showing the circular pubes-cent area bordered by louger and coarser hairs, magnified 32 diameters.

short hairs, these becoming more abundant and longer at sides and behind. Declivity steep with deep wide sulcus; suture wide, elevated, with several coarse granules near apex; lateral elevations with fairly sharp serrate edge armed with 10 to 12 moderate sized, black teeth, each with a stiff tactile hair arising from its inner base. Last ventral abdominal segment deeply and very broadly emarginate.

Female, slightly longer (2.4 mm.) and of same width. Differs from male in having the frons very slightly concave, with a nearly circular area finely and densely punctured and pubescent and bordered with longer coarser incurved hairs. Elytra much less hairy at sides and rear than in male. Lateral elevations of the declivity with serrations of the male replaced by a sparse row of minute granules, long tactile hairs absent.

From Pitkin, Colorado. Bred from material brought in by Mr. R. O. Bassett, Jr.

Host tree: *Picea engelmanni* Engelm. Will also breed successfully in *Abies balsamea* (Linn.) Miller.

The material from which *Pityophthorus bassetti* was bred consists of several slabs taken from the base of an Engelmann spruce near Pitkin, Colorado by Mr. R. O. Bassett, Jr., a former student. These were received at Syracuse Nov. 23, 1915 and upon examination the bark was found to contain numerous living nearly full grown larvæ of a scolytid. Further examination yielded the dead parent beetles and these proved to be an unknown species of Pityophthorus. The slabs were placed in a breeding jar in the laboratory and a considerable number of beetles emerged during the first two weeks of December. Part of these were preserved as specimens while the rest were left in the breeding jar and several pieces of a freshly cut limb of balsam fir about 1 inch in diameter were introduced. The adults readily entered not only the fresh balsam, but also some reentered the slabs of Engelmann spruce from which they had emerged—breeding in both. The new second generation of adults emerged from these two hosts during the summer of 1916 and many of them were still alive in September, at which time also a few small larvæ doubtless of a third generation were found. It would appear that normally there is not more than one generation per year.

The bark on the Engelmann spruce in which the beetles originally bred was about $\frac{3}{16}$ of an inch thick, while that of the balsam limbs to which the new brood readily transferred was only $\frac{1}{16}$ of an inch thick. In the former the larvæ worked nearly entirely in the inner and middle bark usually not even grooving the sapwood while in the latter the larval mines were excavated partly from the sapwood. Aside from this the engravings in the two are similar. In their general characteristics the engraving is not unlike those of other species of this genus. It consists of an entrance gallery leading diagonally upward and inward to the junction of bark and sapwood where it is expanded into an irregular nuptial chamber. From this a variable number of egg-galleries branch off from all sides, but these soon take a general longitudinal direction. In number the egg-galleries vary from 4 to 9 and the average in 13 engravings in balsam fir is 6.9. The effect of this large proportionate number of females to each male upon their relative fecundity could not be determined satisfactorily because of the injuries to the engravings by the numerous brood.

The egg-galleries which have a general longitudinal direction are not excessively long when compared with those of several other species of this genus. In the material at hand they vary from $3\frac{1}{2}$ cm. to 7 cm. with an average length of 4.2 cm. The egg niches, where these are still recognizable, occur on both sides of the gallery and are not closely arranged—usually being 2 mm. or more apart so that the number of eggs laid by each female is probably not great.

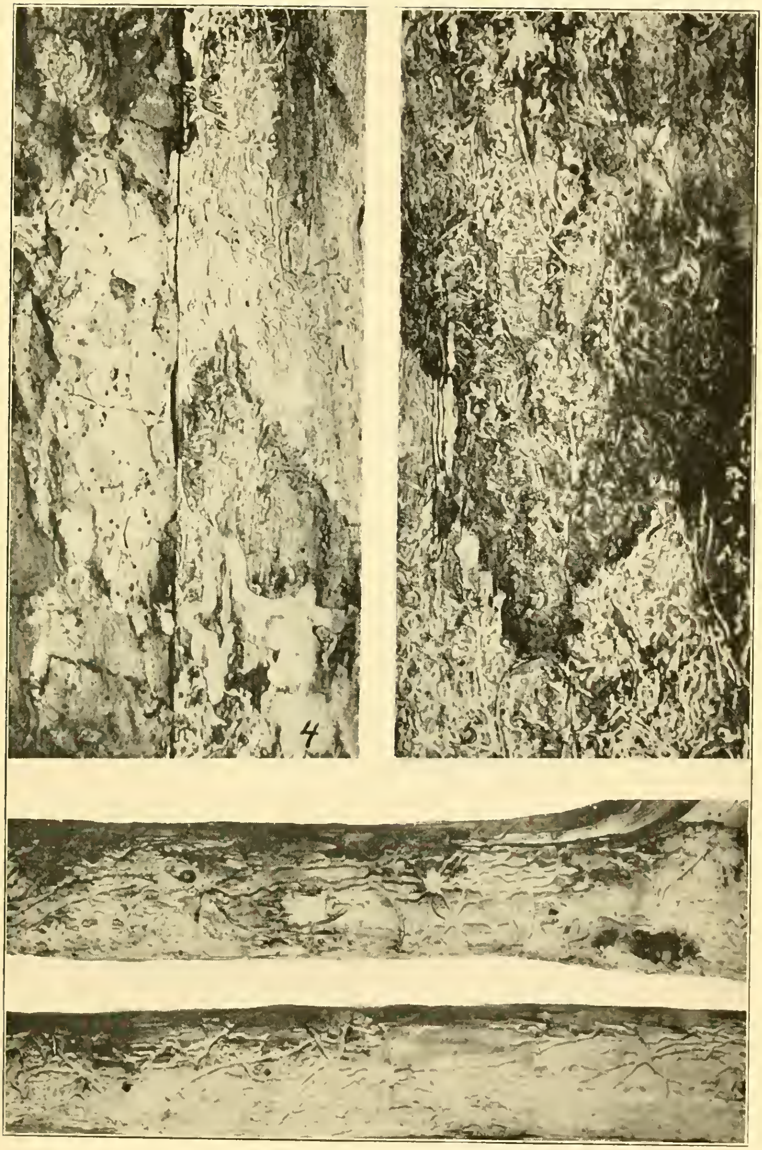
Pityophthorus occidentalis sp. nov.

Reddish brown to nearly black in color; 2.8 times as long as broad.

Male. Length 2.5 mm. *Front* convex with distinct rough transverse carina below level of upper inner angle of eyes, coarsely and roughly punctured above, slightly excavated and more finely punctured below carina, with distinct median vertical carina from transverse carina to margin of epistoma; fine short hairs over entire front but becoming more conspicuous cephalad; edge of epistoma emarginate and bisinuate, bordered with coarser and longer hairs; eyes oval with rather wide and deep emargination; antennæ light reddish-brown, club oval, with first three segments sub-equal and fourth segment shorter; first and second sutures on ventral face nearly straight, third strongly arcuate; outer part of funicle one-half longer than pedicel.

Pronotum slightly longer than broad (14:13), widest behind the summit; sides of basal half slightly arcuate, faintly constricted in front of middle, broadly rounded in front, with distinct nearly regular serrations, slightly more than the cephalic half armed with well developed asperities arranged in concentric nearly regular rows; summit prominent; posterior area shining, with rather numerous moderate sized punctures, except on the impunctate slightly elevated area in the median line; basal marginal line distinct and continued diagonally downward along the sides as a margined ridge easily distinguishable to a point anterior and dorsal to the base of the prothoracic leg. Ventral surface of the prothorax punctured in front, smooth behind except immediately adjacent to the base of the leg.

Elytra of same width as prothorax; sides subparallel, widest before the middle, slightly narrowed behind the middle to the level of the origin of the declivity, from which point it is strongly and



Blackman—Forest Insects.

regularly rounded; tips not acuminate; strial punctures moderately fine, in regular rows except near base where they are somewhat confused, first stria impressed, the others not; interstrial punctures fine and very sparse, almost lacking on the disc; disc nearly glabrous but with a few small hairs, these becoming longer and more numerous at the sides and behind; *declivity* steep with deep, rather narrow sulcus; suture granulate and widened toward apex; lateral elevations abrupt and granulate; granules of the 3rd and 4th interspaces forming two rows which converge and become confused near apex, those of 4th interspace smaller but distinct, others more or less confused, each of granules with a rather long stiff tactile hair arising from near its base. Ventral abdominal segments rather finely punctured and moderately hairy; last segment deeply and broadly emarginate.

Female, of the same general proportions. *Front* flattened, with nearly circular pubescent area bordered by coarser and longer incurved hairs; prothorax as in male; apex of elytra more acutely rounded but not acuminate; declivity not so steep, sulcus not so deep, lateral elevations not so pronounced, with a sparse row of minute granules on the 3rd interspace and a few scattered ones lateral to it; long tactile hairs absent.

Host tree: *Picea engelmanni* Englm.

Locality: From Pitkin, Colo., collected by Mr. R. O. Bassett, Jr., October, 1915.

Explanation of Plate I.

Fig. 4, 5. Slabs from the trunk of Engelmann spruce showing the engravings of *P. bassetti* in the inner bark and the exit holes through the outer bark. About two-thirds natural size.

Fig. 6. Two segments from the limb of a balsam fir, showing the engravings of *P. bassetti* on the surface of the sapwood. About three-fifths natural size.

HYMENOPTERA COLLECTED NEAR BOSTON, MASS., WITH DESCRIPTION OF A VARIETY OF *BOMBUS AFFINIS*.

By J. Bequaert,

American Museum of Natural History, New York City.

While collecting Hymenoptera at Forest Hills, Mass., and other localities in the vicinity of Boston, I have taken on two occasions a bumble-bee, which from its aberrant coloration could not be properly named with Franklin's "Bombidæ of the New World." I have been permitted to examine similarly colored *Bombus*, taken some years previous by Professor Wheeler at Forest Hills and by Mr. J. E. Smith at Sherborn, Mass. It was finally recognized that all these specimens belong to a striking color-variant of *Bombus affinis*, which it is the purpose of this note to describe and name. I have used this opportunity to present an account of the Bombidæ of the neighborhood of Boston and to record some other interesting Hymenoptera of that region.

I am greatly indebted to Prof. Wm. M. Wheeler, Messrs. N. Banks, Wm. T. Davis, C. W. Johnson, E. J. Smith, C. Schaeffer, and Dr. F. E. Lutz, who have kindly allowed me to examine material in their possession or care and to use valuable information.

Bombus affinis var. **novæ-angliæ** var. nov.

Known in the worker and male phases, which are colored much the same. One or more of the abdominal segments behind the second are covered entirely or to a large extent with ferruginous pile (in the brightest specimens very near Ridgway's vinaceous-rufous). Coloration otherwise as in typical *affinis;* in most of the specimens the usual reddish tinge of the yellow pile on the middle portion of the second tergite is rather faint or faded, which, moreover, is often the case with typical *affinis* too.

The structural characters show no differences with those of typical *affinis;* this is especially true for the shape of the male genitalia, which I have carefully compared with those of the typical form.

The specimens examined do not differ in size from typical *affinis;* total length of the worker: 12 to 14 mm.; of the male: 16 to 17 mm.

Type locality: Forest Hills, Mass.; the holotype, a male taken by Prof. Wm. M. Wheeler, is deposited at the Museum of Comparative Zoölogy, Cambridge. The allotype, a worker from the same locality, is in the American Museum of Natural History. Also known from Sherborn, Mass., and Brooklyn, N. Y.

The extent of ferruginous pile on segments 3 to 6 is variable, the following being the combinations observed:

1. Ferruginous pile covering the major part of the fourth tergite; the extreme sides of this tergite and the whole of segments 3, 5, 6, and 7 being black: one worker from Forest Hills, August 3, 1911 (Wm. M. Wheeler Coll.; allotype); two males from Sherborn, August 30 and September 8, 1913 (E. J. Smith Coll.).

2. Ferruginous pile covering the whole of tergite 4 and extending over the apical margin of tergite 3: two males from Forest Hills, June, 1911 (holotype of var. **novæ-angliæ**) and August 18, 1911 (Wm. M. Wheeler Coll.).

3. Ferruginous pile covering the entire fourth tergite; also the greater part of tergite 5, though with some admixture of black hair; tergite 6 with a few rufous hairs in the black pile at the base in the center: one male taken at Forest Hills, visiting the flowers of *Lythrum Salicaria*, August 12, 1919.

4. Tergites 4, 5, and 6 covered with ferruginous pile, except at the extreme sides and in the middle along the apical margin, where the pile is black: one male from Brooklyn, N. Y., July, 1915 (F. M. Schott Coll.).

5. Ferruginous pile very bright, covering the entire fourth tergite, tergite 3 except for a median patch of black hair near the base, and the basal part of tergite 5: one worker taken in the Arnold Arboretum at Forest Hills, collecting pollen of a cultivated variety of *Viburnum*, August 3, 1919. This very brightly colored specimen mimics to a certain degree *Bombus ternarius* Say.

It is not without some hesitation that I propose a varietal name for this curious color-variant of *Bombus affinis*. It has been the great merit of Franklin to elucidate the structural characters of the North American Bombidæ; and, while carefully recording the color-variants of each species, this author has wisely refrained from applying names to them. Indeed, it will be a lengthy process for future students to decide which of the many color forms of bumblebees are mere freak specimens, and which others represents racial differences due either to somatic and environmental influences or to germinal modifying factors. There is, I believe, ample justification for giving such fixed races a nomenclatural standing, as has been the common practice for recent years. Moreover, European students have profusely named the color forms of the palearctic bumble-bees, and, with increasing interest in the study of distributional problems, a similar course will undoubtedly be adopted for the nearctic species.

In the case of *B. affinis* var. *novæ-angliæ* there is every reason to believe that it is not based on freak specimens, but represents a peculiar race, which, having been repeatedly collected, must not be a great rarity in the vicinity of Boston and perhaps in some other localities. Furthermore, *Bombus affinis* varies, as a rule, but little in its coloration, since Franklin, in his Monograph, does not mention a single color-variant and even notes that "this species is very constant in its character, a remarkable fact when the extreme variability of a large proportion of the species of the *Terrestris* group is considered."[1] I have examined over 150 specimens of *B. affinis* from various localities in the states of New York, New Jersey, Pennsylvania, New Hampshire, Massachusetts and North Carolina, and, with the exception of the specimens described above, have only found one aberrant male. This male, collected at Woodbury, N. Y., September 21, 1910, and belonging to the American Museum of Natural History, shows a faint indication of a transverse patch of ferruginous pile in the center and near the base of the fourth tergite; the specimen is otherwise quite normal, but is evidently a transition toward the var. *novæ-angliæ*.

Since this paper was sent to the printer, I have been able to examine several specimens of *B. centralis* Cresson and its var. *juxtus* Cresson, from Colorado, in the collection of the American Museum of Natural History. Such of these specimens as agree best with the description of *juxtus* Cresson, are very similar in coloration to the brightest individuals of *B. affinis* var. *novæ-angliæ*. *B. centralis* and *B. juxtus* are, however, at once separated from *B. affinis* by their much longer oculo-malar space and by their having yellow pile on face and occiput. Titus[2] has recorded *B. juxtus* from Woods Hole, Mass.; but, as Franklin has pointed out,

[1] Trans. Amer. Ent. Soc., 38, 1913, p. 280.
[2] Canadian Entomol., vol. 34, pp. 39 and 43 (1902).

this identification was undoubtedly erroneous. It seems very probable that these Woods Hole specimens belonged to *B. affinis* var. *novæ-angliæ*.

In drawing up the following list of the Bombidæ known to occur within a radius of twenty miles from Boston, I have perused, besides my own data, collected during the summer of 1919, information kindly given to me by Prof. Wm. M. Wheeler and Messrs. N. Banks, C. W. Johnson and E. J. Smith.

Bombus terricola Kirby. This is perhaps the most common species of bumble-bee at Forest Hills; also at Auburndale (C. W. Johnson Coll.) and Sherborn (E. J. Smith Coll.).

Bombus affinis Cresson. The typical form is common at Forest Hills where it visits, among others, the flowers of *Ceanothus americanus;* also at Auburndale and Dedham (C. W. Johnson Coll.); Sherborn (E. J. Smith Coll.).

Bombus bimaculatus Cresson. Common at Forest Hills; also at Cohasset (C. W. Johnson Coll.) and Sherborn (E. J. Smith Coll.).

Bombus impatiens Cresson. Forest Hills; also Auburndale, Dedham, Brookline, and Cohasset (C. W. Johnson Coll.); Sherborn (E. J. Smith Coll.).

Bombus ternarius Say. Mr. E. J. Smith, who has taken a few workers of this species at Sherborn, believes that it is very rare near Boston. Professor Wheeler informs me that in many years collecting he has never seen it at Forest Hills, though he has commonly taken it at Colebrook, Conn.

Bombus perplexus Cresson. Wollaston (Mus. Comp. Zoöl.); Auburndale and Arlington (C. W. Johnson Coll.); Sherborn (E. J. Smith Coll.).

Bombus vagans Smith. Forest Hills; also from Auburndale, Dedham, and Boston (C. W. Johnson Coll.); Sherborn (E. J. Smith Coll.).

Bombus fervidus Fabricius. This is a common species at Forest Hills; also at Auburndale and Cohasset (C. W. Johnson Coll.); Sherborn (E. J. Smith Coll.).

Bombus americanorum (Fabricius) = *Bombus pennsylvanicus* Franklin. Rather scarce near Boston; I have taken it at Lexington and Mr. E. J. Smith has it from Sherborn.

Bombus separatus Cresson. Sherborn (E. J. Smith Coll.).

Mr. E. J. Smith informs me that he has also seen a female of *B.*

auricomus (Robertson), which, according to its label, was taken near Boston many years ago. Neither he nor Professor Wheeler has ever taken that species there, and no Boston specimens are contained in the collections of the Boston Natural History Society and of the Museum of Comparative Zoölogy.

Psithyrus laboriosus (Fabricius). Five males were taken at Forest Hills, about the middle of August, and one female in the Stony Brook Reservation at flowers of *Cephalanthus occidentalis*, July 21; also at Auburndale and Brookline (C. W. Johnson Coll.); Sherborn (E. J. Smith Coll.).

Psithyrus ashtoni (Cresson). Auburndale and Brookline (C. W. Johnson Coll.); Cambridge (S. Henshaw Coll.); Sherborn (E. J. Smith Coll.).

It is interesting to compare this list with other local faunas farther north and south. At Waldoboro, on the coast of southern Maine, Lovell[1] did not find *Bombus impatiens*, *B. americanorum* and *B. affinis*, three species which are rather abundant in the Transition Zone. On the other hand, two forms which are rather Canadian or Boreal, *B. borealis* Kirby and *B. ternarius* Say, are still to be found in southern Maine, while *borealis* has never been seen near Boston and *ternarius* is very rare there. Otherwise the faunas of these two localities are very similar.

From my own collecting experience and from what I have seen in other collections, the bumble-bee fauna of the immediate vicinity of New York City differs mainly from that of Boston in the scarcity of *B. terricola* and the absence of *B. ternarius*, though both these species are commonly found in the Catskills. *B. ternarius* has never been taken near New York City; the nearest locality for that species is Lake Marcia, Sussex County, N. J., where it was collected by Dr. F. E. Lutz.[2] As to *B. terricola*, there are no New York specimens in my own collection, nor in that of Mr. Wm. T. Davis; I find, however, in the Brooklyn Institute of Arts and Sciences two males from Essex Fells, Essex County, N. J. (A. S. Nicolay Coll.) and, in the American Museum of Natural History, two further specimens labeled "Astoria, Long Island." Two species of the Austral Zone, *B. fraternus* (Smith) and *B. auricomus*

[1] J. H. Lovell. The Bumble-bees of Southern Maine. Ent. News, 18, 1907, pp. 195–200.

[2] Bull. Amer. Mus. Nat. Hist., 35, 1916, p. 514. The specimen recorded as *B. ternarius* from Staten Island in Smith's New Jersey List, is a worker of *B. fervidus*, though it bears a label in the late Dr. Ashmead's handwriting "*B. ternarius* Say."

(Robertson), though often seen in southern New Jersey, apparently do not reach New York City.

The vicinity of Boston thus seems to be in some way the meeting ground of certain Boreal and Austral elements, while forms of the Transition Zone constitute the bulk of the local fauna. This may be one of the reasons why the insect fauna of that region contains such a variety of species. Though I was able to devote to collecting only a few odd hours during two of the last summer months, I have to my great surprise taken there many unusual Hymenoptera, among them certain species which I had not seen before in the northeastern states. It will, I believe, be interesting to put on record some of my captures.

Pachymenes symmorphus (Saussure). Two females were taken in the Arnold Arboretum at Forest Hills, July 5. This wasp has been placed by H. de Saussure in the genus *Nortonia*. I have shown elsewhere[1] that *Nortonia* may best be restricted to the species with a transverse raised suture on the first abdominal tergite; whereas such species as the nearctic *N. symmorpha* Saussure and *N. tolteca* Saussure, in which there is no raised suture on tergite one, cannot in my opinion be generically separated from *Pachymenes*. I have also *P. symmorphus* from Greenwood Lake, N. Y., ♀, August 20, 1916; White Plains, N. Y., ♂, at flowers of *Ceanothus americanus*, June 29, 1918; Stowe, Lamoille County, Vt. (E. L. Bell Coll.). Mr. Wm. T. Davis has taken a ♀ at Ramsey, N. J., July 19, 1908, and a ♂ at Cabin John Run, Md., June 17, 1910.

Ancistrocerus unifasciatus (Saussure). One female at Lexington, July 27, 1919, and another at Forest Hills in June.

Anacrabro ocellatus Packard. This was very common at Forest Hills in the latter half of July, visiting *Ceanothus americanus;* I have also taken it at Lexington on *Spiræa salicifolia*, July 27.

Euspongus bipunctatus (Say) = *Paramellinus bipunctatus* Rohwer. Forest Hills, August 3, 1919; one female running about on leaves of pickerel weed in the Arnold Arboretum.

Anthophora walshii Cresson. One female sucking honey at flowers of *Ballota nigra*, Forest Hills, July 27, 1919. I saw a male, which I was unable to capture, at the flowers of *Pontederia cordata*, Forest Hills. Mr. C. W. Johnson informs me that the collection

[1] Bull. Amer. Mus. Nat. Hist., 39, 1918, p. 93.

of the Boston Society of Natural History contains further specimens of this species as follows: Woods Hole, Mass., ♀, July 25, 1903 (C. W. Johnson Coll.); Manomet, Mass., ♂, July 17, 1904, and Falmouth, Mass., ♂, July 8, 1912 (Dr. J. A. Cushman Coll.). In these two males, the terminal joint of the middle tarsi bears the lateral patches of black pubescence characteristic of this species; furthermore, there are at the base of the clypeus two black spots narrowly connected in the middle. These points, together with the white tegumentary bands of the abdomen, make the species easy to recognize. So far as I have been able to discover, this beautiful insect, originally described from Illinois, has also been recorded from Wisconsin, Nebraska and central Texas. At Carlinville, Ill., Robertson found it sucking nectar on several flowers, among them *Lespedeza reticulata*, while the females gathered pollen exclusively from *Cassia Chamæcrista*.[1] In Nebraska, it was taken at the flowers of a *Salvia*, and Graenicher records it from *Rudbeckia hirta* in Wisconsin.

Xenoglossa pruinosa (Say). This handsome species is a common visitor of the flowers of cultivated squash at Forest Hills, between 6 and 8 a. m.; the flowers close by 9 a. m., but the males can often be found during the day, sleeping inside the corolla.

Dianthidium notatum (Latreille). This is fairly common in the first half of August at Forest Hills, on flowers of *Lespedeza hirta* and *L. frutescens*, which are visited by both sexes. I have also taken it at the Blue Hills Reservation, on *Baptisia tinctoria*.

Halictoides novæ-angliæ Robertson. Many males were seen at the flowers of *Pontederia cordata* in the Arnold Arboretum, Forest Hills, from July 8 to August 15; the females are much scarcer and appear later, the first being taken July 24.

Perdita octomaculata (Say). At Forest Hills this little bee was seen nesting in the sandy soil of a vacant city lot; on August 10, the two sexes were found in numbers mating within the flower-heads of *Cichorium Intybus;* the female also visits *Solidago rugosa*.

Epeoloides pilosulus (Cresson). One male at the Blue Hills Reservation, on flowers of *Apocynum androsæmifolium*. *Epeoloides nearcticus* Ducke,[2] described from Pennsylvania, is in my opinion a synonym of *pilosulus*.

[1] Botanical Gazette, 25, 1898, p. 230; and 28, 1899, p. 36.
[2] Rev. d'Ent. Caen, 27, 1909, p. 39.

THE FIRST STAGE LARVA OF *CUTEREBRA AMERICANA* (FABR.) (DIPTERA; OESTRIDÆ).

By G. F. Ferris,
Stanford University, California.

There appears to be but little information concerning the first stage larvæ of any species of Oestridæ, the only very detailed figures that I have seen being those given by Hadwen and Cameron[1] of the larvæ of three species of Gastrophilus. I have been fortunate enough to secure some notes on the first stage of *Cuterebra americana* (Fabr.) (det. Aldrich) and present them in order that they may not be lost, brief though they are.

A female of this species was taken in flight at Palo Alto, Calif., on October 8 and was confined in a glass jar. On this same day (perhaps partially on the following) this female deposited from 100 to 150 eggs which were placed singly and were attached to the glass by a glue so powerful that the eggs could not be detached without being destroyed. Unfortunately no notes were kept as to the shape of the eggs.

The eggs began to hatch on October 22. In the case of the species discussed by Hadwen and Cameron there has existed some doubt as to whether the eggs hatch normally without the stimulus of moisture, heat and friction, although these authors found that at least a certain percentage do. In the case of *Cuterebra americana* these factors seem to have no place as apparently all the eggs hatched.

The first stage larvæ are extremely active. Clinging to the empty egg shells they waved the head energetically about in the air and some of them deserted the egg shells and moved about, progression being accomplished by means of a looping movement much like that of a Geometrid caterpillar. No notes were kept as to the length of time that the larvæ lived without food.

Description of the Larva.

Length (flattened on slide) 1.4 mm.; body fusiform, tapering at both ends (Fig. A). Posterior extremity ending in a single flat lobe

[1] Hadwen, S. and Cameron, A. E. A Contribution to the Knowledge of the Bot-Flies, *Gastrophilus intestinalis* DeG., *G. hæmorrhoidalis* L. and *G. nasalis* L. Bull. Ent. Res., vol. 9, pt. 2, pp. 91–106, figs. (1918).

which projects well beyond the spiracles and is slightly emarginate at the tip. The actual number of segments cannot be determined from the mounts, but there are in all nine transverse series of posteriorly pointing denticles. The anteriormost series is close to the anterior end of the body and is composed of very small denticles. The second to fourth series are each composed of a single row of flat denticles, the points of which are directed toward the median line and end in a recurved hook (Fig. B). Between each two of these

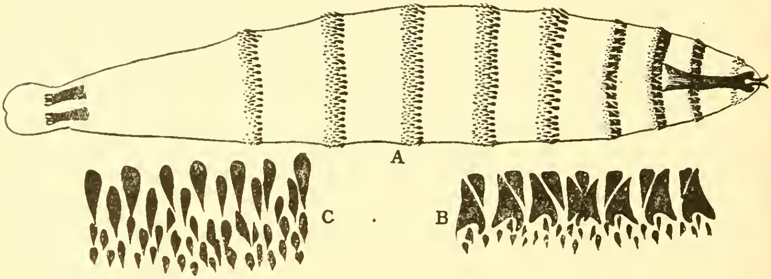


Fig. 1. *Cuterebra americana*, first stage: A, entire larva only the bases of the tracheal trunks are indicated; B, denticles from third series at the median line; C, denticles from fifth series.

denticles are smaller sharply pointed denticles and behind them are a varying number of still smaller, sharp denticles. The remaining series are all composed of numerous sharply pointed denticles, of which the anteriormost are much larger than the others (Fig. C). The cephalopharyngeal apparatus extends back to the anterior margin of the third series.

Note.—The above description is based upon specimens that have been cleared, stained and mounted on a slide.

A REVISION OF THE SPECIES OF THE GENUS LOXOCERA, WITH A DESCRIPTION OF A NEW ALLIED GENUS AND A NEW SPECIES.

By Charles W. Johnson,
Boston Society of Natural History.

Species based entirely on color, a character which further study proves to be very inconstant, are a source of considerable trouble to the student. After a great deal of collecting, and a study of some 75 specimens including Loew's types, it seems apparent that Say's *Loxocera cylindrica* represents an extremely variable species, which for convenience and to more fully emphasize this variability might be divided into four varieties according to the following table.

Table of Species.

1. Wings hyaline with the tips and posterior cross veins distinctly clouded. . . . . *cylindrica* Say
   a. Anterior margin of the thorax, a dorsal line, humeri, and lateral lines, black. . . . . var. *cylindrica* Say
   b. Anterior margin very broad, covering at least one-third of the thorax, a dorsal line, short lateral lines and about one-third of the anterior of the pleura, black var. *pleuritica* Loew
   c. Dorsal line, humeri, lateral margins and the upper half of the pleura, black. var. *pectoralis* Loew
   d. Dorsal and lateral lines (sometimes obsolete) and a spot above the yellow humeri, black. . . . . var. *obsoleta* var. nov.
   Wings brownish, without the apical clouding. 2
2. Anterior third of the thorax black, dorsal and lateral lines wanting; abdomen, except the sides of the first segment, black *collaris* Loew
   Anterior and lateral margins and a dorsal line on the thorax, black; abdomen except at the base red. . . .*fumipennis* Coq.

Loxocera cylindrica Say.

L. cylindrica Say, Jour. Acad. Nat. Sci., Phila., III 98, 1823.

Say's description is very clear: "Thorax with an undulated band on the anterior margin, dorsal line and an obsolete line before the wing, black; wings a little dusky, particularly at tip." This represents practically the more characteristic or intermediate form merging into the darker *pleuritica* on the one hand and the lighter colored *obsoleta* on the other. Say's "var. a" I am calling *obsoleta*. It is the prevailing form of southern Pennsylvania and New Jersey and is the only form found by the writer in southern Virginia and North Carolina. The variety *pleuritica* is the prevailing form from New Jersey northward; it is often confused with *pectoralis*, a much rarer form, of which I have typical examples from only three localities, and in each case a female, as is the type. In its dorsal thoracic markings it approaches *obsoleta*, as the anterior marginal band is interrupted in both cases.

The following records show the northern and southern distribution of the species and its varieties:

L. cylindrica Say (typical).

Glen House and Alstead, N. H.; Dummerston, Vt.; Auburndale, Fall River and North Adams, Mass.; Philadelphia, Pa.; Algonquin, Ill. (Dr. Nason); Minnesota (Washburn); Kansas (Snow). Type, Pennsylvania. I have not seen the specimens from Minnesota and Kansas.

var. **pleuritica** Loew.

Machias, Me.; Mt. Washington, N. H.; Norwich, Vt.; Montreal, Can.; Ithaca, N. Y.; Agricultural College, Mich.; Auburndale and Woods Hole, Mass.; Delaware Water Gap, N. J.; Kansas (Snow). Types, Connecticut, New York.

var. **pectoralis** Loew.

White Mountains, N. H.; Mt. Ascutney, Vt.; Auburndale, Mass.; Edge Hill, Pa. Type, Washington, D. C. Two specimens (♂ ♀) from Great Falls and Chain Bridge, Va. (N. Banks) have the black of the pleura interrupted below the wings.

var. **obsoleta** var. nov.

Burlington, Vt.; Plymouth, Mass.; Branford, Conn.; Delaware Water Gap, and Clementon, N. J.; Philadelphia and Natrona, Pa.; Potomac Creek and Suffolk, Va., and Hertford County, N. C.

Loxocera collaris Loew.

This is usually smaller than *L. fumipennis* Coq., and readily distinguished by characters given in the above table. Specimens from Washington and Oregon I cannot separate from those of the eastern states, thus giving it a wider distribution than any of the other species. Aside from the typical locality, District of Columbia, there are specimens in the collection of the Boston Society of Natural History from Liberty, Me. (J. A. Cushman); Medford, Mass. (G. W. Barber); Salem, Mass. (A. P. Morse). Also from Great Falls, Va., May 19 (N. Banks), in the Museum of Comparative Zoölogy.

Loxocera fumipennis Coq.

Except for the uniform dark brown wings, the species resembles *L. cylindrica*. It is more clearly related to the European *L. elongata* than any of the other American species. Distribution, Kansas, Texas and Colorado.

Loxocera quadrilinea Walker.

The identification of this species from the description is hopeless.

Pseudopsila new genus.

This represents a group intermediate between the true Loxocera and Psila. The former has the third joint of the antenna at least five times as long as the second and exceeding the length of the arista. The typical species of the genus Psila (*P. fimentaria* L.) has an ovate rounded third antennal joint scarcely longer than the second. In Pseudopsila the third joint is subcylindrical and about three times as long as the second, the latter being relatively shorter than in the typical Loxocera. Arista almost double the length of the third joint. One pre-dorso-central, immediately in front of the suture (these are easily broken and are present on but few of the museum specimens), one post-dorso central just in front of the scutellum, two supra alar and a small presutural bristle. Type, *Loxocera fallax* Loew.

Table of Species.

1. Thorax entirely black........................... *fallax* Loew
   Thorax yellow marked with black 2

2. Dorsum without lateral margins of black.................3
   Dorsum with lateral margins of black......................4
3. Humeri and upper half of the pleura black....*angustata* Cress.
   Anterior margin, pleura, metanotum and a narrow dorsal line black..............................*perpolita* sp. nov.
4. With broad lateral margins only, upper half of the pleura black.................................*bivitatta* Loew
   With a broad anterior and lateral margins, upper half of the pleura black.............................*collaris* Loew

Pseudopsila fallax (Loew).

Loxocera fallax Loew, Cent., IC, 89, 1869.

In a note Loew refers to this species as being intermediate between Loxocera and Psila. It is readily distinguished by having both the thorax and abdomen shiny black. It has the following distribution: Mt. Washington, 4,000 feet, Glen House and Intervale, N. H.; Auburndale, Cohasset and Fall River, Mass.; Kaaterskill and Axton, N. Y. Type locality, Canada.

Pseudopsila perpolita sp. nov.

Head yellow, upper half of the occiput and vertical triangle black; third joint of the antennæ black about three times as long as the second; aristæ white. Thorax including the scutellum yellow, with short yellow hairs, anterior margin, a stripe occupying the greater portion of the pleura and the metanotum, shiny black. A very narrow blackish dorsal line is also present, which is usually obsolete behind the suture. One pre-dorso-central just in front of the suture, and one post-dorso-central in front of the scutellum, the alar bristles are wanting. Abdomen shiny black, with short yellow hairs, ovipositor yellow. Halteres white. Wings hyaline, veins light yellow, wings noticeably large for the size of the fly, anterior cross vein slightly nearer the base of the discal cell than in *P. fallax*, *i. e.*, less than one-third the length of the cell. Legs light yellow, tips of the tarsi brown. Length 4 mm.

Seven specimens, six females, Center Harbor, N. H., September 10, 1914 (C. W. Johnson), and one male, Liberty, Me., September 9, 1915 (Dr. J. A. Cushman). Holotype and three paratypes in the collection of the Boston Society of Natural History, two paratypes in the Museum of Comparative Zoölogy and one in the author's collection.

This species resembles *Psila lateralis* Loew in general appearance, but the longer antennæ readily separate it from that species, while from *P. collaris* Loew, it is at once distinguished by the highly polished black markings and the absence of black on the sides of the dorsum.

Pseudopsila angustata (Cresson).

Psila angustata Cresson, Proc. Acad. Nat. Sci., Phila., 1919, p. 193.

An interesting species resembling in color *Psila lateralis* Loew, but much larger. The pre-dorsal-centrals are not present in the two specimens before me, neither are they present in the two following species. In addition to the type locality, Ithaca, N. Y., it has been taken by Mr. A. P. Morse at Woodstock, Vt.

Pseudopsila bivitatta (Loew).

Psila bivittata Loew, Cent., VIII, 67, 1869.

The form of the antennæ places this also in this group. It is common and quite widely distributed from Quebec (Osten Sacken) and Maine to Philadelphia, Pa., and probably much farther South. Type from Connecticut.

Pseudopsila collaris (Loew).

Psila collaris Loew, Cent., VIII, 68, 1869.

This may prove to be only a variety of the preceding. Distribution, White Mountains, N. H. to Virginia. Type also from Connecticut.

PROCEEDINGS OF THE CAMBRIDGE ENTOMOLOGICAL CLUB.

The annual meeting of the Cambridge Entomological Club was held January 13 at the Bussey Institution, Forest Hills, Boston, and the following officers were elected for 1920:

President, C. A. Frost, Framingham.
Vice-President, W. L. W. Field, Milton.
Secretary, J. H. Emerton, Boston.
Treasurer, F. H. Walker, Salem.

Executive Committee, S. W. Denton, Wellesley; L. W. Swett, Lexington; P. G. Bolster, Boston.

Editor of Psyche, C. T. Brues, Boston.

Mr. S. W. Denton presided and thirty-two members and guests were present.

Prof. Robert Matheson, of Cornell University College of Agriculture, spoke on the three species of plant lice of apple trees, *Aphis pomi*, *Aphis sorbi* and *Aphis avenæ*, their habits, and methods of controlling them.

Mr. S. W. Denton gave an interesting account of his experiences in buying and selling butterflies in America and England.

Mr. A. F. Burgess, secretary of the Association of Economic Entomologists, spoke of the meetings of that society and of the Entomological Society of America at St. Louis.

ENTOMOLOGICAL NOTES FROM THE MUSEUM OF COMPARATIVE ZOOLOGY.

Several families of Neuroptera have recently been rearranged in new drawers. The largest of these, the Myrmeleonidæ, occupies 54 drawers and includes 2,395 specimens representing 309 named species, among which are 125 types.

Several lots of small neuropteroid insects have been obtained from Mr. Parish, collected on his Amazon trip.

In mounting a collection of insects from Anticosti Island a specimen of Ornithomyia was found to which were attached two specimens of Mallophaga, one on each side near the tip of the abdomen of the fly. This is doubtless one method of distribution of the parasites.

Mr. Dawson of the University of Nebraska spent the Christmas holidays at the museum studying Serica; Mr. Strickland of the Canadian Entomological Branch at Ottawa spent several weeks studying the collections of Acarina and Psocidæ, and Mr. Leonard of the Cornell University Agricultural College was at the museum in January to study the types of Leptidæ.

EXCHANGE COLUMN.

Notices not to exceed four lines in length concerning exchanges desired of specimens or entomological literature will be inserted free for subscribers, to be run as long as may be deemed advisable by the editors.

Cynipidæ,—galls or the bred makers,—of the world desired for exchange or purchase. Will determine North American material. Address: Alfred C. Kinsey, Bussey Institution, Forest Hills, Mass.

Wanted: Insects of any order from ant nests, with specimens of the host ants, from any part of the world; also Cremastochilinæ of the world. Will give cash or Coleoptera, Hymenoptera and Diptera from the United States.—Wm. M. Mann, U. S. National Museum, Washington, D. C.

Wanted: To exchange, or purchase for cash, specimens of the Genus Apantesis from any locality. Also to purchase rare Catocalæ.—Samuel E. Cassino, Salem, Mass.

Wanted for cash: Lowest representatives of all families of insects, preserved in fluid.—G. C. Crampton, Amherst, Mass.

Wanted: Syrphidæ (Flower-flies) from all parts of the world. Exchanges solicited. Will determine on the usual conditions.—C. L. Metcalf, Ohio State University, Columbus, Ohio.

Largest Expanse—one each ♂ and ♀ Lepidoptera wanted for transfer purposes. Those not good enough for collections will do. Will buy, or exchange for local Lepidoptera, etc.—C. V. Blackburn, 12 Pine St., Stoneham, Mass.

Butterflies of Japan and Formosa, will be exchanged by S. Satake, 48 Aoyama-minamimachi 5-chome, Tokyo, Japan.

For Sale: Psyche, complete set, $40. Volumes 3 to 20, newly bound in 11 volumes, red half calf, with black cloth sides; also Ann. Ent. Soc. Amer., complete, $12. Volumes 1 to 6, newly bound in black half calf, cloth sides.—A. C Hansen, 945 Margate Ter., Chicago.

For sale, or exchange for entomological items not in my library—American Entomologist, complete; Dyar, List of N. A. Lepidoptera; Redi, Experimenta, circa Generationem Insectorum, 1686; many others.—J. E. Hallinen, Cooperton, Okla.

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A COMPARISON OF THE EXTERNAL ANATOMY OF THE LOWER LEPIDOPTERA AND TRICHOPTERA FROM THE STANDPOINT OF PHYLOGENY.

By G. C. Crampton, Ph.D.,
Massachusetts Agricultural College, Amherst, Mass.

Dr. August Busck and Dr. Bethune-Baker have very generously furnished the material upon which the following observations on the Lepidoptera were based, and Mr. Nathan Banks has kindly identified the adult Trichopteron described in the following discussion. To these gentlemen I would express my very sincere gratitude and appreciation for their generous assistance which has made this study possible.

One hundred years ago, that keen observer Leach, 1817 (Zoöl. Misc., Vol. 3) linked together the orders Trichoptera and Lepidoptera in a group to which Haeckel, 1896, applied the term "Sorbentia"; and most entomologists since Leach's time have agreed in regarding the orders Lepidoptera and Trichoptera as extremely closely related. Speyer, 1839 (Oken's Isis, 1839, p. 94) was, so far as I am aware, the first to suggest that the lepidopterous "family Micropterygidæ" forms a transitional group leading to the Trichoptera, and later in 1870 (Stett. Ent. Zeit., 1870, p. 202), he carried the comparison between the two groups still further. Subsequent investigations have served to confirm Speyer's views, and since the micropterygoids occupy such an important position from the standpoint of the phylogeny of the Lepidoptera, their affinities have been much discussed.

Chapman, 1894 (Trans. Ent. Soc. London, p. 335) divides the micropterygoids into two families, the Micropterygidæ and Eriocephalidæ. Meyrick, 1912 (Genera Insectorum, Fasc. 132) treats them as a single family, the Micropterygidæ, and divides them into three subfamilies, the Mnesarchæinæ, Eriocranianæ and Micropteryginæ. In the following discussion, these insects (which belong to three distinct families) will be treated as comprising a single superfamily, the Micropterygoidea, which constitutes the lepidopterous suborder Prolepidoptera.

Packard, 1895 (Monogr. Bombycine Moths, Part 1, Notodontidæ) makes *Eriocephala calthella* the "type" of a distinct suborder of Lepidoptera which he calls Lepidoptera laciniata, or Protolepidoptera, while he places *Micropteryx* in another suborder which he calls the Paleolepidoptera. Chapman, 1916 (Trans. Ent. Soc. London, 1916–1917, p. 310) raises *Micropteryx* to ordinal rank, proposing for it the name Zeugloptera, thus differing from practically all of his predecessors, who agree in regarding the micropterygoids as lepidopterous.

On page 307 of Part II of his treatise on Insects (Cambridge Nat. Hist.), Sharp, 1909, in discussing the fact that Brauer's distinction between the Lepidoptera and Trichoptera on the basis of the presence of mandibles in the pupæ of Trichoptera no longer holds good, makes the statement that "unless it should be decided to transfer *Micropteryx* to Trichoptera, and then define Lepidoptera and Trichoptera as distinguished by the condition of the pupa, it would appear to be very difficult to retain the two groups as distinct." On page xvii of the Proceedings of the Ent. Soc. of London, Sharp, 1896 had likewise suggested that the micropterygoids "should be treated as a group of Trichoptera whose larvæ are not aquatic in habits." Comstock, 1918, in his book on the "Wings of Insects," has followed these suggestions, treating the Micropterygina as a suborder of the Trichoptera, and referring to them as terrestrial Trichoptera. In reviewing Comstock's book, Tillyard, 1919 (Ent. News for May, 1919, p. 149) criticizes him for removing the micropterygoids from the Lepidoptera to the Trichoptera from the study of the wing-veins alone, and states that "even from the point of view of the wing-venation it is scarcely defensible, for a careful study of the freshly turned pupæ of any of the older families of Lepidoptera will show that their wing-tracheation agrees closely with that of *Micropteryx*, particularly in the different courses of Cu and I A in fore and hind wings. Moreover the pupal wing of *Micropteryx* has a complete tracheation; the imaginal wings have broad well developed scales of a higher type than any found in the Trichoptera; the fore wing does not possess a separate M^4; and the hind wing has a definite frenulum.

In all these points this family is definitely Lepidopterous. Neither the larval form nor the imaginal mouthparts are Trichopterous, so that there is really no justification for so radical a change, which must remain as a serious blemish in a fine work."

In order to test the validity of Tillyard's criticism, it has seemed preferable to examine structures other than the wing veins in comparing the micropterygoids with the Tricoptera, and for this purpose, I have chosen the primitive little Trichopteron *Philopotamus distinctus*. These small caddice-flies are particularly interesting because the females have only rudimentary wings—a condition which, so far as I am aware, has been recorded but once before among North American Trichoptera. The bodies of both males and females are of a dusky black color, and the wings of the males are of a slightly ashen hue. Both sexes are found on stones along the banks of swiftly running streams, particularly in the neighborhood of waterfalls, and those found about Amherst first appear the latter part of April. The females have rather long hind legs enabling them to flee rapidly over the surface of the water with quick leaping movements, when disturbed, while the males under these conditions dart to the surface of the water, and after making a short series of "leaping" flights, come to rest on the bank a short distance from the place whence they were dislodged. At the beginning of the season, neither males nor females are readily disturbed, and may be easily captured by a quick grasp with a pair of forceps. The small white larvæ which appear to be those of *Philopotamus* crawl over stones in swift-running brooks, and pupate in their cases made of sand, usually attached to the upper surface of stones. The pupæ, if I remember aright, are protected by a parchment-like case lining the outer one made of sand. I am hoping to find out more of the life history of these insects later, since the habits and œcology of insects should be studied in addition to their structures, in attempting to determine their affinities; but for the purpose of the present paper, it will be sufficient to compare the chief features of their anatomical details with those of the micropterygids.

The head capsule of *Philopotamus* (Plate II, Fig. 2) is surprisingly like that of the micropterygid *Mnemonica* (Fig. 4) in outline, and these two types of head approach the nearest to that of the neuropterous ithoniid *Oliarces clara*, Banks (an insect which should be placed in the family Ithoniidæ, judging from the nature of its thoracic sclerites, head capsule, and other features, although this has not yet been done in any grouping of the Neuroptera which I have seen thus far). In fact, it is very probable that the ithoniids are quite like the forms which gave rise to the lines of descent of the Lepidoptera and Trichoptera, though Tillyard and Handlirsch seem to think that the Mecoptera (or their fossil relatives) represent the ancestors of these two groups. The galeæ of the maxillæ (see structures labeled "mx" in Fig. 4, of the micropterygid) are not developed in the Trichopteron shown in Fig. 2, but Ulmer, 1905 (Zoöl. Anz. 28, p. 56) and Cummings, 1913 (Ann. Nat. Hist. XI, p. 308) describe the maxillæ of the Trichopteron *Dipseudopsis* having the parts well developed, and with the galeæ[1] as long as those of *Mnemonica* ("mx" of Fig. 4). The pupa of *Mnemonica* (Fig. 9) has huge crossing mandibles suggestive of the type found in Trichoptera (Fig. 7), but I have not found any Trichoptera in which the mandibles are enlarged at the tips as in *Mnemonica*, nor have any of the trichopterous pupæ which I have examined, a frontal process like that labeled "e" in Fig. 9 of the pupa of *Mnemonica*.

The lateral region of the thorax of *Mnemonica* (Fig. 1) is astonishingly like that of the Trichopteron (shown in Fig. 3), the outlines of the upper and lower divisions of the mesothoracic episternum ("aes_2" and "kes_2") being very similar in both instances. It may be remarked in passing, that the region labeled "aes" is *not* the entire episternum, nor is the region labeled "kes" the trochantin (which is labeled "tn" in both figures) as is usually stated to be the case, and the hinder portions of the coxæ labeled "me" are *not* detached portions of the epimeron "em," which have become adherent to the coxæ—but these features have been thoroughly discussed in an article dealing with the basal segments of the leg in insects (Zoöl. Jahrb. Abt. Anat., 39, p. 1) and need not be gone into further here.

As is true of all Lepidoptera which I have examined, the mesothoracic merocoxa "me_2" (Fig. 1) or posterior division of the coxa extends along the *entire posterior border* of the anterior coxal division "vc_2" in *Mnemonica* (Fig. 1), and there is *no* "*basicoxite*"

[1] The proboscis of *Plectrotarsus* is not "coiled," as was formerly stated to be the case, but is merely folded.

like that labeled "cm" in the Trichopteron (Fig. 3). On the other hand, the merocoxa "me_2" of Fig. 3 extends only *part way* down the remainder of the coxa in all of the Trichoptera which I have examined, and in all of them *there occurs a mesothoracic basicoxite* "cm" (Fig. 3) *which is absent in all of the Lepidoptera* I have seen. Since these features seem to be constant in the groups under discussion, they are probably diagnostic for the orders in question, and by applying this test to the micropterygids, they are seen to be clearly Lepidoptera and not Trichoptera! I would especially emphasize the importance of this apparently conclusive test, since it is the only feature (of which I have any knowledge) *which holds good in all cases examined*, and on this account it should be of great diagnostic value in attempting to determine whether an insect is lepidopterous or trichopterous.

The tergal region of the thorax is very similar in the lower Lepidoptera and Trichoptera (Figs. 5 and 8), but the mesothoracic scutellum of *Mnemonica* (Fig. 8, "sl_2"), as is the case in most of the other Lepidoptera, tends to become somewhat "transversely oval" in outline, while that of the greater part of the Trichoptera (Fig. 5, "sl_2") is more triangular in outline. This feature may also prove to be of diagnostic value; but I doubt that it will be found to hold in all cases, although I have been unable to find any exceptions thus far. In most Lepidoptera examined, there occurs a tegula-bearing rod labeled "t" in Fig. 8 of *Mnemonica;* but I do not find exactly this type of structure in most of my caddice-fly material. Both of these primitive representatives of the orders Trichoptera and Lepidoptera have a wing-coupling apparatus of the jugo-frenate type (*i. e.* both jugum "j" and frenulum "fr" are present in the insects shown in Figs. 5 and 8) so that Tillyard's distinction between the two orders on this score, will not hold. Since I have not made a study of the wing veins, I shall not attempt to discuss this phase of the matter; but so far as the nature of the jugum-bearing region "jf" and the alar ossicles "np," "ba," "a," etc., are concerned, the basal portions of the wings, like the tergal sclerites, are strikingly similar in the two insects under discussion.

In all of the Trichopterous larvæ which I have examined, homologues of the styli or gonopods ("s" of Fig. 6) are to be found in the posterior region of the abdomen; but I have been unable to find these structures in any lepidopterous larvæ, and since the larvæ of the micropterygids seem to lack these structures, this feature may also be of value in distinguishing between the orders Lepidoptera and Trichoptera. The styli labeled "s" in the larva shown in Fig. 6 are apparently represented by the so-called gonopods, or gonostyli "s" of the adult male Trichopteron shown in Fig. 15 (Plate III). Even when the gonopods "h" are well developed in male Lepidoptera (Fig. 13), they apparently retain only one distinct segment "h," while in those Trichoptera in which the gonopods are exceptionally well developed, the gonostyle portion labeled "s" in Fig. 15, usually consists of two distinct segments. Furthermore, the dorsal lobes "sg" are of a different type in the two groups of insects, and these features may be of some value in further distinguishing between the Lepidoptera and Trichoptera.

McLachlan, 1874–1880 (Monographic Revision of the Trichoptera) on page 206 states that "*Enoicyla* is the only authenticated example of terrestrial habits in the larvæ of recent Trichoptera. . . . The genus is scarcely less remarkable by its practically apterous female. . . . The pupæ . . . have very distinct spiracles. . . . The larva lives under moss, etc., at the foot of trees, chiefly in woods, and often at great distances from water." Since some of the larvæ of the micropterygoids feed on mosses (Musci) and occur in somewhat similar locations, these facts lend additional weight to the view that Trichoptera and Lepidoptera are very closely related.

In discussing the protocerebrum of *Micropteryx*, Buxton, 1917 (Trans. Ent. Soc. London, 1917–1918, p. 135) states that "In *Micropteryx* paired ocelli are present, but the median ocellus is not developed here, or in any other Lepidopteron or Trichopteron." This is very probably true of the Lepidoptera as a whole, but I find a median ocellus in many Trichoptera (see Fig. 11 of article on head region of insects in Annals Ent. Soc. America, 1917, p. 339, and Fig. 2 of the present paper). If no median ocellus occurs in any Lepidopteron, and does occur in some Trichoptera, this may be regarded another feature of some value in distinguishing between the orders.

Mr. Banks has called my attention to the fact that "scales" occur on the wings of certain Trichoptera, and their presence is therefore not diagnostic for the order Lepidoptera. Thus McLachlan (l. c. p. 274) in describing the trichopterous genus

Lepidostoma speaks of the wings of the male as "clothed with scattered black 'scales' regularly placed . . . ," and somewhat similar "scales" occur in certain Leptocerids as well as in the Sericostomatid mentioned above. It must be admitted however, that the "scales" of Trichoptera are not exactly like those of Lepidoptera (see Kellogg, 1895, American Naturalist), though their function in certain cases (*e. g.* androconia-like structures of *Mystacides* wing, described by Kellogg, 1895) may be very like that of the scales of Lepidoptera.[1] Cummings, 1914 (Proc. Zoöl. Soc. London, 1914, p. 461) states that "The occurrence of typical unicellular scent glands at the bases of hairs in Trichoptera as well as Lepidoptera is interesting, and in view of the close relationship between these two orders not wholly unexpected. . . . In *Sericostoma* they (scales) occur on the maxillary palpi, a position in which, I believe, they are undescribed in Lepidoptera." The absence of scales from the maxillary palpi in all Lepidoptera and their presence in some Trichoptera, may prove to be another distinguishing feature in defining the two orders.

From the foregoing discussion it is quite evident that the similarity in the head capsule, the general character of the mouthparts (both adult and pupal), the nature of the thoracic sclerites, the wing venation and presence of a coupling apparatus of the primitive jugo-frenate type, the general character of the terminal abdominal structures, and the occurrence of moss-inhabiting larvæ, are features indicating an extremely close relationship between the lowest Lepidoptera and Trichoptera, so that Comstock's removing the micropterygoids from the Lepidoptera to the Trichoptera has considerable justification. On the other hand, the subdivision of the mesothoracic coxa *for its entire length*, into eucoxa "vc" and merocoxa "me" (Fig. 1) in all Lepidoptera studied, and the *merely partial* subdivision of the mesothoracic coxæ of all Trichoptera examined (Fig. 3 "vc" and "me"), together with the presence of a basicoxite "cm" (Fig. 3) marked off by a downward-sweeping line of demarcation in the mesothoracic coxa of all Trichoptera studied, and the absence of this type of structure in all Lepidoptera examined furnish us with an appar-

[1]Busck, 1914 (Proc. Ent. Soc. Washington, 16, p. 50), calls attention to the fact first observed by Spuler, that if the scales are removed from the wing of a micropterygid, its surface is seen to be covered with minute curved spines (like those of Trichoptera) occurring "between the scales and much more numerous than these."

ently decisive test for determining whether an insect is lepidopterous or trichopterous, and when this test is applied to the micropterygoids, they are seen to be clearly lepidopterous, not trichopterous! The "transversely ovate" outline of the mesothoracic scutellum (Fig. 8, "sl_2") in most Lepidoptera as opposed to the triangular scutellum of most Trichoptera (Fig. 5, "sl_2"), the absence of a median ocellus in all known Lepidoptera and its presence in some Trichoptera, the presence of "scales" on the maxillary palpi of some Trichoptera and their absence in all known cases in Lepidoptera, and the presence of structures homologous with the posterior abdominal styli in all trichopterous larvæ examined, coupled with the absence of such structures in lepidopterous larvæ are features of value serving to support the above mentioned test, when applied to the micropterygoids, and the evidence furnished by these features (which seem to have a very general application throughout the two orders) should be conclusive. I would therefore maintain that the micropterygoids are lepidopterous, not trichopterous, although I too would emphasize the remarkably close relationship between the lower Lepidoptera and Trichoptera (See Trans. Ent. Soc. London, 1919, p. 93).

In the appended diagram (text figure 1) the lines of descent of the Lepidoptera and Trichoptera are represented as though diverging from a common Lepidoptero-Trichopteron stem composed of forms combining in themselves the primitive ancestral features of the two orders. Just after these two lines of descent begin to diverge as they emerge as distinct orders (the common stem, however, was probably trichopterous) the line of development of the micropterygoids appeared, carrying over from the common ancestry many primitive features occurring in the Trichoptera, yet exhibiting certain peculiarly lepidopterous characters. The line of development of such Trichoptera as *Philopotamus* likewise arose very near the point of origin of the micropterygoid line of development, as shown in the diagram, but since *Philopotamus*' line of development is on the side of the Trichoptera, it did not acquire any peculiarly lepidopterous features, though it has developed certain features in common with all other Trichoptera, as would naturally be expected. This simple and self-evident explanation will serve to show how the micropterygoids may be truly Lepidoptera, and the *Philopotamus*-like forms may be truly

Trichoptera, despite the fact that both micropterygoids and lower Trichoptera exhibit a remarkable degree of similarity; and it is therefore quite evident that it is not necessary to remove the micropterygoids from the Lepidoptera to the Trichoptera, nor is it necessary to regard them as representing a distinct order.

It has seemed unnecessary to append a "bibliography" at this point, since the more important reference works dealing with the anatomy on the insects in question have been given in the text of this article. If the reader is interested in the further study of the anatomy of the micropterygoids, the following works, in addition to those previously cited, may be of interest. Walter, 1885 (Jen. Zeit. f. Wiss., 8, p. 755), on the mouthparts; Tillyard, 1918, Proc. Linn. Soc. N. S. Wales, xliii, pp. 298, and 626, for wing structures; and the excellent general description of the anatomy of all stages of *Mnemonica*, by Busck and Böving, 1914 (Proc. Ent. Soc. Washington, 16, p. 151).

The following list of abbreviations applies to the figures of Plate IV (illustrating the following article on genitalia of higher insects) as well as to the plates of the present paper, and will therefore serve equally well for both articles. Since homologous structures bear the same label throughout the series of figures, it will be unnecessary to give a more detailed description of the various anatomical features of the insects under discussion.

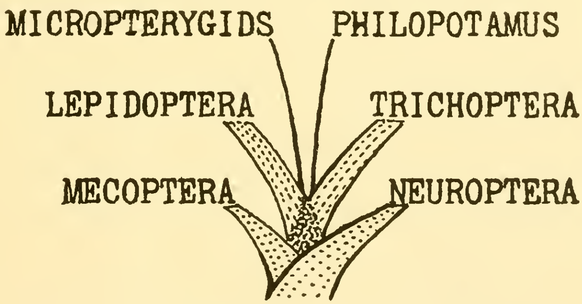

Fig. 1. Lines of descent of Lepidoptera and Trichoptera.

Abbreviations (Plates II, III, IV).

a.......posterior notal wing process (adanale).
aes.....upper division of episternum (anepisternum).
b ......thread of penis (penisfilum).
ba .....wing ossicle at base of anal veins (basanale).
c.......clypeus.
ca......cerci.
cm.....coximarginal sclerite (basicoxite).
cx......coxa.
d ......tergal plate and setæ of ninth segment.
e.......frontal process (frontonasus).
em.....epimeron.
ep......epiproct (uncus, tegumen, or pygidium), also proctiger or structure bearing anus.
eps.....epipodal setæ.
es......epicranial suture.
f.......frons.
fp......frontal (tentorial) pits.
fr......frenulum.
g.......“stipes” of gonopods (gonostipes).
gp .....genal process.
h ......harpago or clasp; last segment of gonopod, also called “harpes” and cochlearium.
ha .....hypandrium, or plate under genital apparatus of male.
ip......interpleurite.
j.......jugum, or “clavus.”
jf......jugum-bearing region (jugifer).
kes.....lower division of episternum (katepisternum).
l.......labrum.
lc......lateral cervical plates.
lp......labial palpus.
ls......laterosternite.
m......median wing ossicle (mediale).
md.....mandible.
me.....posterior division of coxa (merocoxa, or meron).
mp.....maxillary palpus.
mx.....maxilla.
np .....notal wing ossicle (notopterale).

o.......ocelli.
p......styliger or "coxite" bearing styli (also called cardo, or gonocardo).
pa.....parietal region of head, prealar bridge of thorax.
pc......postcranial region of head.
pf......parafrons.
pfi.....paranotal fringe (parafimbrium).
pl......propleuron.
pn.....pronotum.
pp.....gonopleurite.
pr......plates on either side of anus (paraprocts or parapodial plates).
ps......podal setæ.
psl.....postscutellum.
pt......patagium, or patagial areas.
pv.....penisvalvæ, penis, ædeagus or phallus.
s.......styli, or gonopods (gonostyles).
sa......plate under wing (subalare).
sal.....anterior tergal wing process (suralare).
sc......scape of antenna.
sct.....scutum.
sg......process above gonopod (surgonopod) probably homologous with dorsal lobes rather than cerci.
sl......scutellum.
t.......tegula-bearing rod (tegulifer).
tf......terminal filament (telofilum).
tg......tegula.
tn......trochantin.
vc......anterior division of coxa (eucoxa or veracoxa).

Explanation of Plates II and III.

Fig. 1. Lateral view of thorax of *Mnemonia auricyanea*, Wals. (Micropterygoid).

Fig. 2. Frontal view of head of *Philopotamus distinctus* (Trichopteron).

Fig. 3. Lateral view of thorax of *Philopotamus*.

Fig. 4. Frontal view of head of *Mnemonica auricyanea*, Wals.

Fig. 5. Dorsal view of thorax and wing bases of *Philopotamus*.

Fig. 6. Lateral view of terminal structures of larval Trichopteron.

Fig. 7. Frontal view of pupal head of *Philopotamus* only mandibles shown.

Fig. 8. Dorsal view of thorax and wing bases of *Mnemonica auricyanea*, Wals.

Fig. 9. Frontal view of pupal head of *Mnemonica auricyanea*, Wals.

A COMPARISON OF THE GENITALIA OF MALE HYMENOPTERA, MECOPTERA, NEUROPTERA, DIPTERA, TRICHOPTERA, LEPIDOPTERA, HOMOPTERA, AND STREPSIPTERA, WITH THOSE OF LOWER INSECTS.

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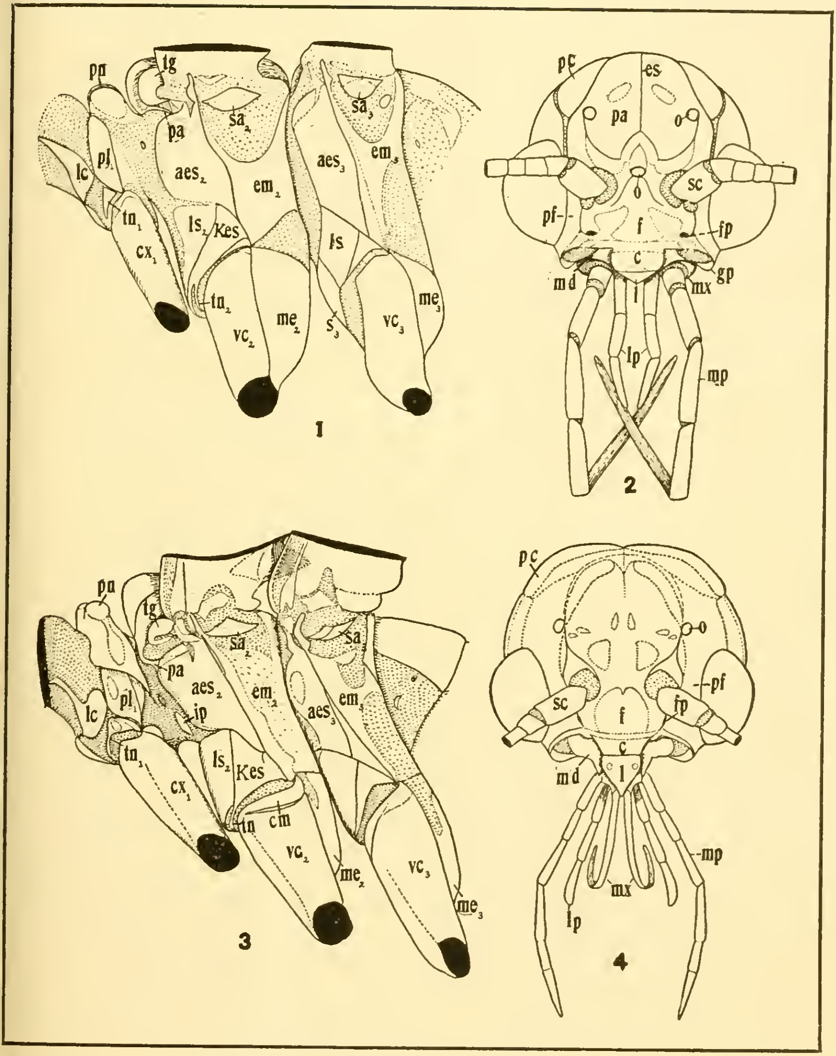
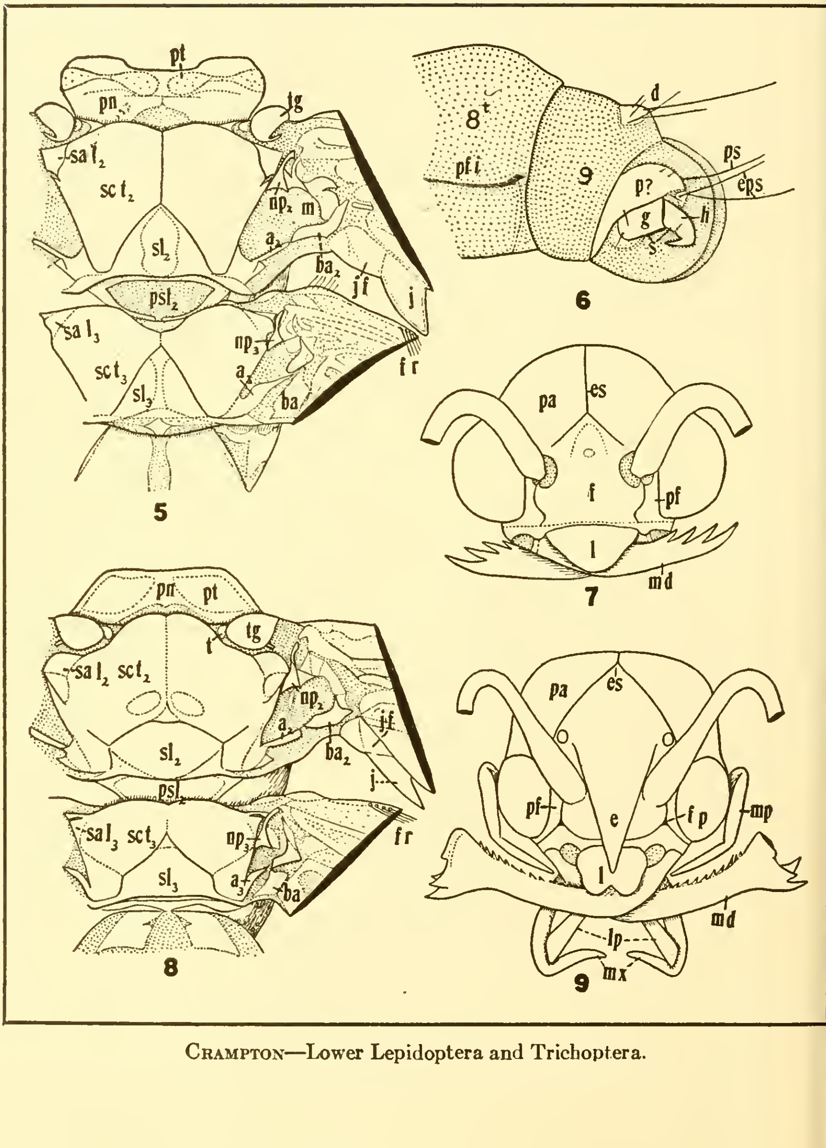
Since the same plates have been used to illustrate both the present paper, and the preceding one dealing with a comparison of the lower Lepidoptera with the Trichoptera, the same list of abbreviations will serve for both papers, and by referring to the explanation of the labeling, given on page 32, this will obviate the necessity of repeating in the present paper, the list of abbreviations there given. For the Strepsipteron here described, I am indebted to Dr. C. T. Brues. Dr. Bethune-Baker has loaned me the lepidopterous material used; Dr. R. J. Tillyard has furnished the neuropterous material; and Mr. S. A. Rohwer has furnished the sawfly material used in the preparation of this paper. Mr. Nathan Banks has very kindly identified the Trichopteron referred to, and Mr. A. N. Caudell has had the Homoptera identified for me. To all of these gentlemen, I would express my deep appreciation of their generosity and assistance so freely given.

The genitalia of male insects have been discussed in several recent articles; but the correct interpretation has not been given to the parts in all cases. Recently, however, I have been able to examine a far wider and more inclusive range of forms than was at first available for study, and the added evidence, together with that furnished in Dr. Walker's excellent account of the parts of the



CRAMPTON—Lower Lepidoptera and Trichoptera.



Crampton—Lower Lepidoptera and Trichoptera.

male of the interesting insect *Grylloblatta campodeiformis*, has made it possible to revise the interpretation of the parts in the higher forms, in the light of the increased knowledge of the subject, gained from these sources.

For the purpose of the present paper, it is sufficient to begin the study of the modifications met with in the higher forms with a consideration of the condition exhibited by the primitive mayfly *Blasturus cupidus* (Fig. 11). The sternite of the ninth abdominal segment in this insect (labeled "ha" in Fig. 11, Plate IV) bears a pair of somewhat closely united, plate-like sclerites, called the styligers or "coxites," one of which is seen in profile in Fig. 11, where it bears the label "p." Dr. Walker correctly compares these styligers or "coxites" with the basal segments of abdominal limbs (protopodites ?) retained in such lower insects as *Machilis*, in which the styligers or "coxites" bear styli which are possibly homologous with the exopodites (or epipodites ?) of crustacean limbs. Similarly, in *Blasturus*, the styligers or "coxites" labeled "p" in Fig. 11, bear styli "s"; but in the latter insect, there are traces of two segments in the styli (and in some mayflies there are three or more segments in the styli), while the styli of most apterygotan insects are composed of but one segment. The segmented styli of ephemerids ("s" of Fig. 11) are called gonopods, gonostyli, or arthrostyli. Following Morgan, 1913, Eaton (Monograph of the Ephemerida), Berlese, 1909, and others who have figured the parts of male ephemerids, I formerly interpreted the plates "p" of Fig. 11 as representing the sternite of the tenth segment; but they are apparently structures belonging to the ninth segment, as pointed out above. In this connection, it should be noted that the designation "tenth segment" refers to the tenth *abdominal* segment, not including the three thoracic segments in the count, as is usually done by lepidopterists. Furthermore, it should be borne in mind that the actual first abdomnial sternite has become atrophied in most insects, and the first apparent sternite really represents the sternite of the second abdominal segment, so that it is preferable to count the segments on the dorsal side, where most of them are preserved in the lower forms.

Palmen, 1884 (page 42) in describing the development of the vasa deferentia of mayflies, states that they extend to the posterior margin of the ninth sternite where they are inserted in the hypodermis. On page 47, he states that the penes (here homologized with the penis valves "pv") arise as two protuberances of the hypodermis in the location of the insertion of the vasa deferentia (*i. e.* on the posterior margin of the ninth sternite), so that the partially united appendages (labeled "pv" in Fig. 11) lying above and between the gonopods "s," and forming the phallus or penis of the male *Blasturus* may represent appendages of the ninth segment in addition to the gonopods "s." If both penes and gonopods are structures belonging to the ninth segment in such primitive forms as the mayflies, this fact is of considerable importance in attempting to determine to what segment structures homologous with them in the higher forms may be assigned; and this also has some bearing on the view that the penis valves "pv" represent the endopodites of a pair of abdominal limbs whose exopodites are formed by the gonopods "s," since in order to fulfil the latter conditions, both penis valves and gonopods would have to belong to the same segment—for it is clearly impossible for the exopodites of a pair of limbs to belong to one segment while the endopodites of the same limb belong to another segment. On the other hand, Wheeler, 1893 (p. 124) states that "the male ducts of *Blatta* end at first in terminal ampullæ enclosed by the appendages of the tenth abdominal segment just as in *Xiphidium*" but later "the terminal ampullæ lie completely in the ninth segment, having shifted their position headward" (p. 118). On page 132 he states that in *Xiphidium* and *Blatta* the male ampullæ lie "at the hind end of the ninth abdominal segment. Just as the deferent ducts of ephemerids extend to the penes and open to the exterior, so the terminal ampullæ originally extend into a pair of appendages, albeit on the tenth segment and not opening to the exterior. If the penes of the ephemerids are really modified ambulatory appendages they would be homologous with the styli of Orthoptera. The curious persistence of these appendages in existing Orthoptera may be due to their having once functioned as penes, long after the other abdominal ambulatory appendages have disappeared." While I would not agree with Wheeler in his suggestion that the penes of the ephemerids (which are apparently homologous with those of the blattids) represent the styli of the Orthoptera (*i. e.* that "pv" of Fig. 11 represent "s" of Fig. 12), there is some reason to suppose that styliform appendages borne on the tenth abdominal segment of certain Trichopteron larvæ (see Plate III, fig. 6, "s") may take part in the formation of portions of the genitalia of the adult male, although this matter is greatly in need of further investigation.

The tenth tergite labeled "ep" in Fig. 11, overlaps the paraprocts "pr" which are situated on either side of the anal opening, and bear the cerci "ca." The paraprocts "pr" are latero-ventral structures of the eleventh segment, and are usually interpreted as representing the divided sternite of this segment, although it is quite possible that they represent the protopodite of the uropod whose endopodite forms the cercus. The eleventh tergite of the ephemerid shown in Fig. 11 bears a terminal filament or telofilum "tf." The eleventh tergite is usually atrophied in the higher forms, while the paraprocts "pr" usually unite with the tenth tergite "ep" to form a structure through which the anus opens (*i. e.* the "proctiger" of higher insects).

In the blattids (whose parts are of the type serving as the "starting point" for the modifications developing in the various orthopteroid insects) the styli-bearing plates "p" of Fig. 12, are usually indistinguishably united with the ninth sternite "ha," although in the roach shown in Fig. 12, traces of these plates are still retained. The styli, "s," however, usually remain distinct even after the plates bearing them have become indistinguishable fused with the ninth sternite. The penis valves "pv" of Fig. 12, possibly represent the paired organ "pv" of the ephemerid shown in Fig. 11, although the parts are asymmetrically developed in the roach. The tenth tergite "ep" is distinct in most blattids, as is also true of the paraprocts "pr" (Fig. 12); but the eleventh tergite is atrophied in these insects and their immediate relatives.

A different path of specialization is apparently followed in the higher insects although the condition occurring in these forms is probably a modification of the basic plan exhibited by the Ephemerida (Fig. 11). Thus in the Prohymenopteron (sawfly) shown in Fig. 17, the tergite of the ninth segment "9^t" becomes very small, while the sternite of the ninth segment is very large, and projects beneath the genitalia of the male to form the so-called hypandrium "ha." The tenth tergite "ep" is very small, and the paraprocts "pr" of Fig. 11, which bear the cerci "ca," have united with the tenth tergite "ep" in the sawfly shown in Fig.17. In most sawflies, the ninth tergite "9^t" is greatly reduced, and the tenth tergite "ep" (Fig. 17) unites with it. In the siricid shown in Fig. 17, the basal sclerite "p" (interpreted as the tenth sternite by some entomologists) may possibly represent the plate labeled "p" in Fig. 11 of the ephemerid—though it is also possible (but not as probable) that the segment "g" of the genital claspers of the siricid shown in Fig. 17 represent the styligers "p" of the ephemerid (Fig. 11). In either case, the styliger region "p" of the sawfly (Fig. 17) would be distinct from the ninth sternite "ha" thus approximating the condition exhibited by *Grylloblatta campodeiformis*, which Walker considers unique in having styligers distinct from the ninth sternite. The two-segmented clasping forceps "s" composed of the segments labeled "g" and "h" in the sawfly shown in Fig. 17, may represent the claspers labeled "s" (and also composed of two segments labeled "g" and "h"—which however may not be the exact homologues of the segments bearing these labels in Fig. 17) in Fig. 11 of the ephemerid.[1] The penis valves "pv" composing the penis or phallus in the sawfly shown in Fig. 17, doubtless represent the penis valves "pv" of the ephemerid shown in Fig. 11. The sawfly group, or Prophymenoptera, is thus seen to have retained the primitive condition of the parts as nearly as any of the higher forms have done, and a study of the parts in the sawflies is therefore of considerable importance.

In the Mecopteron shown in Fig. 19, the tergite labeled "ep" doubtless represents the tergum of the ninth segment, while the tenth tergite has either united with it, or has become greatly reduced. The ninth sternite "ha" is well developed, and the gonopods are composed of two segments "g" and "h" which are possibly homologous with those bearing the same labels in Fig. 17. The sclerite labeled "p" in Fig. 17 apparently unites with the pleural region of the ninth segment in the Mecoptera (Fig. 19); and in the insect shown in Fig. 19, the penis valves, which are usually separate in the lower forms, have probably united to form the single membranous structure "pv." In the Mecopteron shown in Fig. 21, the plate "pp" represents the ventral and lateral portions of the ninth segment, while the ninth tergite becomes prolonged into two lobe-like processes labeled "sg," which are

[1] The parameres of Dermaptera and Coleoptera are also homologous with these structures.

extremely elongate in some *Bittacus*-like Mecoptera, and doubtless serve as clasping organs in mating. The basal segment "g" of the gonopods is very large in the Mecopteron shown in Fig. 21, while the terminal segment "h" is greatly reduced. The penis valves "pv," however, are quite large, are partially united, and bear a coiled penisfilum "b." The structure labeled "ep" probably represents the tenth tergite with which the paraprocts bearing the cerci "ca" have united. The structures labeled "ca" may not represent the cerci; but they occupy the position characteristic of these organs, and have been provisionally interpreted as the cerci in the present paper.

In the Strepsipteron shown in Fig. 18, the structure labeled "ep" is a "proctiger," since the anus opens at its posterior end. It is probably formed largely by the tenth tergite, although a portion of the ninth tergite may also be involved in its composition. The structure labeled "g" may represent the hypandrium or plate below the genitalia of the male (*i. e.* the ninth sternite) but I am inclined to think that the basal segment of the gonopods also enters into the composition of this structure, while the small hooks labeled "h" might possibly represent the terminal segments of the gonopods. The structure labeled "pv" is the ædeagus or phallus, and in some Strepsiptera an intromittent organ is protruded from the ædeagus at the time of mating.

The sternite of the ninth segment labeled "ha" in the Neuropteron shown in Fig. 20 is well developed and is demarked from the pleural region of the segment "pp." The ninth tergite is partially produced on either side to form a pair of lobe-like structures "sg," comparable to the copulatory lobes "sg" of the Mecopteron shown in Fig. 21. The structure labeled "ep" in Fig. 20 probably represents the tenth tergite, or the fusion product of the tenth tergite and the paraprocts (or plates on either side of the anus). I formerly interpreted the structures labeled "s" in Fig. 20, as the penis valves (*i. e.* "pv" of other insects, Figs. 17, 21, etc.); but there are some grounds for considering the structures "s" of Fig. 20, as the remains of the gonopods labeled "s" (which are composed of the segments "g" and "h" in other insects), or a portion of it, in the other figures, and I have provisionally adopted the latter interpretation in the present paper.

In the psyllid shown in Fig. 14, the tergal sclerites labeled 6 and 7, probably represent the eighth tergite, and the structure labeled "ep" bears the anus at its tip (*i. e.* it is a "proctiger"). The proctiger "ep" probably represents the tenth tergite united with the ninth, although the embryology of these insects would have to be studied in order to definitely determine what segments enter into the composition of the structures in question. The structure labeled "g" is here interpreted as representing the united basal segments of the gonopods (labeled "g" in other figures—as in Fig. 21 for example) though it may also include the ventral plate "ha" of other insects as well. The forceps "h" of Fig. 14 apparently represent the distal segments of the gonopods "h" of other figures. All that remains of the phallus or ædeagus, is the slender bowed structure "pv," which bears a terminal articulated appendage or "telædeagus" fitting into the groove on the lower (posterior) surface of the proctiger "ep." In the fulgorid shown in Fig. 16, the structure bearing the label "8?" probably contains the ninth segment; but it appears to be the eighth. The dorsal structure labeled "ep" is apparently formed in great part by the ninth tergite which has probably united with the tenth tergite, and has grown downward and posteriorly below the anal opening. The structure "ep" is thus a "proctiger" rather than an "epiproct," though either term might be applied to it. The forceps "s" of Fig. 16 represent either the styli (gonopods) of other figures (labeled "s") or they represent portions of these styli (gonopods); and the inner structures "pv" which they enclose, are probably homologous with the penis valves "pv" of other insects. It is quite possible that the structure "ep" of Fig. 16 may represent a union of the structures labeled "sg" and "ep" in Fig. 20; but I have been unable to determine this point.

The tergal region "ep" of the Trichopteron shown in Fig. 15 probably represents the ninth, or the united ninth and tenth tergites, while the lateral lobes "sg," are apparently homologous with the copulatory lobes "sg" of Figs. 20 and 21. The structure labeled "pv" in Fig. 15 is the ædeagus or phallus, and is possibly composed of the united penis valves of certain other forms. The gonopods "s" of Fig. 15 are two-segmented (*i. e.* are made up of segments "g" and "h") and are apparently homologous or homodynamous with the styli "s" (also composed of two segments "g" and "h") of the trichopterous larva shown in Fig. 6(Plate III). The basal plate "p" of Fig. 6 (Plate III) has been provisionally homologized with the styli-bearing plate "p" of Fig. 11 (Plate IV) but this may prove to be incorrect. While it is quite probable that the gonópods "s" of the adult Trichopteron shown in Fig. 15 (Plate IV) are homodynamous, or serially homologous, with the gonopods labeled "s" in Fig. 6 (Plate III) of a larval Trichopteron, in the sense that the legs of the mesothorax are serially homologous (homodynamous) with those of the metathorax, the two structures in question may not be *absolutely* homologous, since the gonopods or styli labeled "s" in the larval Trichopteron (Fig. 6, Plate III) are apparently borne on the *tenth* segment, as is also true of the styli in certain larval sawflies, while the gonopods of the adults may not belong to the tenth segment. The question naturally arises as to whether the styli borne on the tenth segment of the larval Trichopteron ("s" of Fig. 6, Plate III) form the gonopods "s" of the adult (Fig. 15, Plate III) or whether they represent the penis valves which unite to form the phallus of the adult. The observations of Wheeler, 1893, who maintains that the penis valves are appendages of the tenth segment, would lend weight to the latter view; but it is much simpler to refer to both styli "s" of larvæ (Fig. 6, Plate III) and gonopods "s" of adult insects (Fig. 15, Plate IV) as gonopods or gonostyles regardless of the segment to which they belong; and for the sake of convenience, this method has been adopted in the present discussion.

The dorsal region "ep" of the Lepidopteron shown in Fig. 13, represents either a posterior prolongation of the ninth tergite, or the fusion product of the tenth tergite with the ninth. The lateral lobes "sg" are probably homologous with the copulatory lobes "sg" of Fig. 21, or the lateral lobes "sg" of the Trichopteron shown in Fig. 15. The structure labeled "pv" in the Lepidopteron (Fig. 13) is the phallus or ædeagus, and the filament "b" possibly represents the coiled filament "b" of Fig. 21. The harpago "h" of the Lepidopteron is possibly the terminal segment of the gonopod, whose basal portion has united with the ninth abdominal segment; or the harpago "h" may represent the whole gonopod "s" of Fig. 15, although the former explanation is the more probable one. The dorsal structure "ep" of the Lepidopteron (Fig. 13) is sometimes called the uncus or tegumen, and a ventral prolongation possibly homologous with the lower portion of the structure labeled "ep" in Fig. 16 is sometimes called the scaphium in Lepidoptera.

In the Dipteron shown in Fig. 10, the dorsal plate "ep" is probably the tergite of the ninth segment alone; but I am not sure of this point. The elongate slender processes "sg" resemble cerci; but I am more inclined to regard them as lateral processes of the ninth tergite possibly homologous with the lateral lobes "sg" of Fig. 21, and I have therefore referred to them as the surgonopods in the following discussion. They are possibly homologous with the structures referred to as "gonopods" in such Neuroptera as *Ithone* (See Crampton, 1918a Fig. 14); but these structures in both cases are probably homologous with the parts termed surgonopods in the insects described in the present paper. I would likewise use this opportunity of calling attention to the fact that the lateral plates called paraprocts in the paper referred to above as dealing with the Neuroptera, etc. (Crampton, 1918a) are not the true paraprocts "pr" of Figs. 11, 12, etc., but are homologous with the lateral plates of the ninth segment called gonopleurites in the present paper ("pp" of Figs. 20, etc.). The basal segment of the gonopods labeled "g" in Fig. 10 has probably united with the pleural region to form the apparent basal segment "g," while the distal segment "h" is distinct and well developed. The terminal portions of both gonopods "h" and surgonopods "sg" bear short spine-like structures which are apparently of use in enabling the forceps-like structures to hold more securely. The sternite of the ninth abdominal segment "ha," forms a hypandrium or plate below the genitalia of the male, as in the Neuroptera and sawflies.

The principal points brought out in the preceding discussion may be briefly summarized as follows. The epiproct, or plate above the anal opening ("ep" of Figs. 11, 17, etc.) is usually formed by the tenth tergite, or the tenth united with the ninth tergite (or a portion of it). In some cases the region above the anal opening may grow downward on either side, or unite with other regions to form a proctiger ("ep" of Fig. 16?) through which the alimentary tract opens. Lateral prolongations of the ninth tergite form the surgonopods "sg," or dorsal structures frequently employed as upper claspers in mating. The pleural plates of the ninth abdominal segment form the gonopleurites "pp," while the sternite of the ninth segment usually forms the hypandrium "ha" or plate belown the genitalia of the male. When the cerci "ca" are present, they are borne on a region representing the union of the paraprocts of the eleventh segment ("pr" of Fig. 12) fused with the tenth tergite, as in Fig. 17, and this in turn may unite with the ninth tergite. In the lower insects a pair of styli "s" or gonopods is attached to the posterior margin of the hypandrium (ninth sternite), or plate below the genitalia of the male. In higher insects a pair of styli (gonostyli, or gonopods) forms the outer ventral pair of claspers "s" between which the penis valves "pv" or phallus are situated. The only structures which one can compare with these gonostyli or gonopods in larval insects, are borne on the tenth sternite (Fig. 6, "s") as in larvæ of Trichoptera, certain sawflies, etc.

From a study of the wing veins, and head region, I formerly maintained that the Homoptera (and Hemiptera) are somewhat more closely related to the insects grouped about the Psocidæ than to those grouped about the Neuroptera. The thoracic sclerites of the Homoptera, however, are very like those of the Neuroptera, and the genitalia of the male Fulgoriadæ, Psyllidæ, etc., here studied would bear out the view that the Homoptera are more closely allied to the Neuroptera and other Neuropteroid insects such as the Mecoptera, Lepidoptera, etc. The nature of the genitalia of the Strepsiptera would tend to confirm the contention that these insects are quite closely related to the Homoptera, such as the Psyllidæ, etc., although they show considerable resemblance to the Mecoptera and other Neuropteroid insects. The genitalia of the Diptera are like those of the Mecoptera and Trichoptera, and the lower Trichoptera are very similar to the lower Lepidoptera, as one would expect from a study of other features than the genitalia. The genitalia of the sawflies are as much like those of the Mecoptera as any insects, although they exhibit some resemblances to the genitalia of the Diptera also. In the main, the study of the genitalia of the higher insects would serve to substantiate the evidences of relationships furnished by other anatomical structures, and it would therefore be in harmony with the views concerning the interrelationships of the insects related to the Neuroptera, recently published in the Transactions of the Entomological Society of London (Crampton, 1919a).

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Abbreviations.

For list of abbreviations employed in the labeling of the figures used to illustrate the present paper, see page 32.

Explanation of Plate IV.

Fig. 10. Lateral view of terminal abdominal structures of the tipulid Dipteron *Bittacomorpha* sp.

Fig. 11. Lateral view of terminal structures of the ephemerid *Blasturus cupidus.*

Fig. 12. Same of the Blattid *Cryptocercus punctulatus.*

Fig. 13. Same of the Lepidopteron *Eriocrania calthella.*

Fig. 14. Same of the psyllid Homopteron *Psylla* sp.

Fig. 15. Same of the Trichopteron *Philopotamus distinctus.*

Fig. 16. Same of the fulgorid Homopteron *Ormenis pruinosa.*

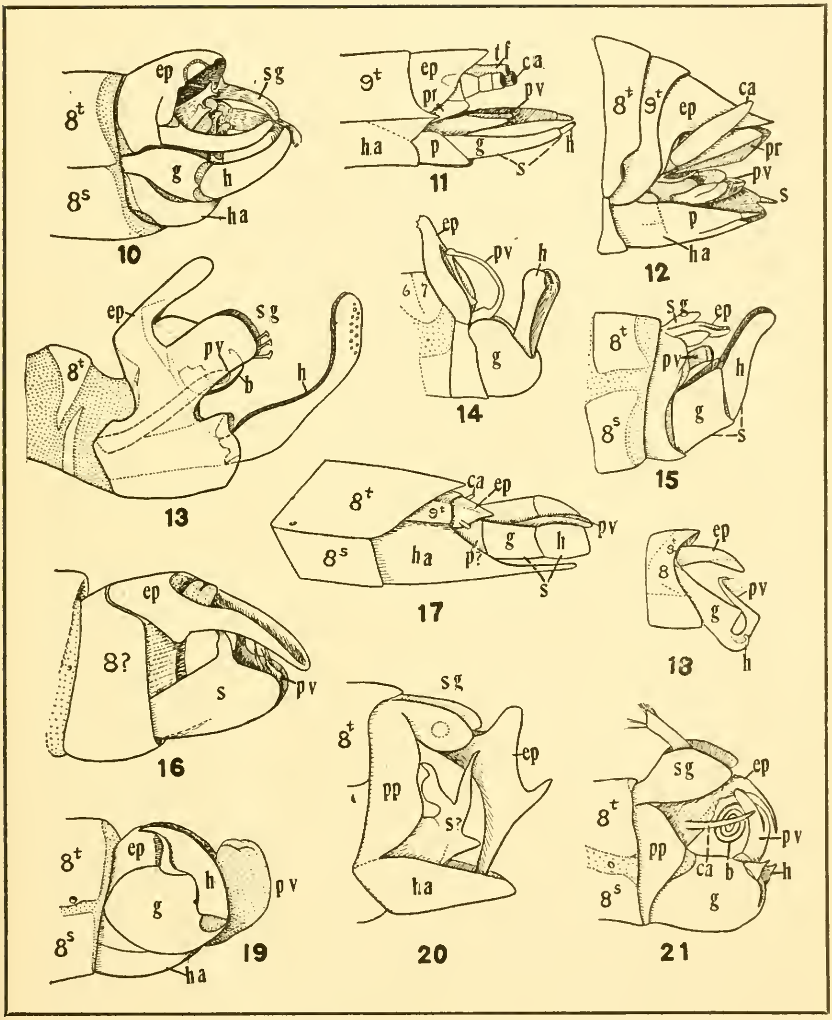
Fig. 17. Same of the sawfly *Sirex edwardsii.*

Fig. 18. Same of the Strepsipteron *Xenos pallidus.*

Fig. 19. Same of the Mecopteron *Boreus nivoriundus.*

Fig. 20. Same of the Neuropteron *Nymphes myrmeleonides.*

Fig. 21. Same of the Mecopteron *Bittacus pilicornis.*



Crampton—Genitalia of Insects.

THE SUBFAMILIES OF FORMICIDÆ, AND OTHER TAXONOMIC NOTES.[1]

By William Morton Wheeler.

A comparison of the seventh volume of Dalla Torre's "Catalogus Hymenopterorum," which summarizes what was known of the classification of the Formicidæ down to 1890, with any very recent monograph of these insects, gives the impression that there has been no change in expert opinion concerning the limits of the family and its subfamilies during the past thirty years. Dalla Torre recognizes five subfamilies, the Dorylinæ, Ponerinæ, Myrmicinæ, Dolichoderinæ and Camponotinæ and the same groups are retained in Emery's contributions to the "Genera Insectorum" (1910–'13), so far as published, and in his recent sketch of the classification of the Myrmicinæ (1914). Between the appearance of the "Catalogus" and the works just mentioned, however, Emery, who has shown greater interest than other myrmecologists in the definition of taxonomic categories above the rank of the genus, proposed an additional subfamily, the Pseudomyrminæ in 1899, and in 1895 transferred a group of genera, comprising the tribe Cerapachyini, from the Ponerinæ, where it had been placed by Forel in 1893, to the Dorylinæ. After Forel and I had objected to this proceeding, Emery, in the "Genera Insectorum" (1913) returned the Cerapachyini to the Ponerinæ, but gave them the rank of a section, the Prodorylinæ. He had long since reunited the Pseudomyrminæ with the Myrmicinæ. In his most recent sketch of the classification of this subfamily (1914) he unites the tribes Metaponini and Pseudomyrmini as the first section, the Promyrminæ, and places all the other tribes in a second section, the Eumyrmicinæ. Thus in 1920 the five subfamilies have again acquired the limits which they had in 1890.

During the past year a study of ant-larvæ, representing more than a hundred genera and many subgenera of all five subfamilies, has convinced me that Emery was right in 1899, when he regarded the Pseudomyrminæ as constituting an independent subfamily. I am also of the opinion that the Cerapachyini should be removed

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 169.

from the Ponerinæ and raised to the rank of an independent subfamily, between the Dorylinæ and Ponerinæ. A number of reasons may be adduced for making these changes.

In 1899 Emery, after a comparative study of the larvæ of several Formicid genera, concluded that "Those of *Sima* and *Pseudomyrma*, besides their extremely hypocephalic development, exhibit a very special character in the presence of rudiments of antennæ. I believe that this very noteworthy fact, together with the well-known peculiar characters of the head of the imagines, will justify the separation of these genera from the remainder of the Myrmicinæ, to form the new subfamily of the Pseudomyrminæ." My study of numerous species of this group, which now embraces four genera, *Tetraponera* Smith (= *Sima* Roger), *Pachysima* Emery and *Viticicola* Wheeler of the Old and *Pseudomyrma* Lund of the New World, shows that Emery was far from realizing the full import of their larval characters. Not only have the larvæ peculiar long, straight, cylindrical, distinctly segmented bodies with blunt anterior and posterior ends, a large, usually subquadrate head, ventrally placed and with rudiments of antennæ (which are also present in the larvæ of many other ants, notably in the Ponerinæ), but the thoracic and first abdominal segments are furnished with peculiar exudatory papillæ (exudatoria), which form a cluster around the mouth. I have described and figured these organs in *Viticicola* and *Pachysima* (1918b) and have shown that they have the form of extraordinary appendages in the first larval stage (trophidium) of the two known species of the latter genus, and that the swollen ventral portion of the first abdominal segment, just behind the mouth, forms a pocket in which the workers place a pellet of food. The exudatoria, the pocket, which I call the *trophothylax*, and the unusual method of feeding are characteristic of all four genera and no distinct traces of such conditions have been found in any other ant-larvæ.

More recent study has added two very interesting facts, which, in advance of a complete account to be published in collaboration with my colleague, Prof. I. W. Bailey, may be briefly considered in this place. The food pellet proves to be merely the small pellet ("corpuscule enroulé," or "corpuscule de nettoyage" of Janet) which the worker ant moulds in its own infrabuccal pocket and consists of the solid food-particles from which the juices are sucked, *plus* the various particles collected by the ant by means of the strigils of the fore tibiæ from the surfaces of the antennæ and other parts of the body and carried into the infrabuccal pocket after being wiped off by the maxillæ. Other ants eventually spit out the pellet which is commonly a moulded, subspherical conglomerate of diverse particles, such as small pieces of insects, fragments of plant tissue, fungus spores and hyphæ, pollen grains, etc., and cast it away as refuse, but the worker nurses of the Pseudomyrminæ place it as pabulum in the trophothylax of the larva!

Even this, however, is not the whole story. An examination of the mouth of the larva reveals a singular structure, evidently used for reducing the food pellet to such a finely divided state that it can, when acted on by the digestive juices of the mesenteron, yield a certain amount of nutriment, which the worker ant could not extract from it while it was in the infrabuccal pocket. This larval structure, which may be called the *trophorhinium*, consists of two flat, opposable plates, the dorsal and ventral surfaces of the buccal cavity, each furnished with very fine, parallel, transverse striæ or welts, which, under a high magnification are seen to be made up of minute chitinous projections or spinules. The ventral usually has more numerous rows of spinules than the dorsal surface. The two surfaces are evidently rubbed on one another and thus triturate the substance of the food pellet, only small portions of which are ingested at a time from the trophothylax. In all Pseudomyrmine larvæ and in many larvæ of the other subfamilies, except the Dorylinæ and Cerapachyinæ, the trophorhinium is beautifully developed, although in many ants (Ponerinæ) it may be used for comminuting parts of insects given directly to the larvæ by the workers. A detailed description of the organ and of its extraordinary variations of structure in the various genera of Formicidæ is reserved for future publication.

In its development the trophorhinium bears a strange resemblance to the stridulatory organs of the petiole and postpetiole of many adult Ponerinæ and Myrmicinæ. It may, in fact, function also as a stridulatory organ, when the food supply is exhausted, and thus apprise the worker nurses of the larva's hunger. Many ant-larvæ, notably those of the Ectatommiine Ponerinæ and of most genera of Camponotinæ (Formicinæ), also have elaborate but coarser stridulatory surfaces on the mandibles, so that the larva may be able to produce a variety of sounds and therefore apprise the nurses of more than one need or craving.

The adult Pseudomyrminæ are so peculiar in structure that Emery, Ashmead (1905) and others have been led to separate them sharply from all other Myrmicinæ. The shape of the head in the worker and female and especially of the clypeus and frontal carinæ is unique, the eyes are very large and there is a strong tendency to development of ocelli in the workers, the conformation of the petiole, postpetiole and tibial spurs is peculiar, and as I have recently shown (1919b), the number of antennal joints (12) is the same in the male as in the worker and female in all four genera.

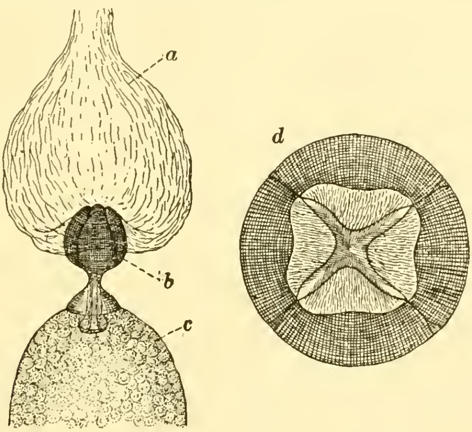


Fig. 1. *a*, Ingluvies, or "crop," *b*, calyx of proventriculus, or "gizzard," and *c*, ventriculus, or "stomach," of *Pachysima aethiops* Fabr.; *d*, proventriculus seen from the front under a higher magnification.

Little study has been devoted to the structure of the proventriculus, or "gizzard" in the Myrmicinæ, but Meinert, Forel and Emery have described and figured it as simple and tubular in most genera and of a very primitive type compared with the conditions in the Dolichoderinæ and Camponotinæ. I find, however, that the proventriculus of all four genera of the Pseudomyrminæ is much more specialized, being anteriorly developed as an apple- or quince-shaped ball, covered with longitudinal and circular muscles and with four distinct, connate sepals, bluntly rounded and finely hairy at their tips, and posteriorly as a very short, tubular, constricted portion which projects as a button into the cavity of the ventriculus (Figs. 1 and 2). The peculiarities mentioned seem to me to justify us in returning to Emery's contention of 1899 that the Pseudomyrminæ constitute an independent subfamily. I have endeavored to show in a recent paper (1919a) that neither the larval nor the imaginal Metaponini can be regarded as at all closely related to the Pseudomyrminæ. Emery's section Promyrmicinæ should therefore be abandoned and his term Eumyrmicinæ may be regarded as merely synonymous with Myrmicinæ.

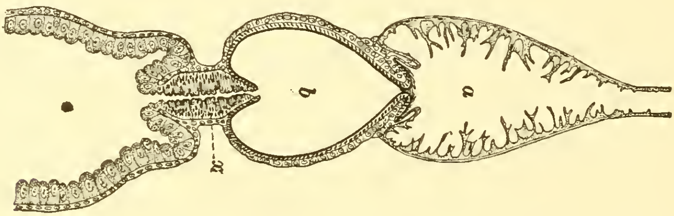


Fig. 2. *Viticicola tessmanni* Stitz; *a*, sagittal section through part of the alimentary tract, including *a*, the ingluvies, or "crop" (much contracted); *b*, calyx of proventriculus, or "gizzard," *x*, its cylindrical portion, and *c*, anterior portion of ventriculus, or "stomach."

A study of the larvæ of the Cerapachyini shows that they are extremely like the larvæ of the Dorylinæ. This was noticed by Emery in his observations on the larva of *Acanthostichus serratulus* (1899). The mandibles are small, narrow, pointed and rather feebly chitinized, and I have failed to find a trophorhinium in either group. Apparently the young are fed only on soft food. That the foraging habits of certain Cerapachyini (*Phyracaces*) resemble those of the Dorylinæ was shown in my paper on the Australian species (1918a). We know nothing of the pupæ, but they are probably not enclosed in cocoons as in the Ponerinæ. Although the worker of the Cerapachyini has a Ponerine habitus, the characters of the female in the various genera are peculiarly diverse. In some cases (*Phyracaces*), this caste is winged and not unlike the females of certain Ponerinæ, in others (*Parasyscia*, *Eusphinctus*) the female is wingless and ergatomorphic and in still others (*Acanthostichus*, *Nothosphinctus*) the female is so much like the corresponding caste in the Dorylinæ, that it might be regarded as a dichthadiigyne. A similar diversity is seen in the males of the Cerapachyini. The male of *Acanthostichus afflictus*, recently discovered by Gallardo (1919) in Argentina, is so much like an *Eciton* or *Dorylus* male that even an expert myrmecologist would not hesitate to place it among the Dorylinæ. The males of other genera (*Lioponera*, *Phyracaces*, *Cerapachys*, *Eusphinctus*) on the other hand, though lacking the cerci, have a decidedly Ponerine habitus. It would seem, therefore, that the Cerapachyini are intermediate between the Dorylinæ and Ponerinæ, as Emery has contended, and that we might unite them with either. I should prefer, however, to separate them out as an independent subfamily, which may be ascribed to Forel, who in 1893 first recognized the "Cerapachysii" as a natural tribe. Of course, the name Prodorylinæ Emery cannot be used for the subfamily, because there is no genus *Prodorylus*.

For many years I have deemed it necessary to introduce another nomenclatorial change, namely that of the subfamily name Camponotinæ to Formicinæ. Forel, in his study of the poison apparatus and anal glands of ants, published in 1878, divided the subfamily Formicidæ Mayr (1855) into two subfamilies, which he called Camponotidæ and Dolichoderidæ. This was unjustifiable according to our present rules of nomenclature, for Mayr's name should have been retained and restricted to the group containing the genus *Formica*. At that time, which antedated the use of *inæ* as a subfamily suffix, Forel justified his course on the ground that "Formicidæ" was already in use as a family name.

Owing to the fact that definite rules and conventions in regard to the suffixes of family and especially of subfamily names in Zoölogy have been stabilized only within recent decades, there is considerable confusion concerning the authors to whom our modern names in *idæ* and *inæ* are to be attributed. It seems to be customary to accredit a family or subfamily name to the author who first recognized the group as supergeneric and gave it a Latin or Greek name based on that of one of its genera. If this is done in the case of the Formicidæ the authorities cited in the literature require revision. Frederick Smith (1851), Westwood (1840), Shuckard (1840) and Stephens (1829) all attribute Formicidæ as a family name to Leach. They appear to refer to his article published in the Edinburgh Encyclopædia in 1815, where he used the term

Formicarides, or to some later work which I have not seen. Latreille, however, as early as 1810, used Formicarii as a family name, and it would seem to be permissible to cite him as the author of Formicidæ. The subfamily Dorylinæ is attributed by Emery and others to Shuckard (1840), but this author says: "Mr. Haliday has first raised them to a family equivalent to the whole of the social Ants, etc." and at p. 195 he definitively attributes the Dorylidæ to Haliday. This may have been based on correspondence as I find no mention of the term in such published writings of Haliday as I have seen. But the matter is of little moment because Leach, in the 1815 paper referred to above, created a family Dorylida, so that, unless there is an earlier authority, the subfamily Dorylinæ should be accredited to this early British entomologist. Forel attributes the subfamilies Ponerinæ and Myrmicinæ to Lepeletier, but Dalla Torre gives Mayr as the author of the latter and Donisthorpe refers the Ponerinæ also to Mayr. Smith regarded himself as the authority for Poneridæ and Myrmi-

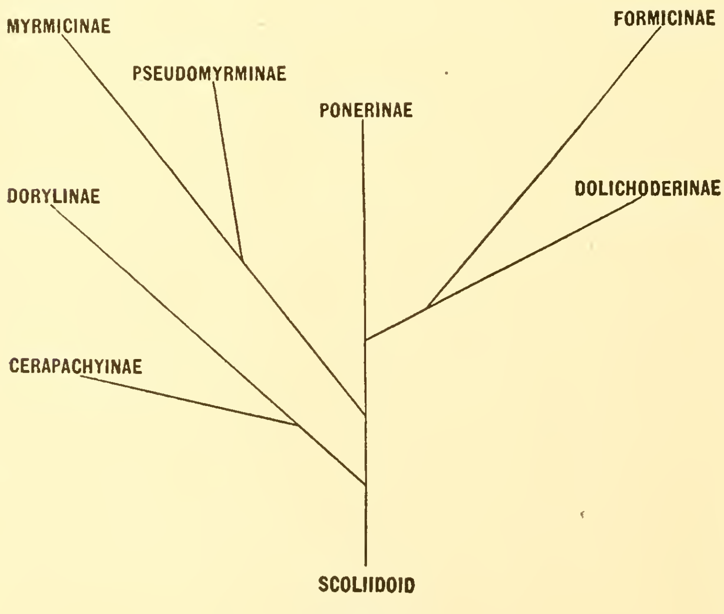


Fig. 3. Phylogenetic relationships of the seven subfamilies of Formicidae.

cidæ. It is clear, nevertheless, that not only the Ponerinæ and Myrmicinæ but also the Formicinæ are to be referred to Lepeletier (1836), who called them respectively the tribes Ponérites, Myrmicites and Formicites, the last, like Mayr's subfamily Formicidæ, being made to include both the modern Dolichoderinæ Forel and Formicinæ (Camponotinæ Forel).

The phylogenetic relations of the seven subfamilies, as understood at the present time, are indicated in the accompanying diagram (Fig. 3). For taxonomic purposes they may be most conveniently arranged in the following linear sequence:

Family Formicidæ Latreille (1910).

Subfamily 1. Dorylinæ (Leach 1815)
2. Cerapachyinæ (Forel 1893)
3. Ponerinæ (Lepeletier 1836)
4. Pseudomyrminæ (Emery 1899)
5. Myrmicinæ (Lepeletier 1836)
6. Dolichoderinæ (Forel 1878)
7. Formicinæ (Lepeletier 1836)

In conclusion I may add that while working on the ants of the Belgian Congo and constructing dichotomic keys for the identification of the genera and subgenera of the world, I have been led to adopt the following new names based on previously described species:

Phrynoponera gen. nov. (Genotype: *Bothroponera gabonensis* Ern. André)

Viticicola gen. nov. (Genotype: *Sima tessmanni* Stitz)

Macromischoides gen. nov. (Genotype: *Macromischa aculeata* Mayr)

Hypocryptocerus subgen. nov. (Subgenotype: *Formica hæmorrhoidalis* Latreille)

Heteromyrmex gen. nov. (Genotype: *Vollenhovia rufiventris* Forel.)

Diodontolepis gen. nov. (Genotype: *Melophorus spinisquamis* Ern. André)

Pseudaphomomyrmex gen. nov. (Genotype: *Aphomomyrmex emeryi* Ashmead)

Cladomyrma gen. nov. (Genotype: *Aphomomyrmex hewitti* Wheeler).

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ODONATA OF CHATHAM, MASSACHUSETTS.

By R. Heber Howe, Jr.,
Thoreau Museum of Natural History, Concord, Mass.

The following list of Odonata includes material collected last summer at Chatham, and also that taken on various excursions to the surrounding towns. Mr. C. W. Johnson had collected a few species at Eastham of which I make mention, and other species have been recorded from Provincetown, Cotuit, Hyannisport, Woods Hole, Martha's Vineyard, the Elizabeth Islands, beside those listed by the author from Nantucket (May, 1919, report Maria Mitchell Association), and from Wareham (Psyche 26: June, 1919). Specimens of all recorded material are in the author's collection.

Zygoptera.

Agrionidæ.

1. *Agrion maculatum* Beauv. One at Chatham, July 3. Not recorded from east of Wareham before.

Cœnagrionidæ.

2. *Lestes forcipatus* Ramb. Chatham, July 20 to Aug. 23. New to Cape Cod, east of Woods Hole.
3. *Lestes unguiculatus* Hagen. Chatham, Orleans, July 4 to Sept. 8. Common on Cape Cod.
4. *Lestes rectangularis* Say. Chatham, July 3–4. Common on Cape Cod.
5. *Lestes vigilax* Hagen. Chatham, South Yarmouth, Brewster, South Orleans, Eastham, July 8 to Sept. 6. Common.
6. *Argia violacea* (Hagen). Orleans, Aug. 23. Not recorded from east of Wareham before.
7. *Enallagma civile* (Hagen). Chatham, South Orleans, July 4 to Sept. 6. Abundant on Cape Cod.
8. *Enallagma durum* (Hagen). South Orleans, Portanimicutt Pond, July 27. Recorded before from Woods Hole, Cuttyhunk Island, Wareham and Nantucket.
9. *Enallagma minusculum* Morse. South Orleans, Orleans, Eastham, July 8 to 12. Mr. Johnson had taken this species at Eastham in June, 1904. Since the species was described in 1895 by Dr. Morse from Sherborn, Mass., its range has been extended to Meredith Neck, Lake Winnepesaukee, by the author in 1916; to Eastham and Manomet, Mass., by Mr. Johnson in 1904 and 1905; Mt. Desert, Echo Lake, Maine by Mr. Johnson in 1918, where it was again taken by Mr. D. Merrill in 1919. Until this summer no female had ever been captured. In sweeping the marginal grass swale along the pond I captured one female which may be described as follows: Cuneiform bluish post ocular spots not completely connected. Vertex, a mid-dorsal thoracic, and a humeral stripe iridescent black, rest of thorax bluish. Abdomen bluish with dorsum of segments 1 to 10 with a broad iridescent black stripe widening into distal semi-rings on segments 1 to 7. Legs black above. Lgth. 29 mm. Abd. 20 mm. Hd. Wg. 16 mm.

10. *Enallagma signatum* (Hagen). Chatham, July 20. Not recorded from east of Wareham and Woods Hole before.
11. *Enallagma doubledayi* Selys. South Orleans, July 8 to Aug. 23. It has been reported from Provincetown by Mr. E. B. Williamson, and from Woods Hole, Nonamesset Island, by Dr. P. P. Calvert.
12. *Nehalennia irene* (Hagen). Chatham, Provincetown, July 12. Not recorded from east of Cotuit before.
13. *Ischnura posita* (Hagen). Chatham, Wellfleet, Barnstable, July 4 to July 22. Not recorded from east of Woods Hole before.
14. *Ischnura verticalis* (Say). Chatham, Eastham, Wellfleet, South Orleans, Brewster, Barnstable, South Yarmouth, July 8 to Sept. 8. Abundant on Cape Cod.

Anisoptera.

Æschnidæ.

15. *Progomphus obscurus* Ramb. South Orleans, July 12–14. Recorded only from Boston and Wareham before, this being the third station for New England.
16. *Anax junius* (Drury). Orleans, South Orleans, Chatham, July 3 to Sept. 6. Great migrating swarms of this species were noted at Chathamport. An abundant Cape Cod species.
17. *Æshna umbrosa* Walk. Orleans, Chatham, Oct. 19. Not recorded before from east of Wareham and Woods Hole on Cape Cod.
18. *Æshna clepsydra* Say. Chatham, July 11 to Aug. 23. Common on Cape Cod.
19. *Æshna canadensis* Walk. Chatham, Aug. 23. Not taken from east of Wareham and Woods Hole before on Cape Cod.

Libellulidæ.

20. *Epicordulia princeps* (Hagen). Chatham, White pond, July 24. Not recorded before from east of Wareham on Cape Cod.
21. *Tetragoneuria cynosura* (Say). Orleans, July 1–3. Not recorded from east of Wareham or Woods Hole before.
22. *Libellula exusta* (Say). Chatham, July 7. Not recorded before from east of West Chop and Woods Hole.

23. *Libellula pulchella* Drury. Chatham, Orleans, Brewster, July 1 to Aug. 23. Common on Cape Cod.
24. *Libellula semifasciata* Burn. Chatham, Orleans?, July 3–7. Recorded before from several stations on Cape Cod.
25. *Libellula incesta* Hagen. South Orleans, July 27. Not recorded before from east of Wareham and Woods Hole on Cape Cod.
26. *Libellula auripennis* Burn. South Orleans, July 27. Rare. Common about Buzzard's Bay.
27. *Platyemis lydia* (Drury). Chatham, July 17. Not recorded before from east of Wareham and Woods Hole on Cape Cod.
28. *Perithemis domitia* var. *tenera* (Say). South Orleans, July 27 to Aug. 23. Not recorded before from east of Wareham and Woods Hole on Cape Cod.
29. *Nannothemis bella* (Uhler). Brewster, July 12. Not recorded before from east of Wareham on Cape Cod.
30. *Erythrodiplax berenice* (Drury). Chatham, Cotuit, Orleans, July 20 to 27. Common at littoral stations where salt marshes are present.
31. *Pachydiplax longipennis* Burn. Orleans, July 3 to Aug. 23. Common on Cape Cod.
32. *Sympetrum rubicundulum* (Say). Chatham, Barnstable, July 3 to Sept. 6. Abundant on Cape Cod.
33. *Sympetrum vicinum* (Hagen). Chatham, Aug. 23 to Oct. 20. Common on Cape Cod.
34. *Leucorrhinia intacta* Hagen. Chatham, July 3 to 20. Common on Cape Cod.
35. *Celithemis elisa* (Hagen). Brewster, South Orleans, South Yarmouth, July 8 to Aug. 23. Common on Cape Cod, and with the small middle wing spot commonly absent.
36. *Celithemis ornata* (Ramb.). South Orleans, Quanset pond, July 27. Not uncommon on Cape Cod.
37. *Tramea carolina* (Linn.). Chatham, July 3 to Sept. 8. Not recorded before from east of Wareham and Woods Hole on Cape Cod.

THE BRACONID GENUS TRACHYPETUS GUÉRIN.

By Charles T. Brues,
Bussey Institution, Harvard University.

In 1839 Guérin[1] published an account of a very strange Australian Braconid for which he erected the genus Trachypetus. He placed Trachypetus in proximity to Helcon, Sigalphus and Chelonus and recent authors (*e. g.* Ashmead and Szépligeti) have tabulated it as a member of the Cheloninæ, next to Sphæropyx. Apparently this insect remained unknown in nature to hymenopterists since Guérin's time, until 1911 when Schulz[2] examined two specimens in the Saussure collection, obtained in New South Wales. Schulz (*loc. cit.*) makes Trachypetus the type of a new subfamily Trachypetinæ which he places provisionally in the "Cryptogastrini." Among these, he would distinguish the Trachypetinæ by the petiolate abdomen in which the first segment is articulated to and not fused with the post-abdomen as is the case in the other Cryptogastrini except Sphæropyx.[3]

Last summer, I received from Dr. R. J. Tillyard, two specimens of a magnificent Braconid collected at Woy Woy, Queensland, which Dr. Tillyard was unable to place satisfactorily in any family. These prove to be Guérin's *Trachypetus clavatus* which is very carefully described at considerable length in the first publication cited above, and in still greater detail by Schulz.

Trachypetus is undoubtedly a Braconid, but it is much more difficult to locate it in any of the recognized subfamilies. Superficially it is somewhat similar to Sphæropyx in the form of the abdomen which, however, lacks the deeply concave venter characteristic of the Cheloninæ. The wings, aside from the radial cell, and the neuration of the hind pair, are somewhat like those of Sphæropyx as are also the form of the propodeum, multiarticulate antennæ and the legs; here, however, the similarities cease. There

[1] Voyage de la Coquille, Zoöl., vol. 2, pt. 2, p. 201; atlas, pl. 8, fig. 7.

[2] Zoöl. Ann., vol. 4, p. 85.

[3] Sphæropyx includes one well known and widespread European species, *S. irrorator* Fabr. and several North American species described by Provancher and Cresson. Whether all these may be considered as congeneric, I do not know, but Cresson's species, *S. bicolor* is quite similar to *S. irrorator* and could scarcely be separated although much smaller and of somewhat different habitus. I do not know Tetrasphæropyx Ashmead which is based on *Rhogas pilosus* Cresson, but Mr. Rohwer has kindly examined Ashmead's type and writes me that it is a Rhogadine.

is no circular mouth-opening, which at once removes Trachypetus from the several subfamilies of the group Cyclostomi, with none of which it has otherwise any characters in common, except perhaps the fact that the abdomen resembles slightly that of some

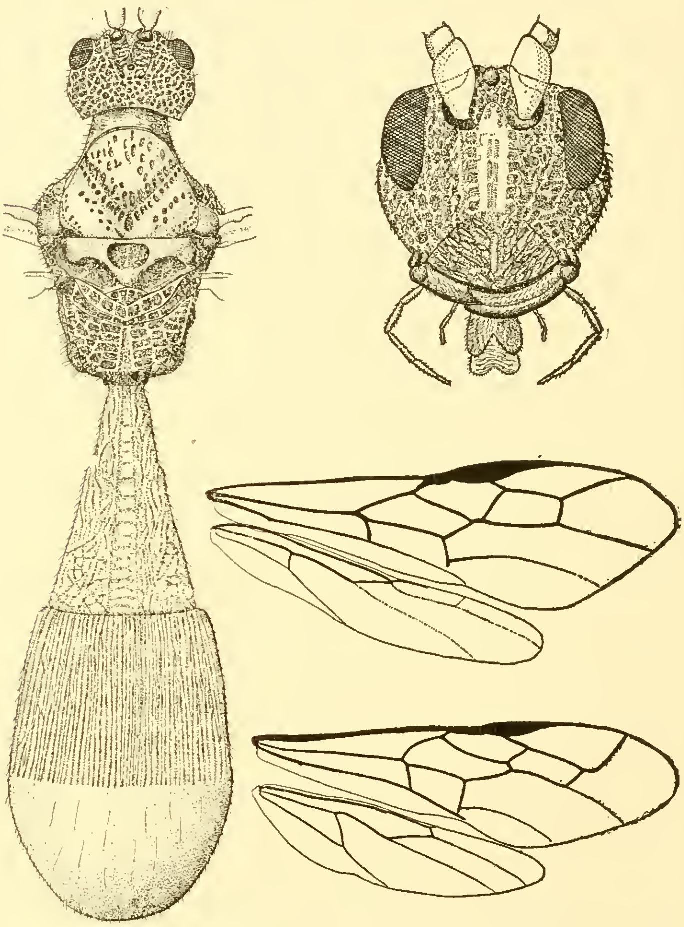

Fig. 1. *Trachypetus clavatus* Guérin; body from above and head from the front; wing of Sphæropyx above, of Trachypetus below.

Stephaniscinæ. It could not possibly be placed in this group and must fall in the Polymorphi, with several groups of which it appears to be allied, although not easily referable to any one of them.

As it has been placed in the Cheloninæ, I shall first compare it with the members of this subfamily. Of these only Sphæropyx has the abdomen petiolate with an actually flexible articulation between the petiole and the post-abdomen. In that genus the carapace is divided by a deep, crenulate suturiform articulation, so that so far as the abdomen is concerned Sphæropyx is more like a Braconine than Chelonine if we take Chelonus, Ascogaster, or even Phanerotoma as typical of this subfamily. In neuration, except for the truncate radial cell, Trachypetus is rather similar to Sphæropyx, neither of which closely resembles any Chelonine. Indeed the neuration of certain Sigalphinæ is more like that of these two genera except for the presence of only two cubital cells and a less complete venation in the hind wing. Beyond the petiole the abdomen of Trachypetus is practically unsegmented although there is a trace of the suturiform articulation, a condition met with occasionally in groups other than the Cheloninæ and Sigalphinæ.

As to its relation to other groups of the Polymorphi, Trachypetus appears to be very generalized. The abdomen is clearly petiolate as in the Meteorinæ and Euphorinæ and Helorimorphinæ with which it clearly has no close affinity. There are three cubital cells and a large, complete radial cell as in the Macrocentrini and Helconinæ, to which latter group it shows, I think, the closest affinities. Several genera of Helconinæ with the abdomen clavate have been described, such as Brulléia Szép. from New Guinea, and Euscelinus Westw. from Borneo, while Hymenochaonia D. T. (*Chaonia* Cress.) from Cuba may possibly belong here. None of these, however, have the segments of the post-abdomen so completely fused and all may be quite different from Trachypetus, as I unfortunately do not know them in nature. Sphæropyx lacks the thick Helconine head, which is present in Trachypetus.

Aside from the closed marginal cell, the neuration is quite like that of Cardiochiles Nees. as is also the structure of the head, thorax and legs.

Even outside the family Braconidæ, the fusion of the abdominal tergites into a carapace or shield-like piece occurs and this character alone is in no way distinctive of the Cheloninæ. Thus in the Alysiidæ, Symphya has a typical carapace and even in Vanhornia, the type of quite a different family with exodont mandibles the upper surface of the abdomen forms a carapace.

From the foregoing it would appear that Trachypetus is a very generalized Braconid, perhaps best placed in the subfamily Helconinæ as at present understood unless it be separated as Schulz has done as a monotypical subfamily known only by one species in one sex, a position of very doubtful stability. As I believe that the present unsatisfactory classification of the Braconidæ as a whole can be improved only by a careful examination of the quite considerable number of apparently aberrant forms, I have taken this occasion to discuss and figure Trachypetus.

AN INFESTATION OF THE WHITE-PINE APHID.

By H. B. Peirson,
Bussey Institution, Harvard University.

While working at the Harvard Forest, Petersham, Mass., my attention was called to a somewhat isolated clump of white-pine trees, forty to fifty years old, which were dying. The trees averaged about fourteen inches D. B. H. and were approximately twelve in number. On two sides of the clump of mature trees were young white-pine plantations. A careful examination showed that the trees were being killed due to an extremely heavy infestation of black aphids which upon identification proved to be *Lachnus strobi* Fitch., the White-pine Aphid. Many of the larger limbs were barren of foliage, whereas on others the foliage was brown, the individual needles each showing many puncture marks where the aphids had been feeding.

The trees were first examined October 10, 1919, at which time the aphids were laying their eggs on the needles. These are laid end to end generally in lines of five or six, although as many as twenty-seven were found on a single needle, and it was not at all uncommon to find as many as ten or fifteen attached end to end. The eggs were invariably laid on the green needles, and the aphids apparently anticipating the death of the older trees were laying the majority of the eggs on the younger trees in one of the adjacent plantations. Practically all of the needles on the more heavily infested trees had batches of eggs on them.

Large numbers of the aphids were still feeding. These had congregated on the needles and small twigs. The survival of the aphids in spite of heavy rains and low temperatures was remarkable, subsequent examinations showed them feeding up until about the first of November. Very few winged individuals were found. The oviparous females are brownish black in color, with a white line along the middle of the thorax. The antennæ are pale, with black tips.

The eggs are smooth and elongate, averaging .12 mm. in length by .02 mm. in breadth. They are of a pale yellow tinge when first laid, but in a few hours the color changes to a dark orange, and later to a shiny jet black.

TWO NEW SCHENDYLOID CHILOPODS FROM GUATEMALA.

By Ralph V. Chamberlin,
Museum of Comparative Zoölogy, Cambridge, Mass.

The interesting new chilopods described below are represented by single specimens taken from soil about the roots of the pacaya or salad palm (Chamædorea sp.) from Coban, Guatemala, at quarantine in Washington, D. C., January 29, 1920, by Messrs. W. B. Wood and H. L. Sanford and transmitted to me for identification from the United States Bureau of Entomology. In addition to the two chilopods, two diplopods were also found, these being *Orthomorpha coarctata* (Saussure) and Cleidogona sp., the latter being represented by an immature specimen which is possibly *C. stolli* Pocock.

Sogolabis gen. nov.

Labrum not free, forming an arc armed with an even series of teeth much as in, *e. g.*, Adenoschendyla.

Claw of palpi of second maxillæ long, the margins smooth, neither pectinate or spined. Pleurosternal suture of second maxillæ complete, sharply marked, the pleurite extending forward to coxosternum.

No ventral pores present.

Coxopleural pores of pregenital segment small, simple, several on each side as in Escaryus.

Anal legs composed of six articles beyond coxopleura, without claw.

Genotype: *S. scapheus*, sp. nov.

A genus differing from all other schendylids excepting Escaryus and Eucratonyx in having several coxopleural pores on each side. From these genera it differs in not having the labrum free, in the non-pectinate claw of the second maxillæ, the absence of chitinous lines from the prosternum, etc. It departs from all other known schendylids in having the anterior margin of the prosternum and the femuroid of prehensors armed.

Sogolabis scapheus sp. nov.

Pale fulvous, with the head and prehensorial segment orange.

Head longer than wide in about ratio 13:8. Sides of head nearly parallel from the oblique caudal corners forward to in front of the middle, then slightly converging. Anterior margin convex, not notched at middle. Posterior margin truncate. No frontal suture.

Antennæ filiform, the last joint about equalling the two preceding taken together.

Prebasal plate not exposed. Exposed portion of basal plate short, broad. Claws of prehensors when closed surpassing the head, attaining the distal end of the first article of the antennæ. Anterior margin of prosternum armed with two strongly chitinized teeth which in the type are broader than high, rounded. Femuroid of prehensors armed toward distal end with a subconic but distally rounded tooth of moderate size. Next two joints unarmed. Claw armed at base with a larger, strongly chitinous, tooth which is conical, distally acute.

First legs a little shorter and more slender than the second, the others nearly uniform in length and thickness to the penult inclusive.

No ventral pores detected in the type.

Sternite of pregenital segment of moderate width, nearly equal in width and length, trapeziform, the sides and posterior margin straight. Each coxopleura with five simple pores.

Last legs longer than the penult; with few hairs; last article clawless, distally rounded.

Anal pores present.

Number of pairs of legs in female, thirty-nine.

Length, 8 mm.

Schendylellus gen. nov.

Median arc of labrum armed with strongly chitinous true teeth with distinct roots.

Claw of palpi of second maxillæ abortive, in the genotype appearing only as an extremely minute rudiment or point.

Ventral pores present on sternites, these arranged in a narrow transverse band across plate at level of major setæ.

Coxopleuræ of pregenital segment each with two homogeneous glands.

Genotype,—*S. hodites*, sp. nov.

This genus is obviously close to Schendyla, but differs in the abortive claw of the palpi of the second maxillæ and in the arrangement of the ventral pores, these in Schendyla forming a median area as long as or longer than wide and commonly quadrate or sub-circular in outline.

Schendylellus hodites sp. nov.

General color pale fulvous, head and prehensors dilute orange.

Head widest toward posterior end, narrowing forward, the anterior and posterior margins truncate. Prebasal plate not exposed.

Antennæ filiform, the last four articles preceding the ultimate in the type much shortened, the last three of these about equalling the ultimate in length.

Median arc of labrum with ten, not crowded, teeth, or near that number.

Claws of prehensors when closed a little surpassing the anterior margin of head but not attaining the distal end of first antennal article. Prehensors in dorsal view also a little exposed toward base. Claw armed at base with a very small but distinct tooth, the other joints unarmed. Anterior margin of prosternum unarmed, smooth.

First legs a little shorter and more slender than the second, the others of nearly uniform length and thickness to the penult inclusive.

Ventral pores beginning on the first sternite and present on all to the thirty-fourth segment, *i. e.*, to the penult pediferous. On the first plate they are few, only about six in number, these being in an irregular transverse row at middle of plate. On the succeeding sternites the pores are more numerous and form a narrow transverse band extending on each side well toward the lateral margin at level of posterior major marginal seta. Pores fewer again on the last several plates.

Sternite of pregenital segment broad, trapeziform. Coxopleural glands two on each side, simple, the pores covered by the sternite.

Last legs in the male clavately enlarged, scarcely exceeding the penult in length. Unfortunately these became detached and lost in the course of the clearing of the specimen for mounting for microscopical study.

Number of pairs of legs in the male, thirty-five.

Length of the type, 7.5 mm.

It is thought best not completely to dissect the head of the single type specimen at this time. Hence mandibles and maxillæ are not described in detail.

PROCEEDINGS OF THE CAMBRIDGE ENTOMOLOGICAL CLUB.

At the meeting of the Cambridge Entomological Club February 10, on account of the difficulties of travel only 14 persons attended. The meeting voted to approve the publication, in PSYCHE, of abstracts of the proceedings of the Club meetings and of local entomological news.

Prof. C. T. Brues read some notes on distribution of South African Hymenoptera, several of which occur or have their nearest relatives in South America or India rather than in more northern parts of Africa. Professor Wheeler read a satire on human society from the supposed standpoint of a member of a colony of Termites. This paper is published in the *Scientific Monthly* of February, 1920.

Mr. Varás showed a beetle with a branched tibia of one of the third pair of legs, and this was followed by discussion of abnormal insert legs in general.

At the meeting of March 9, Mr. J. H. Emerton read some notes on last season's collections of spiders in Canada, including specimens from the Rocky Mountains, near Banff, Pribiloff Islands, Klondike Valley, Gaspe, St. John's, Newfoundland, Ontario and Quebec.

Mr. Frost read notes on the habits, occurrence and classification of several Coleoptera which he had found in Maine—*Scythropus elegans, cicendela elegans* and *cicendela spreta* Lecr. The latter species he thought to be the same as *C. limbalis* Klug.

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Notices not to exceed four lines in length concerning exchanges desired of specimens or entomological literature will be inserted free for subscribers, to be run as long as may be deemed advisable by the editors.

Cynipidæ,—galls or the bred makers,—of the world desired for exchange or purchase. Will determine North American material. Address: Alfred C. Kinsey, Bussey Institution, Forest Hills, Mass.

Wanted: Insects of any order from ant nests, with specimens of the host ants, from any part of the world; also Cremastochilinæ of the world. Will give cash or Coleoptera, Hymenoptera and Diptera from the United States.—Wm. M. Mann, U. S. National Museum, Washington, D. C.

Wanted: To exchange, or purchase for cash, specimens of the Genus Apantesis from any locality. Also to purchase rare Catocalæ.—Samuel E. Cassino, Salem, Mass.

Wanted for cash: Lowest representatives of all families of insects, preserved in fluid.—G. C. Crampton, Amherst, Mass.

Wanted: Syrphidæ (Flower-flies) from all parts of the world. Exchanges solicited. Will determine on the usual conditions.—C. L. Metcalf, Ohio State University, Columbus, Ohio.

Largest Expanse—one each ♂ and ♀ Lepidoptera wanted for transfer purposes. Those not good enough for collections will do. Will buy, or exchange for local Lepidoptera, etc.—C. V. Blackburn, 12 Pine St., Stoneham, Mass.

Butterflies of Japan and Formosa, will be exchanged by S. Satake, 48 Aoyama-minamimachi 5-chome, Tokyo, Japan.

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For sale, or exchange for entomological items not in my library—American Entomologist, complete; Dyar, List of N. A. Lepidoptera; Redi, Experimenta, circa Generationem Insectorum, 1686; many others.—J. E. Hallinen, Cooperton, Okla.

Wanted: To examine, determine and exchange Cicadellidæ or "Jassidæ" from all parts of North America.—J. G. Sanders and D. M. DeLong, State Capitol, Harrisburg, Pa.

Cochineal Insects: Wish to obtain living specimens of cochineal scales. Will purchase or exchange as may be desired.—C. T. Brues, Bussey Institution, Boston 30, Mass.

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EUPONERA GILVA (ROGER), A RARE NORTH AMERICAN ANT.

By W. M. Wheeler and F. M. Gaige,
Bussey Institution, Harvard University and University of Michigan.

In 1863 Julius Roger described, among other North American Formicidæ, *Ponera gilva* and *Discothyrea testacea*, two species which the senior author has vainly sought for the past twenty years, both in the field and in the numerous collections sent him for identification. "Nordamerika" was the only locality appended to the descriptions, and as the other species of the two genera are tropical or subtropical it was natural to infer that Roger's types were taken somewhere in Mexico. The *Discothyrea* is still to be rediscovered, but recently the junior author succeeded in taking four workers of *gilva* in northwestern Tennessee.

In his most recent revision of the Ponerinæ (1910) Emery refers this species to the subgenus *Trachymesopus* of the genus *Euponera*. He divides the species of the subgenus into three groups: those with small, but developed eyes in the worker (*stigma* group), those with very minute, vestigial eyes in the same caste (*ochracea* group), and those known only from female specimens (*darwini* group). The first group comprises several species of which the best-known, *E. stigma* Fabr., is common throughout tropical America and even has a variety, *quadridentata* Smith, in the Indomalayan and Papuan Regions. The typical form of the species occurs also in Florida, since Father J. Schmitt many years ago gave the senior author a worker captured at Fort Worth. To the *ochracea* group Emery assigns three species: *gilva* Roger, *ochracea* Mayr of the Mediterranean Region (according to Forel with a subspecies, *guatemalensis*, in Guatemala!) and *sauteri* Wheeler of Japan. To the group known only from female specimens two species are assigned: *darwini* Forel, which occurs in Northern Australia, India, Indonesia, Madagascar and the Congo, and *crassicornis* Emery from New

Guinea. Since workers of *darwini* var. *indica* Emery, recently received by the senior author from the Philippines, have minute, vestigial eyes, this species must be transferred to the *ochracea* group.

The yellow or ferruginous coloration of both females and workers and the minute eyes of the latter in all the species of the *ochracea* group show that these ants must lead a concealed, hypogæic existence. The females of some of the species, notably of *ochracea* and *darwini*, are known to fly to lights and are therefore more frequently taken than the workers. But *gilva* must be either extremely rare or extremely local or its female would have turned up in some of the many collections made since 1863. It would seem to be, in fact, an ancient relict on the verge of extinction. Its discovery in Tennessee, a region in which other interesting animal and plant relicts have survived, is not without significance. Since there is a *Trachymesopus succinea* Mayr, in the Baltic Amber, the subgenus goes back at least to the Lower Oligocene, but as only female specimens of this species are known it is impossible to say whether it bebelongs to the *stigma* or *ochracea* group.

Emery in his admirable paper on the North American ants, published in 1895, states that he has seen two worker cotypes of *gilva* from the Berlin Museum and besides adding somewhat to Roger's description, gives an excellent figure of the thorax. A more detailed description, with a figure (Fig. 1) of the head, body and middle leg, is appended.

Euponera (Trachymesopus) gilva (Roger).

Pondera gilva Roger, Berlin. Ent. Zeitschr. 5, 1863, p. 170 ☿; Mayr, Verh. zool. bot. Ges. Wien, 36, 1886, p. 438 ☿; Dalla Torre, Catal. Hymen. 7, 1893, p. 39 ☿; Emery, Zool. Jahrb. Abth. Syst. 8, 1895, p. 266, pl. 8, fig. 10 ☿; Wheeler, Ants, etc., 1910, p. 561 ☿.

Pachycondyla (*Pseudoponera*) *gilva* Emery, Ann. Soc. Ent. Belg. 45, 1901, p. 46 ☿.

Euponera (*Trachymesopus*) *gilva* Emery, Genera Insect. Ponerinæ, 1910, p. 86 ☿.

Worker. Length 3–3.4 mm. Head shaped as in *Ponera coarctata*, slightly longer than broad, somewhat broader behind than in front, with feebly convex sides and nearly straight posterior border.

Eyes very small, distinctly larger, however, than in *E. ochracea*, *sauteri* or *darwini*, at the anterior sixth of the sides of the head. Mandibles rather convex, with 6–7 distinct teeth, the apical somewhat coarser than the basal. Clypeus short, high and carinate in the middle, especially behind, depressed on the sides, with broadly rounded, entire anterior border. Frontal carinæ small, flattened, together forming a cordiform plate, divided by a narrow, impressed, longitudinal line, which runs back onto the head as far as the vertex in the form of a frontal groove. Antennal scapes not reaching the posterior border of the head by a distance somewhat greater than their greatest diameter; funiculi slender at the base and enlarged at the tip, all the joints, except the first and last distinctly broader than long; last joint nearly as long as the three preceding, which are subequal and form with it an indistinct club. Pronotum as long as broad, somewhat depressed above, with bluntly submarginate sides. Promesonotal and mesoëpinotal sutures pronounced, the mesonotum transversely elliptical, as high as the pronotum and feebly convex in profile. Epinotum shorter and narrower than the pro- and mesonotum together, laterally compressed at the base, broader behind, its dorsal outline in profile nearly straight, horizontal, lower than the mesonotum, longer than the declivity into which it passes rather abruptly, the latter feebly concave, distinctly marginate on the sides. Petiole from above transversely elliptical, a little broader than the posterior part of the epinotum, the node in profile broad below, a little lower than the epinotum, narrowing upward, with very feebly concave, steeply sloping anterior, flat, vertical posterior and evenly rounded dorsal surface; the ventral surface with a low, rounded projection in the middle. Postpetiole truncated in front, as long as, but distinctly narrower than the first gastric segment. Remaining segments rather small; sting well-developed, curved. Legs stout; middle tibiæ and metatarsi short and strongly bristly on their extensor surfaces.

Mandibles smooth, shining, with a few sparse punctures, mainly near the apical borders and some indistinct striæ near the base. Head opaque, very finely and densely punctate, so that it has a velvety texture. Thorax less opaque, especially the epinotum, and the fine punctures, especially of the latter, not so dense. Sides of epinotum, petiole, gester and legs shining, with very fine and still more distinctly separated punctures.

Hairs and pubescence golden yellow, both poorly developed on the head, more abundant on the body and legs; the hairs erect, rather fine, moderately long, the pubescence long and rather coarse, not very closely appressed.

Ferruginous; legs and antennæ scarcely paler; head and mandibles a little darker, in some specimens with the occiput slightly infuscated.

Redescribed from four specimens taken August 30, 1919 by the junior author near Camden, Tennessee. The specimens were found four miles west of the town on a rather dry hillside covered with an open forest of second growth oak. The trees were small and so scattered that there was a ground cover of short wiry dry grass under them, with a few small shrubs and bushes. There was very little ground débris, as the natives seem to keep such picked up for firewood, but under a small stick, perhaps two feet long and three inches wide at its greatest width all four of the ants were found. The stick had evidently been lying in one position for a long time, as it was slightly buried, so that it came up with difficulty and disturbed the earth in loosening. The ants were in the soil beneath the stick, close together, but no evidence of a nest was seen. They were very sluggish and slow-moving, even more so than a few specimens of *Stigmatomma pallipes* Haldem, which were found in the same habitat. They made no effort to escape, seemed dazed and confused by the sudden disturbance, and one of them when picked up with the forceps and placed in the palm of the hand, feigned death for several seconds, with the antennæ drawn close to the head and the legs held tightly against the body.

NOTE ON PTERERGATES IN THE CALIFORNIAN HARVESTER ANT.

By Harlow Shapley,
Mount Wilson Observatory, Pasadena, California.

The phenomenon of vestigial wings in worker ants that otherwise are normal is of interest because of its significance in the problem of the origin of social castes among the Formicidæ, and also because of its infrequent occurrence. The recorded captures of workers with wing-vestiges are very few. Wheeler has taken three pterergates in New York from a colony of *Myrmica scabrinodis* var.; Keys found one of the same species in England (figured in Donisthorpe's *British Ants*, p. 41). Wheeler has also taken a large worker with vestigial wings from a colony of *Cryptocerus aztecus* in Mexico, and Bondroit found at Landelies in Belgium one pterergate of the species *Lasius flavus*.

One of the most common ants in Pasadena at the present time is the large red harvester, *Pogonomyrmex californicus* Buckley, but apparently it is being exterminated by *Iridomyrmex humilis* Mayr, the rapidly spreading Argentine ant. From one of the small embattled nests of *P. californicus* which has been under observation since March, 1919, I sent a few specimens to Professor Wheeler, who called my attention to the presence of three pterergates. Further investigation has shown that of all the workers of this nest

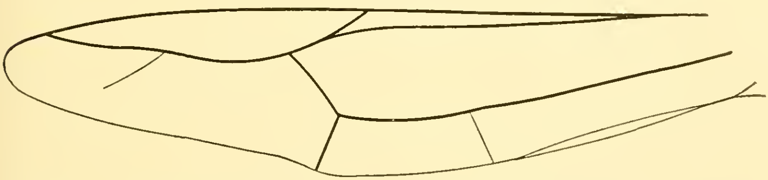

Fig. 1. Vestigial anterior wing of a worker of *Pogonomyrmex californicus* Buckley.

seen during 1919 one-half has vestigial wings, varying in degree of development from small chitinous nodules on the mesothorax to membranous structures one to two millimeters in length. Except for these organs representing wings, there is no conspicuous difference in thoracic structure, or otherwise, between the pterergates and the remainder of the workers.

The vestiges observed in all six of the pterergates mentioned in the first paragraph are on the mesothorax, and indicate the abnormal development of anterior wings. There is also but a single pair of vestiges for sixteen of the pterergates of *P. californicus* so far examined.

One individual from this nest, however, is unique, not only in having vestiges both of anterior and of posterior wings, but also in possessing one anterior wing that is membranous and veined. A diagram of the venation of this most developed wing, which resembles more closely that of a normal hind wing, is given in the accompanying figure. At the time of capture the pterergate was beset by a half dozen Argentine ants; it is quite possible, therefore, that the other anterior wing had been pulled off in the course of this last fight or during previous activities.

SIBERIAN ANOPHELES.

By C. S. Ludlow,
Army Medical Museum, Washington, D. C.

The collections of mosquitos sent by the Surgeons of the American Expeditionary Force in Siberia, have been of much interest because of the new forms they contained, and the specimens have usually been in excellent condition, so that it has been comparatively easy to differentiate them.

While there have been some smaller species as a rule the forms have been large, heavily scaled, and more hirsute than the species from the more southern areas. Among these new forms are two *Anopheles* belonging to the *maculipennis* group, *i. e.* with spotted wings, very closely allied, yet showing differences which, because the Siberian forms are not well known, it seems desirable to consider specific, and both are described below.

Anopheles lewisi sp. nov.

Female. Head light brown with a median bunch of white forked and lanceolate scales, and long slender white scales on the vertex projecting forward, brown forked scales on the occiput and sides, light bristles on the vertex, brown ones around the eyes; antennæ dark brown, basal joint brown with a few flat brown scales, verticels brown, scanty, and short, the pubescence is white; proboscis brown, labellæ brown; palpi brown, the proximal joint heavily brown scaled, the following not so dark and the scales appressed, short brown hairs on the ultimate and penultimate joints and a few at the apex of the antepenultimate; clypeus light brown, pruinose; eyes dark.

Thorax; prothoracic lobes light brown, covered with light to brown bristles; mesonotum has broad greyish median stripe reaching from the nape to the scutellum, immediately laterad a broad dark brown stripe extending from the scutellum cephalad about one-half the length of the mesonotum, the lateral portions a soft brown shading gradually into the lighter pleura. In the greyish stripe are two narrow raised lines running from the nape caudad about one-half its length and dividing it into three nearly equal parts. The greyish stripe is heavily covered with fine golden brown (almost yellow) hairs through which the two lines show more or less distinctly often giving the effect of three definite stripes of the golden scales, but this does not appear clearly on all the specimens; the short brown stripes are nude, and the softer brown lateral portions are covered much more diffusely than the median greyish stripe. There is a brown median spot just cephalad of the scutellum; golden brown bristles on the lateral margin and heavy dark brown bristles over the wing joint. The scutellum follows closely the coloring of the mesonotum, with fine golden hairs, and dark brown border bristles; pleura light brown shading to the yellow of the coxæ, covered with a silvery tomentum and having a few small bunches of long light hairs; metanotum light brown, pruinose.

Abdomen brown, with broad light basal bands in the integument, all well covered with long golden hairs, venter mostly light but with some narrow apical brown bands. The abdomen as a whole is so markedly hairy as to resemble that of a male.

Legs: coxæ light, in some specimens a definite yellow, with some light hairs, trochanters follow the general coloring of the coxæ, with some white and some brown long flat scales and hairs; femora covered with brown scales having a tendency to greenish or bronze reflections, ventrally almost white to near the apex, a narrow light knee spot; tibiæ darker, the apex very narrowly light; the tarsal joints are all dark, but the scales are so sensitive to the direction of the light, that at one moment they may be brown, and in another light are at once almost white. Ungues all large and simple.

Wings clear, heavily clothed with long brown scales, somewhat truncate on the costa, the proximal part of the first long, and the stem of the fifth long vein, but otherwise the scales are very long lanceolate scales. The membrane is slightly infuscated at the spots which are made by aggregations of the scales and occur at the forks of the first submarginal, and second posterior cells, at the cross-veins and at the root of the second long vein. The first submarginal cell is about a third longer than the second posterior, its stem about one-half the length of the cell; basal cross-vein about its own length from the anterior. The fringe is brown, and has the same golden brown reflections that characterize the other wing scales. At times this is so marked as to be rather deceptive even suggesting small fringe-spots, which I think are entirely the result of the reflections. The halteres have a light stem and dark knob.

Length about 10.5 mm. (body 7 mm., proboscis 3.5 mm., wing 6 mm.).

Male. The coloring is much as in the female; antennæ white, with very narrow brown bands at the joints, verticels brown with golden reflections, terminal joints brown, pilose; the basal joint large, brown, with a few minute hairs; palpi with dark brown scales, heavily clubbed, the terminal joint with some, and the preceding joint with heavy tufts of long brown hairs, both the hairs and the scales turning to golden-brown with changing light. Thorax more sparsely scaled, but the dark lines showing plainly; abdomen more definitely banded and very hairy. Legs much as in female, but the fifth fore tarsal has on the ventral aspect very short and heavy scales or bristles, one hardly knows what to call them, they are so very stout and short, arranged as an inverted V the broad part at the proximal end of the joint. The ungues are very uneven, the larger bi-serrated, the small one very short and heavy, and the joint itself is markedly curved; the heavy bi-serrated claw, the strong short bristles, and the curved joint making an unusually strong combination. Mid ungues large and simple, hind ungues small and simple. Wings more sparsely scaled, the infuscation at the spots showing plainly.

Length about 10 mm. (body about 7 mm., proboscis 3 mm., wing 6 mm.).

Taken July 10–22, at Selenga, and Verkhne Udinsk, Siberia.

Described from eight females and fourteen males collected by the surgeons on duty at these stations. It is a very large and fuzzy-looking Anopheline, resembling a single specimen received from Fort Gibbon, Tanana, Alaska, which, however, was in much too bad condition to place.

There are also with this species some much darker specimens, that may be a new species, a variety, or merely an accidental variation, but is described below.

Anopheles selengensis sp. nov.

Female. Head black, with a median depression, and on either side are white forked and lanceolate scales forming a well marked bunch, long white scales and bristles on the vertex, projecting forward, some smaller dark forked scales at the sides and the margin of the occiput. Antennæ black, basal joint black shiny bearing a few small flat upright scales, verticels dark, short, and scanty, pubescence white and plentiful; proboscis black, labellæ a lighter brown; palpi dark brown, with outstanding scales at the base, the remainder appressed scales; clypeus dark brown pruinose; eyes black.

Thorax: prothoracic lobes well separated, scantily covered with small light hairs and dark bristles; mesonotum bluish grey and dark brown, practically black. The grey median broad stripe is pruinose, with a very narrow median brown line extending from the nape almost to the scutellum, where it widens to form the "bare space," and rather ill-defined submedian broader brown lines extending about one-half the way to the scutellum. Laterad to this grey stripe, extending about half the length of the mesonotum, from the scutellum, is, on either side a very dark brown, or black, club-like stripe, and on the lateral parts the integument is very dark, shading into the lighter pleura. The specimen is partly denuded but the scales which are fine yellow hairs and have apparently been thickly placed, are lacking on the dark club-like parts, are diffuse on the laterad portions, a row of longer hairs and very dark brown bristles on the lateral margins, well marked over the wing joint; scutellum dark but rather toward the grey, a few yellow hairs, and many dark marginal and submarginal bristles; pleura dark, somewhat lighter than the darker parts of the mesonotum, and show a few bunches of hairs and black bristles; metanotum dark, pruinose.

Abdomen almost black, well covered with yellow hairs and long yellow bristles, venter dark.

Legs all dark except a light ventral line on the femora and tibiæ. The knee spot if present is reduced to a single row of scales. Ungues all simple.

Wings clear, slightly infuscated at the spots, which occur at the forks of the second and fourth long veins, at the root of the second, and at the cross-veins. The first submarginal is longer and a little narrower than the second posterior, its stem about one-half the length of the cell. The basal cross-vein not quite its length from the anterior. The scales are dark brown, somewhat truncate on the costa, the first long vein and the stem of the fifth, otherwise they are long narrow lanceolate. Halteres have light stem and dark knobs.

Length (abdomen 4 mm., body 7 mm., proboscis 3 mm., wing 6 mm.).

Taken, Selenga, Siberia, July 10, 1919, by First Lieut. J. P. Kopecky, M.C., U. S. Army (A. E. F.–S.) and described from two females sent with specimens of *Anopheles lewisi*, described above. It is quite in the possibilities that this may prove to be only a variation, of *lewisi*, but as the Anophelines of this region are not well known it has seemed worth while to describe it.

NOTES AND DESCRIPTIONS OF SPECIES OF TELENOMUS HAVING TEN-JOINTED ANTENNÆ (HYMENOPTERA; SCELIONIDÆ)

By A. M. Wilcox,[1]
Gipsy Moth Assistant, U. S. Bureau of Entomology.

While working over a collection of Proctotrypoid parasites during the winter of 1918–19, I found many specimens of Telenomus with the females having only ten antennal joints. These were separated into three species.

The following two species appear to be new to science and their descriptions are herewith presented. In the form of the abdomen they resemble Phanurus but the head is transverse and not quadrate or subquadrate as typical of that genus. They are, therefore, placed in Telenomus.

Telenomus hemerocampæ sp. nov.

Female. Length 1.25 mm. Black, shining; the legs, except the coxæ, dusky yellow, upper sides of femora slightly darker, especially the posterior pair; wings hyaline, ciliated; head about three times as wide as thick as seen from above. Ocelli in a curved line, the lateral ones nearly touching the margin of the eyes, the median

[1] The writer desires to express his thanks to Prof. C. T. Brues of the Bussey Institution, Harvard University, for his valuable assistance in the preparation of this paper, for the loan of specimens and for the examination and comparison of the species treated.

one set in a shallow fovea. Head margined behind. Vertex shagreened; front below shining, smooth except for a single row of minute punctures along the inner margin of the eyes and a shagreened area on the sides below. The row of punctures extends along the vertex behind the median ocelli and are somewhat larger than those on the sides. Mandibles dark reddish brown. Antennæ ten-jointed with a five-jointed club, scape and pedicel dusky yellow, funicular joints pale brown, the club darker. Scape reaching to the vertex, pedicel twice as long as thick at the apex; first funicular joint twice as long as thick, slightly thicker than the pedicel; second shorter, two-thirds as long; third one-half as long as the first and rounded; first four joints of the club quadrate, about equal; last slightly longer and conically pointed. Prothorax about as long as wide, convex in front, thinly covered with whitish pubescence, shagreened. Scutellum shining with fine, sparse punctures which show faintly. Postscutellum finely rugose. Abdomen sessile, longer than the head and thorax, pointed at the tip. First segment wider at the sides than medially, longitudinally striated at the base; second segment fully twice as long as wide, shining and striated at the base near suture, these striæ not being as long as those at the base of the first segment. Behind these striæ are faint aciculations, showing somewhat stronger at the sides. Following segments much shorter. Wings hyaline, ciliated; venation pale yellow.

Male. Differs from the female as follows: Legs and antennæ paler. Antennæ twelve-jointed; scape and pedicel yellowish; the flagellar joints fuscous becoming darker towards the tip. Pedicel and first three funicular joints longer than thick, about equal in length; fourth to ninth moniliform; the last joint twice as long as the penultimate, pointed.

Type locality. New Hampshire. Type: Gip. Moth Lab. No. 4176E. Deposited in U. S. Nat. Mus. Type Cat. No. 23066, U. S. Nat. Mus. Host: *Hemerocampa leucostigma* Abb. & Sm.

Described from four specimens reared from the eggs of *H. leucostigma* collected April 14, 1910.

Telenomus euproctidis sp. nov.

Female. Length 0.75 mm. Black, shining; the legs brownish; wings hyaline with long cilia. Head about three times as wide as thick as seen from above. Lateral ocelli nearly touching the eyes, the median one set in a shallow fovea. Vertex shagreened, with a few punctures; front below smooth, shining, with a row of punctures along the sides near the eyes, shagreened on the sides below. Antennæ dark brown or black, ten-jointed, with a four-jointed club. Scape nearly reaching to the vertex; pedicel more than twice as long as thick; first funicular joint two-thirds as long as the pedicel, second and third one-half as long as the first, not as thick, about equal, fourth considerably wider than long; first, second, and third club joints nearly quadrate, about equal, the last longer and conically pointed. Thorax about as long as wide, convex in front, thinly pubescent with whitish hairs, faintly shagreened. Scutellum smooth, shining, finely pitted around the outer edge; postscutellum finely rugose. Abdomen smooth, shining, longer than the thorax; first segment considerably wider at tip than at base, rather deeply, longitudinally striated at base, striæ a little longer than one-half the length of the segment. Second segment more than twice as long as wide, striated at base, the striæ not as deep as those on first segment but slightly longer; following segments short and coming to a point. Wings hyaline with rather long cilia; venation pale yellowish brown.

Male. Differs from the female as follows: antennæ and legs, except coxæ, considerably paler; abdomen not pointed at apex. First three funicular joints of antennæ about two-thirds the length of the pedicel; fourth to ninth shorter, moniliform; the last twice as long as wide and pointed.

Type locality: Japan. Type: Gip. Moth Lab. No. 3348A. Deposited in U. S. Nat. Mus. Type: Cat. No. 23067, U. S. Nat. Mus. Host: *Euproctis conspersa* Butl.

Described from several specimens reared from the eggs of *E. conspersa* from Japan, August 25, 1910.

Telenomus dalmani (Ratz.).

Ichneum. der Forstinsect., vol. 1, p. 185 (1844), (Teleas).
Mayr, Verh. zool.—bot. Gesellsch. Wien, vol. 29, p. 708 (1879).
Telenomus fiskei Brues, Psyche, vol. 17, p. 106 (1910).

There are a few specimens of this species from Dresden, Germany, in the collection and many others from New England. The specimens from New England were first determined as *Telenomus fiskei*

Brues[3] but later were found to agree with Mayr's description of *T. dalmani*. The type of *T. fiskei* agrees with the description and when compared with specimens of *T. dalmani* was found to be the same. Prof. C. T. Brues, who has gone over the description and compared the specimens, is also of the opinion that *T. fiskei* and *T. dalmani* are the same species.

This species has been taken in Maine, New Hampshire, Massachusetts, New York, Ottawa, Canada, England, Holland and Germany. It has been reared from the eggs of Notolophus antiqua and Hemerocampa leucostigma in U. S. Crawford records this species as having been reared from the eggs of Orgyia antiqua in England, Holland and Ottawa, Canada.

Telenomus abnormis Crawford.

Proc. U. S. Nat. Mus., vol. 41, p. 270 (1911).

I have not seen this species. It is described as having the second segment about as long as wide. It differs in this character from any other species under consideration in this paper.

The females in this group may be separated with the following table:

1. Antennal club five-jointed 3
   Antennal club four-jointed 2
2. Second segment of abdomen about as long as wide
   abnormis, Craw.
   Second segment of abdomen much longer than wide
   euproctidis sp. nov.
3. Abdomen truncate at apex .... *dalmani* (Ratz.)
   Abdomen pointed at apex .... *hemerocampæ* sp. nov.

THE NOCTUID GENUS COPABLEPHARON (HARVEY) WITH NOTES ON ITS TAXONOMIC RELATIONSHIPS.

By E. H. Strickland,
Entomological Branch, Ottawa, Canada.

The Genus Copablepharon was erected by Harvey ('78) for a single Californian species, *absidum* Harv. which he had previously ('74) placed in the genus Ablepharon-Arsilonche. In his description he states that the genus is related to Arsilonche in that the eyes are lashless and naked, and to Ommatostola in the ornamentations and habits of the moth. It differs from either, however, in the possession of spinose tibiæ. Both of these supposedly related genera have been placed in the sub-family Acronyctinæ by Hampson ('16).

Four species of moths were included in this genus when Smith published his list of American Lepidoptera in 1903, and he placed it next to the genus Nycterophæta, in the cuculliid group of the undivided family "Noctuidæ." This allocation of Copablepharon was accepted, with slight modifications, by taxonomists until Hampson ('03) transferred it to the sub-family Agrotinæ on account of its spined tibiæ. Barnes and McDunnough ('17) follow Hampson's classification in their check list, and this is the generally accepted standard for American Lepidopterists.

The six species now included in Copablepharon are apparently confined in their distribution to Western America. They are nowhere very common, and nothing has been published upon the immature stages of any species.

In the spring of 1913 larvæ of *C. longipennis* Grt. and *C. grandis* Strk. were taken in Manitoba and Alberta respectively. Mr. N. Criddle, who found the *longipennis* larvæ, and bred from them a single adult, states that the larvæ were typical "cutworms." Unfortunately Mr. Criddle did not examine the pupal stage, which was passed in an earthen cell below ground.

On May 9 a single larva of *C. grandis* was taken in a stubble field at Monarch, Alberta.

This larva resembled superficially a lightly pigmented specimen of *Euxoa ochrogaster* Gn. (The Red-Backed Cutworm). *Grandis*, however, differs from *ochrogaster* in that the median and lateral lines are white instead of brown. In all of the larvæ of Euxoa, and of closely related genera, that we have examined tubercle II is considerably larger than tubercle I (see diagram). In the larva of *grandis*, and also in specimens, now inflated, which Mr. Criddle collected at the same time as, and believes to be identical with, the specimen from which he bred *longipennis* this tubercle is no larger than is tubercle I.

The larva of *grandis* evidently hibernates when about half grown since the specimen taken on May 9 in Alberta was in the fourth stage. This larva was found below ground, among other cutworms, and in captivity it fed freely on alfalfa and to some extent on barley.

When mature the larva measured $1\frac{1}{2}$ inches in length, and by July 5 it had pupated in an earthen cell similar in construction and size to that of the species of Euxoa, though it was somewhat distorted internally.

Thus it will be seen that Copablepharon larvæ are typically Agrotine in their habits, and were it not for the minute tubercle II their structure also would be in harmony with that of typical members of this sub-family.

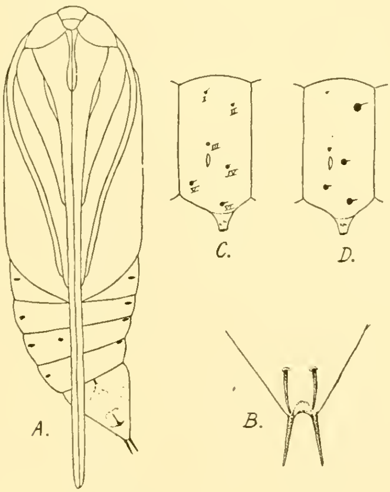

Fig. 1. *A*. Pupa of *C. grandis*, x 3; *B*. Cremaster of pupa, dorsal aspect, x 12; *C*. Diagram of larval tubercles based on abdominal segment IV of *C. grandis; D*. Diagram of larval tubercles of typical Euxoa species based on abdominal segment IV of *Chorizagrotis thanatologia* Dyar.

The pupa, of which an illustration is given, is remarkable in that the proboscis sheath is so elongated that it extends beyond the apex of the abdomen. The pupa itself is 19 mm. long and the proboscis sheath, of which 8 mm. is free, extends 2 mm. beyond the cremaster.

The only other Noctuid pupæ which we know to have an extended proboscis sheath are those of certain genera of the Cucullinæ, and to a less extent the Plusiinæ.

Mosher ('16) in her classification of Lepidopterous pupæ states that in the Cuculliinæ the wings and maxillæ (proboscis sheath) never extend beyond the caudal margin of the fourth abdominal segment. This statement is apparently based entirely upon observations made on two specimens of the same genus, Graptolitha Hbn. Humphreys ('43) figures the pupæ of several British species of the genus Cucullia in all of which the proboscis is extended well beyond segment IV. Lintner ('69), in describing the pupa of the American species *Cucullia intermedia* Say, states that the free end of the tongue case projects 5/100 inch beyond the wing cases, and the pupa is 7/10 inch long. We have examined empty pupa-cases of this species which confirm this statement and indicate that in the living pupa the free apex of the proboscis sheath extends beyond the margin of the fifth abdominal segment.

We have insufficient data upon the cremaster of Cuculliid pupæ for drawing definite conclusions therefrom, but the cremaster of *intermedia* certainly bears no resemblance to *Copablepharon grandis* in which latter species it appears to be identical with the type found in the commonest Agrotinæ, such as the numerous species of Euxoa. This consists of two stout terminal spines, which vary considerably as to form and divergence within the species, together with two supernumerary dorsal bristles, one or both of which may be absent.

The eggs of *C. grandis* are sub-globular. The upper surface is shallowly rugose, and the under side is smooth. In captivity they were laid in the soil, and were greenish-white when deposited.

With the exception of the spined tibiæ the adults, which have long narrow primaries, show greater affinities to the Cuculliinæ than they do to the Agrotinæ. From the appearance and habits of the larvæ, and from the pupal cremaster, however, it would seem that this genus is rightly placed in the latter sub-family despite the superficial resemblance of the pupa and adult to those of some genera in the Cuculliinæ.

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AN INSECT AND LACK OF ENTOMOLOGICAL KNOWLEDGE AN IMMEDIATE CAUSE OF THE WORLD WAR.

BY M. T. SMULYAN,
U. S. Bureau of Entomology, Melrose Highlands, Mass.

"What dire offence from amorous causes springs,
What mighty contests rise from trivial things!"
—POPE.

Those familiar with the beliefs of the ancient Greeks doubtless recall the highly fascinating bit of tradition dealing with Peleus and Thetis and the events which grew out of their marriage: how Peleus, King of Thessaly, wooed and finally overcame the scruples of the divine Thetis: how that mortal, in order to please his bride, invited the gods of Olympus to attend the nuptial rites and festivities on Mount Pelion; how the vindictive Discordia, previously expelled from heaven for sowing dissension and stirring up strife, in revenge, for not having been included among those invited, threw an apple in their midst, with the inscription, "To the most beautiful"; how this aroused the envy and jealousy of the proud and powerful divinities, Juno, Venus, and Minerva; how the dispute was carried for arbitrament to the shepherd Paris, son of Priam, King of Troy; how Paris decided in favor of Venus who offered the most tempting bribe, that of the fairest woman as wife; how later, with the assistance of the goddess, he contrived to visit the court of Menelaus, King of Sparta, husband of Helen; how the base prince then, violating all laws of hospitality and honor, carried the beautiful Helen away to Troy; and, finally, how all Greece rose to avenge the insult and the wrong.

Thus did a mere *apple* cause that mighty commotion, the Trojan War.

Historians and others interested in tracing the cause and origin of the late war, the great human convulsion of modern times, appear to be generally agreed that the fundamental causes are to be found in pre-war Germany's need for expansion, in the pressure of democratic ideas upon her autocratic régime, in the doctrine of the Superman and the ambition for world conquest, in the rivalry for trade routes and world trade, etc., etc., and that the conflict was precipitated by Austro-Serbian friction and, directly, by the assassination of the Austrian archduke. But alas for our limited human understanding! Our historians and scholars have apparently completely overlooked one of the most important and immediate facts in the chain of causation, namely, the fatal activities of an *insect*—an object infinitely more mischievous if far more insignificant and less attractive than Discordia's apple—a parasite (species unfortunately not known). I am unable to state at the present moment how this extremely important discovery came to be made or through what channels the intelligence reached this country; whether it is to the credit of some able press correspondent, or whether it is due to the Red Cross or American Medical Mission. The fact is inseparably bound up with a most pathetic occurrence—as pathetic as its effects were far-reaching and terrible—of which the following is the briefest outline: In a village in the interior of Serbia there lived a maiden who was loved passionately by a youth of the same village. But while she apparently accepted his, her own love, strange as it may seem, focused upon a beautiful, little, caged bird which she possessed and which she prized above all things. In the course of time, however, an insect parasite attacked the bird and killed it. The gentle girl, affected to the depths of her inmost being by the loss, developed fever and after a short illness died. The ardent youth, her lover, half-crazed by the event, rushed away from the village, the scene of his tragic misfortune, and out into the world. Some time later, in another part of the country, he became a member of an extreme patriotic-revolutionary organization and very shortly afterwards, at Sarajevo, assassinated Archduke Franz Ferdinand of Austria. The last, as is known, led to Austria's ultimatum to Serbia and to the war.

The conclusion (or lesson) is, of course, clear. Had there been sufficient entomological knowledge in that Serbian town to diagnose the bird's malady and to devise proper remedial measures, the world war with all its attendant horrors might have been averted.

PROCEEDINGS OF THE CAMBRIDGE ENTOMOLOGICAL CLUB.

At the meeting April 13, 1920 a paper was read by S. M Dohanian on the mosquito control of which he had charge at the army flying station near San Antonio, Texas. By filling holes and frequent oiling of all open water around the camp, it was kept almost free from mosquitoes. Discussion followed on the effect of petroleum on plants and several cases were mentioned where water plants grew through a thick film of oil without apparent injury.

R. Heber Howe, Jr., spoke of the Odonata in New England and showed maps on which the distribution of each species is plotted and his lately completed Manual of New England Odonata which contains illustrations of the distinctive characters of the species and pictorial tables explaining their classification.

Mr. Varás, a student in Boston, gave an account of the physiography and faunal conditions of Chile, his native country.

Two meetings were held in May on the 11th and 25th. W. M. Wheeler gave an account of the feeding habits of ants, especially of the larvæ of Pseudomyrminæ which have on the ventral side within easy reach of the mouth a pouch in which the worker ants deposit the waste pellets from their mouth. The mouths of the larvæ are provided with a triturating apparatus for chewing this food and appear to get their whole nourishment from it. A full account of this will be published in the Transactions of the American Philosophical Society.

D. J. Caffrey of the U. S. Bureau of Entomology gave an account of recent studies of the European corn-borer in America for which see recent bulletins of the U. S. Dept. of Agriculture and N. Y. State Dept. of Farms and Markets.

At the meeting of May 25 three recent publications by members of the Club were shown. Revision of the Nearctic Termites by Nathan Banks and T. E. Snyder in U. S. Nat. Museum Bulletin 108. Manual of the Orthoptera of New England by A. P. Morse in Proc. Boston Soc. Nat. History. Catalogue of the Spiders of Canada known to the year 1919 by J. H. Emerton in Trans. Canadian Institute, Toronto 1920.

C. A. Frost read a paper on the habits, distribution and systematic relations of several species of New England and Canadian

Coleoptera; H. C. Fall discussed Mr. Frost's paper and gave a brief account of his own recent studies of Coleoptera especially in the genera Hydrophorus and Gyrinus. C. W. Collins mentioned the finding at Winchester, Mass., after its disappearance for several years, the European *Carabus auratus* introduced there as a destroyer of the Gipsy Moth in 1908. He also noted the finding unexpectedly at Framingham of the European *Carabus granulatus*.

Notes on recent collecting were reported by several members and all agreed in noticing an increasing scarcity of insects of all kinds near all large centers of population.

EXCHANGE COLUMN.

Notices not to exceed four lines in length concerning exchanges desired of specimens or entomological literature will be inserted free for subscribers, to be run as long as may be deemed advisable by the editors.

Cynipidæ,—galls or the bred makers,—of the world desired for exchange or purchase. Will determine North American material. Address: Alfred C. Kinsey, Bussey Institution, Forest Hills, Mass.

Wanted: Insects of any order from ant nests, with specimens of the host ants, from any part of the world; also Cremastochilinæ of the world. Will give cash or Coleoptera, Hymenoptera and Diptera from the United States.—Wm. M. Mann, U. S. National Museum, Washington, D. C.

Wanted: To exchange, or purchase for cash, specimens of the Genus Apantesis from any locality. Also to purchase rare Catocalæ.—Samuel E. Cassino, Salem, Mass.

Wanted for cash: Lowest representatives of all families of insects, preserved in fluid.—G. C. Crampton, Amherst, Mass.

Wanted: Syrphidæ (Flower-flies) from all parts of the world. Exchanges solicited. Will determine on the usual conditions.—C. L. Metcalf, Ohio State University, Columbus, Ohio.

Largest Expanse—one each ♂ and ♀ Lepidoptera wanted for transfer purposes. Those not good enough for collections will do. Will buy, or exchange for local Lepidoptera, etc.—C. V. Blackburn, 12 Pine St., Stoneham, Mass.

Butterflies of Japan and Formosa, will be exchanged by S. Satake, 48 Aoyama-minamimachi 5-chome, Tokyo, Japan.

For Sale: Psyche, complete set, $10. Volumes 3 to 20, newly bound in 11 volumes, red half calf, with black cloth sides; also Ann. Ent. Soc. Amer., complete, $12. Volumes 1 to 6, newly bound in black half calf, cloth sides.—A. C. Hansen, 945 Margate Ter., Chicago.

For sale, or exchange for entomological items not in my library—American Entomologist, complete; Dyar, List of N. A. Lepidoptera; Redi, Experimenta, circa Generationem Insectorum, 1686; many others.—J. E. Hallinen, Cooperton, Okla.

Wanted: To examine, determine and exchange Cicadellidæ or "Jassidæ" from all parts of North America.—J. G. Sanders and D. M. DeLong, State Capitol, Harrisburg, Pa.

Cochineal Insects: Wish to obtain living specimens of cochineal scales. Will purchase or exchange as may be desired.—C. T. Brues, Bussey Institution, Boston 30, Mass.

CAMBRIDGE ENTOMOLOGICAL CLUB

A regular meeting of the Club is held on the second Tuesday of each month (July, August and September excepted) at 7.45 P. M. at the Bussey Institution, Forest Hills, Boston. The Bussey Institution is one block from the Forest Hills Station of both the elevated street cars and the N. Y., N. H. & H. R. R. Entomologists visiting Boston are cordially invited to attend.

PSYCHE

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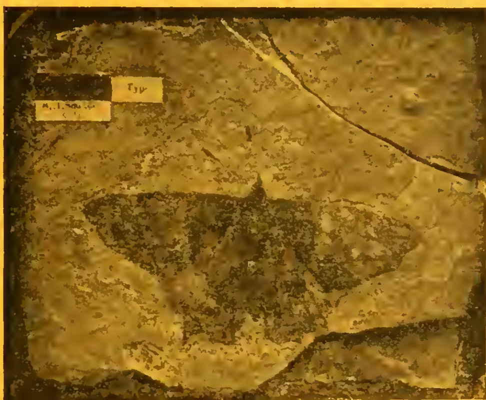

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PSYCHE

VOL. XXVII OCTOBER, 1920 No. 5

SYNOPSIS OF THE DIPTEROUS FAMILY PSILIDÆ.[1]

By A. L. Melander,
Pullman, Washington.

The following keys are given to assist in the determination of the flies of the family Psilidæ as at present known from North America. The study is based entirely on my own collection, species before me being indicated by starring the localities represented. In the February (1920) issue of Psyche Mr. Charles W. Johnson gives tables of *Loxocera* and a new genus, *Pseudopsila*. With slight modifications these tables are incorporated in the present paper.

Table of Genera.

1. Antennæ greatly lengthened, longer than the head, the third joint very slender, more than four times the length of the second joint and distinctly longer than the arista; no fronto-orbital or postvertical bristles. . .*Loxocera* Meigen
   Antennæ shorter, the arista longer than the third joint 2
2. Third antennal joint subcylindrical, about three times as long as the second; no fronto-orbitals, but postverticals present, one presutural dorsocentral present . . .*Pseudopsila* Johnson
   Third antennal joint short, ovate, rounded. 3
3. Face very strongly retreating; anal cell as long as second basal. . . . .*Psila* Meigen
   Face more nearly perpendicular, the head not triangular in profile 4
4. Robust; occiput flat, ocellar triangle small and placed well back; 4 scutellar bristles; pteropleuræ bare; first vein ending opposite anterior crossvein, second vein near wing-tip, anal cell shorter than second basal and truncate *Chyliza* Fallen
   Slender; head spherical, ocellar triangle placed forward; 2 scutellar bristles; pteropleuræ with hairs; first vein ending before anterior crossvein, second vein about midway

[1] Contribution from the Zoölogy Laboratory of the State College of Washington.

between posterior crossvein and wing-tip, anal cell almost equalling second basal and with rounded apex
Strongylophthalmyia Heller

Loxocera Meigen

Eyes large, in profile attaining the front margin of the head, with the occiput one-tenth and the cheeks one-third their greatest diameter 2

Eyes small, nearly round, not reaching the front of the head, the occiput one-third and the cheeks fully as wide as their greatest diameter. (Wash.*)..........*microps*, sp. nov.

2. Wings hyaline with the tip and posterior crossvein clouded. (*cylindrica* Say)..................................3

Wings uniformly brownish hyaline......................4

3. Anterior margin of the thorax, a dorsal line, humeri, and lateral lines, black. (N. H., Vt., Mass., Pa., Ill.,* Minn., Kans.)
var. *cylindrica* Say

Anterior margin very broad, covering at least one-third of the thorax, a dorsal line, short lateral lines and about one-third of the anterior of the pleura, black. (Me., N. H., Vt., Quebec,* Mass.,* Conn., N. Y.,* N. J., Mich., Kans.)
var. *pleuritica* Loew

Dorsal line, humeri, lateral margins and the upper half of the pleura, black (N. H., Vt., Mass., Pa., D. C., Va.)
var. *pectoralis* Loew

Dorsal and lateral lines (sometimes obsolete) and a spot above the yellow humeri, black. (Vt., Mass., Conn., N. J., Pa., D. C.,* Va., N. C., La.,* Tex.*)...var. *obsoleta* Johnson

4. Anterior third of the thorax black, dorsal and lateral lines wanting; abdomen, except the sides of the first segment, black. (Me., Mass.,* Conn., N. H., N. J., Va., Wis., Mont.,* Idaho,* Wash., Ore.).............*collaris* Loew

Anterior and lateral margins and a dorsal line on the thorax, black; abdomen except at the base red. (Kans., Tex., Colo.*)..........................*fumipennis* Coquillett

Loxocera microps sp. nov.

Male. Length, 5 mm. Polished testaceous variegated with black. Head testaceous with a median frontal black stripe, anterior orbits blackish; frontal triangle attaining suture and occupying half of the front at the ocelli; face greatly receding, antennal grooves white-velvety, center stripe wide and polished; eyes small, nearly round, not reaching front margin of profile by one-fifth their greatest diameter and the hind margin by about one-third, facets uniform, cheeks deeper than eye, orbits distinctly sunken; occiput flat, swollen in back of the cheeks, with fine yellow hairs; palpi tipped with brown; antennæ greatly lengthened, basal joints small, third joint twenty times as long as the second, arista yellow, the thickened basal part with brown tip, pubescence microscopic. Thorax testaceous, notum centrally broadly black in front, vestiture pale yellow, bristles weak and black, one dorsocentral and one pair scutellars; metanotum centrally blackened; mesopleuræ with white hairs below. Abdomen piceous, sides toward the base yellowish; genitalia minute. Legs yellowish. Halteres pale yellow. Wings nearly hyaline with a brownish tinge, veins firm and brown, sections of fourth vein proportioned 2: 5: 4, third and fourth veins apically parallel.

Two specimens. Paradise Valley, Mount Rainier, Wash., August, 1917.

Pseudopsila Johnson.

Thorax entirely black (N. H., Mass., N. Y., Can.). . .*fallax* Loew
Thorax yellow, marked with black 2
2. Dorsum without lateral margins of black 3
 Dorsum with lateral margins of black 4
3. Humeri and upper half of pleuræ black (Vt., N. Y.) (Proc. Acad. Nat. Sci. Phil., 1919, 193) (*Psila*). . *angustata* Cresson
 Anterior margin, pleuræ, metanotum and a narrow dorsal line black. (Me., N. H.) (Psyche, 1920, 18). . *perpolita* Johnson
4. With broad lateral margins only, upper half of pleuræ black. (Conn., Me., N. J., Pa., Quebec) (*Psila*). . . *bivittata* Loew
 With a broad anterior and lateral margins, upper half of pleuræ black. (N. H., Mass., Conn., Va.) (*Psila*). . . *collaris* Loew

Psila Meigen.

Mesonotum and pleuræ entirely yellow 2
Thorax more or less black; abdomen wholly black 5

2. Entire insect yellow, except the black frontal or ocellar triangle; arista, and cephalic and thoracic bristles black...........3
   Head and thorax yellow, abdomen wholly black; arista and bristles yellow, the arista short-pubescent; tip of palpi black (*bicolor* Meigen).....................................4
3. Frontal triangle large, black, polished; arista, pubescent; antennæ half as long as the face. (N. H.) *frontalis* Coquillett
   Only ocellar triangle black; arista bare; antennæ distinctly less than half the facial length. (Ore.). .*microcera*, sp. nov.
4. Metanotum wholly yellow (Europe, N. H., Can., Mont.,* Wyo.,* Wash., Alaska)..............var. *bicolor* Meigen
   Metanotum centrally black (Can., Colo.,* Wyo.) var. *dimidiata* Loew
5. Mesonotum yellow the humeri alone black; only upper pleuræ black; bristles of head and thorax black; third antennal joint dark...6
   Mesonotum centrally black...........................7
6. Head entirely yellow except the small ocellar spot; palpi yellow (Tex.*)...............................*colorata*, sp. nov.
   Occiput bimaculate; palpi black (N. J., D. C., Wis.) *lateralis* Loew
7. Bristles of head and thorax black; legs mostly black; antennæ, the nearly bare arista, and the palpi black; head and sternopleuræ black 8
   Bristles of head and thorax yellowish; coxæ and legs yellow; arista yellowish; head yellowish.......................9
8. Base of arista thick; last section of fourth vein arched and shorter than the penultimate section. (Wash.*) *washingtona* sp. nov.
   Arista not thickened; last two sections of fourth vein equal; face greatly receding; two dorsocentrals. (Idaho*) *atrata*, sp. nov.
9. Sternopleuræ black; at least tip of palpi blackened; third antennal joint mostly or wholly yellow.................10
   Sternopleurae black; palpi and antennæ yellow; mesonotum with short white pilosity (Mex.)...........*exigua* Wulp
   Sternopleuræ yellow; palpi wholly yellow; third antennal joint black. (N. Y.,* N. J.,* Ill.,* Wis.)......*sternalis* Loew

10. Palpi wholly black; third antennal joint round, wholly yellow (eastern) or upper edge dark (western); frontal triangle black. (N. H., Alaska*)............ ......*levis* Loew
Palpi with black tip; third antennal joint oval, tipped with black; only ocellar spot black. (Europe*; Can., N. Y., Colo., Wash.*)..........................*rosæ* Fabricius

Psila microcera sp. nov.

Male. Length, 4 mm. Entirely yellow except for the black ocellar prominence and the black upper edge of the third antennal joint. Frontal triangle almost reaching the suture, periorbits distinct, one fronto-orbital, postverticals diverging and long, cephalic bristles black; antennæ short, third joint rounded, slightly longer than deep, arista bare and black. Eyes nearly round, equal to the longest diameter of the cheek. Thoracic bristles black, strong, two notopleural, one supra-alar, one dorsocentral, two scutellars. Wings hyaline, with a yellowish tinge, veins yellow, sections of the fourth vein proportioned 2 : 7 : 5, of the fifth vein 12 : 1, posterior crossvein transverse.

A single specimen collected by Professor A. L. Lovett at Duffy Prairie, Ore., July 26, 1915, and presented by F. R. Cole. Three females collected by R. C. Shannon at Sprague, Ewan and Medical Lake, Wash.* The last mentioned specimen has the bristles yellow.

Psila colorata sp. nov.

Male. Length, 4 mm. Head yellow, a small black spot between the ocelli; lower occiput swollen; third antennal joint twice as long as deep, black beyond the arista, which is yellow, and white-pilose; mouthparts yellow; cephalic bristles long and black, no fronto-orbitals. Mesonotum, scutellum, center of metanotum, and lower pleuræ yellow, humeri, mesopleuræ, pteropleuræ and sides of metanotum black, prothoracic spiracle yellow; thoracic bristles black, hairs yellow, one dorsocentral, pleural hairs sparse. Abdomen black. Legs wholly pale yellow, apical spurs small and yellow. Halteres whitish; calypteres luteous, the fringe blackish. Wings with yellow tinge becoming brownish apically, veins luteous, the third vein becoming brown, sections of fourth vein proportioned 1 : 1 : 2 : 2.1, the last section slightly arched, posterior crossvein transverse, curved, twice as long as the last section of the fifth vein.

One specimen. Austin, Tex., April 20, 1900.

Psila washingtona sp. nov.

Female. Length, 4 mm. Head, thorax and abdomen entirely shining jet black, the fine pubescence pale. Face one-third longer than the front; cephalic bristles black, two minute fronto-orbitals; antennæ black, the third joint bluntly triangular, one-half longer than wide, the arista black, thick at the base then subulate, its pubescence very short; mouthparts black. Thoracic bristles black, two dorsocentrals, pleural hairs not abundant. Legs mostly blackish, coxæ jet black, the knees, front tibiæ, tips of posterior tibiæ and the tarsi brown. Halteres yellow. Wings with uniform yellow tinge, veins yellow, sections of fourth vein proportioned 1 : 1 : 2 : 0.8, the last section arched, posterior crossvein nearly transversely located, more than twice as long as the last section of fifth vein.

One specimen. Mount Constitution, Orcas Island, Wash., July 17, 1909.

The species comes nearest the European *P. nigra* Fallen, which usually has from two to four dorsocentrals, one to three fronto-orbitals and the last section of the fifth vein more than half the length of the posterior crossvein; its arista is not thickened basally. *P. morio* Zetterstedt is also similar, but has two distinct fronto-orbitals, four dorsocentrals, black tarsi and the anterior crossvein more basally located. *P. atra* Meigen has a more pubescent arista, two fronto-orbitals and four dorsocentrals well developed.

Psila atrata sp. nov.

Length, 3 mm. Head, thorax and abdomen entirely shining black, the fine pubescence yellow. Head conical, the face very greatly receding and nearly half longer than the front; cephalic bristles black, one minute fronto-orbital; antennæ blackish, the third joint elliptical, the arista blackish, not greatly thickened at base, its brown pubescence short but obvious; mouthparts black. Thoracic bristles black, two dorsocentrals, pleural hairs sparse. Coxæ black, femora blackish, knees narrowly brown, anterior tibiæ and all tarsi brown, hind tibiæ broadly blackish along the middle. Halteres yellow. Wings with uniform slight yellow tinge, veins pale yellow, sections of fourth vein proportioned 1 : 1 : 2 : 2, the last section only slightly curved, posterior cross-vein nearly transverse, equal to the last section of fifth vein.

Twenty specimens. Type from Boville, Idaho, June 18, 1911; paratypes from same place (Melander), Troy (W. M. Mann) and Vollmer (J. M. Aldrich), all in Idaho; and Hood River, Ore. (F. R. Cole).

Chyliza Fallen

Dorsum of thorax yellow 2

Dorsum of thorax mostly black, the humeri and scutellum usually red 5

2. Pleuræ more or less yellow 3

Pleuræ and pectus black, a quadrangular black prealar spot; abdomen black; all femora with apical black ring; palpi reddish (Mex.) . . . . *enthea* Giglio-Tos

3. Pleuræ entirely yellow; wings hyaline (Fla.) . . . *similis* Johnson

Upper half of pleuræ with black vitta; apex of wings clouded 4

4. Apical cloud of wings following the margin, not widened behind, veins two, three and four ending in the cloud; pleuræ marked with only the vitta. (N. J., Pa., D. C., Kans.,* Colo., La., Mex.) (*Tetradiscus pictus* Bigot) . *apicalis* Loew

Apical cloud widening behind, apex of veins two, three and four not clouded. (Mex.) (*Tetradiscus notatus* Bigot, not *Chyliza notata* Loew) . . . . *bigoti*, nom. nov.

5. Front and hind femora blue-black but brownish at base, front tarsi black; palpi red; wings hyaline; thorax dark green, shining. (Can.) . . . . *metallica* Walker

Femora black except tips, tarsi yellow; palpi black; wings smoky; body black. (Ore.*) . . . . *leguminicola* sp. nov.

Femora largely yellowish, sometimes with subapical dark ring 6

6. At least hind femora with well marked subapical black or brown band; wings with apical clouding, second and third sections of costa as three to one 7

Femora yellow, at most reddish apically; wings not clouded apically, second and third sections of costa of *robusta* proportioned two to one 11

7. Femoral bands present on all legs; palpi brown (Europe; Mass., det. Hough)................. *annulipes* Macquart
   Femoral bands weak or wanting on front and middle legs.....8
8. Vertex narrower than depth of eye; head largely yellow, punctured; halteres yellow..........................9
   Vertex much broader than depth of eye; head black except narrow stripe on lower occipital orbits, deeply pitted; halteres black. (Wash.,* Ore.).......*scrobiculata* sp. nov.
9. Palpi entirely black................................10
   Palpi tipped with black; anterior femora apically dark; sides of thorax more or less yellow; first posterior cell basally shaded. (Mex.)..........................*varipes* Wulp
10. Head, humeri, scutellum, posterior sides of mesonotum and at least sterno-mesopleural suture yellow. (N. H., D. C., N. J., Idaho.,* Wash.*).....................*notata* Loew
    Thorax entirely black, except a reddish scutellar spot, occiput and frontal orbits mostly black. (Mass.*)..*erudita* sp. nov.
11. Black; antennæ, broad apices of femora, tibiæ and scutellum reddish; marginal cell dark gray, costal cell brownish. (Nev.) ....*robusta* Coquillett
    Blackish-green; antennæ black; legs yellowish; wings hyaline. ("U. S.")..........................*nigroviridis* Walker

Chyliza scrobiculata sp. nov.

Female. Length, 6 mm. Robust, deeply and closely punctured, with short dense woolly pale pubescence and short black bristles. Head large, eyes oblique, lower occiput deep, upper occiput flat, head coarsely punctured except the face and the shining vertical triangle which reaches half way to the antennæ, front opaque except the periorbital stripes; head black except for an orbital yellow stripe on lower occiput and a small orbital spot just below the antennal level; antennæ black above, yellow below, the third joint thumb-shaped, half longer than broad, arista brown on basal third, apically white; palpi broad, hairy and black. Thorax entirely black except the outer part of the scutellum, metathoracic callosities strong. Abdomen depressed, densely pubescent. Legs including the coxæ reddish yellow, the hind femora with a subapical incomplete black annulus. Halteres black. Wings smoky blackish throughout, darkest along the costa and at the tip, second costal section three times the third, first vein ending near middle of the wing, third and fourth veins parallel.

Two specimens. Spokane, Wash., 30 August (Melander); Whitman National Forest, Ore., July (W. J. Chamberlin) in the collection of F. R. Cole.

Chyliza leguminicola sp. nov.

Length, 4–7 mm. Black, the anterior part of the front, the immaculate face, cheeks, occipital orbits, antennæ and scutellar margin luteous, the extremities of the femora, the tibiæ except distal half of hind pair, and the tarsi flavous, coxæ fuscous, halteres whitish. Front square, eyes large, palpi broad, frontal bristles black and inconspicuous, arista piceous, cephalic pubescence yellow. Thorax with strong piligerous punctures, the yellow hairs more or less whorled, bristles black, reduced in size and number to one pair each of supra-alar, intra-alar, dorsocentral and acrostichal, four scutellars. Abdomen sericeous with golden pubescence. Calypteres and fringe yellow, wings infumated, darker anteriorly, veins firm and black, costal sections proportioned 4 : 5 : 2, fourth vein 1.5 : 2 : 3, fifth vein 10 : 1, hind crossvein transverse.

Three specimens sent by L. P. Rockwood, who has swept this fly from the lupine, *Lupinus polyphyllus* Lindl., at Forest Grove, Ore., toward the end of April. He has also found puparia attached to the lower part of this plant during July, from which adults emerged the following March when wintered at room temperatures.

Chyliza erudita sp. nov.

Male. Length, 5 mm. Black, closely but not deeply punctured, the pale pubescence dense and appressed, bristles black. Head variegated black and yellow, the occiput black except the lower orbits, front subshining, centrally brownish, measuring in width seven-eighths the depth of the eye, frontal triangle narrow, reaching two-thirds the length of the front, two fronto-orbitals, face yellow, with two blackish subantennal spots, cheeks black except at the mouth-opening, mouthparts black, the palpi very broad; antennæ yellow, the upper edge darker, arista white and feathery pubescent. Thorax entirely black except the reddish tip of the scutellum. Legs including the coxae pale yellow, the hind femora with prominent black subapical ring. Halteres pale yellow.

Wings with costal half infumated, second and third sections of the costa proportioned 3 : 1, third and fourth veins parallel.

One specimen. Boston, Mass., May, 1914.

Strongylophthalmyia Heller

Heller, Wien. ent. Ztg. xxi, 226 (1902) *Strongylophthalmus* Hendel, Wien. ent. Ztg. xxi, 179–181 (1902).

One species occurs on the Pacific slope, having slender body and long legs suggestive of the Micropezidæ or the Cordyluridæ. The short antennæ and little receding face suggest *Chyliza*, but the slender, impunctate and nearly glabrous body and narrow wings are distinct from that genus. The vestigial, straight and evanescent auxiliary vein, distinct break in the costa before the end of the first vein, relatively long basal cells, absence of oral vibrissæ, slightly divergent postvertical bristles, pubescent arista, absence of distinct pleural bristles, and widely open first posterior cell indicate the family Psilidæ. From *Chyliza* the genus stands out in having the posterior cheeks not swollen, the center of the face neither sunken nor concave, the palpi slender, the pubescence of the notum and pleuræ not dense, appressed or parted in the female, the sides of the metathorax not calloused, the calypteres long-ciliate, the first vein shortened and the anal crossvein incurved. Hendel further characterized his genus as differing from *Chyliza* in having long ocellar and postvertical bristles, the latter located far behind the ocelli, mesopleuræ with distinct prealar bristle, only two strong scutellar bristles, with which chætotaxy the present species agrees. The pteropleural hairs are sparse.

Strongylophthalmyia angustipennis sp. nov.

Length, 3.5 to 5 mm. Head, thorax and abdomen polished black, impunctate, male with striking yellow pubescence, female with pubescence pale and sparse, bristles yellow. Head globose, the anterior part of the front, more extended in the male, the face, very narrow cheeks, and lower occipital orbits yellow, face short and narrow, half the length of the front; eyes large, lower facets larger than the upper ones; two fronto-orbital bristles, frontal triangle not polished; antennæ short, third joint orbicular, large and yellow in the male and brown and smaller in the female, arista brown, very briefly and closely pubescent; proboscis brownish, palpi narrow, yellow in the male and brown in the female. Thorax slender, pectus yellowish, pleuræ nearly glabrous. Abdomen narrow, male genitalia with two small spoon-shaped end-valves and central short penis, female abdomen tapering. Legs including coxæ pale yellow, the tarsi a little brownish, apex of hind femora and middle of hind tibiæ usually dusky. Halteres pale yellow, calypteres yellow, with long fringe. Wings narrow, three times as long as wide, hyaline, veins brown, first vein ending at basal third of the wing, second and third sections of the costa proportioned 2 : 1, sections of fourth vein nearly 1 : 2: 3, the last section arching forward but apically becoming parallel with the third vein, anal vein extending two-thirds the distance to the margin, anal crossvein recurved at tip.

Twelve specimens. Type from Potlatch, on Hood's Canal, Wash., July 28, 1917; others from Blaine, Lynden and Auburn, Wash., and Lake Coeur d'Alene, Idaho, July to September. Several of the specimens were found on windows.

ON CERTAIN SPECIES OF HALTICA, OLD AND NEW.

By H. C. Fall,
Tyngsboro, Mass.

About a year ago, after reading the then recently published paper[1] by William Colcord Woods on the life histories of certain Maine Halticas previously regarded as varieties of *H. ignita* Illig., and having examined typical examples of all forms, kindly sent by Mr. Woods, some observations seemed pertinent to the writer, but the matter was allowed to go by default, and nothing was done beyond communicating one or two points to Mr. Woods by letter, chief of which, perhaps, was the fact that his *Haltica torquata* was not the *torquata* of Le Conte.

More recently comes Mr. Malloch's article,[2] in which he, too, alludes to the probable error in identifying the eastern blueberry flea beetle as Le Conte's *torquata*. Although Mr. Leng frankly admits his responsibility for the mistaken identification, he is by no means the first offender, as the *torquata* mix-up really dates back to Horn's Synopsis of the Halticini in 1889, in which he erroneously

[1] Maine Agric. Exp. Station Bull., 273; October, 1918.

[2] Bull. Brooklyn Ent. Soc. XIV, p. 123.

suppresses the name as a synonym of *carinata* Germ. As a matter of fact, in the series of *carinata* in the Horn collection the name label *is* attached to a specimen of *torquata* bearing the locality label "Bengtn Co., Vt." The type of *torquata* came from Santa Fé, New Mexico (not from Kansas as Malloch says), and while I have seen scores of specimens from New Mexico, Arizona, Nevada and California, I have as yet to see an example from anywhere east of the type locality. Mr. Malloch has specimens from western Kansas which he believes to be the true *torquata*. If he is correct in his identification, this must I think, be the eastern limit of its range; but I strongly suspect his specimens are representatives of an unnamed species which is associated with *torquata* in collections and which will be described in the present article.

The accuracy of the "Vt." label on the Horn specimen may, therefore, be most seriously questioned, the more so, since this is only one of a number of species ranging from the seashore to the western deserts, which bear the impossible label "Bengtn Co., Vt." These all come from the same collector, who undoubtedly mixed material from various sources, and then, perhaps long after, carelessly attached the same locality label to the whole bunch. It, therefore, behooves students of distribution to look with a very critical eye on this particular label before accepting it as genuine.

If, as all the available evidence seems to indicate, *torquata* does not occur east of the Rocky Mountains or vicinity, then it cannot be the *carinata* of Germar, which was described from Kentucky at so early a date that even accidental importation from the western plains or mountains is out of the question. Unfortunately Germar's description of *carinata* is too short and indefinite to be of much service, but it fits as well as any other the *carinata* of the Le Conte collection, which is also (and probably in consequence) the *carinata* at least in part of the most reliable modern collections, and of numerous bibliographical references. In the absence of any definite contradictory evidence this species should continue to bear the name *carinata*. It is not at all similar to *torquata*, but is closely related to *chalybea* and *ignita;* it is the *ulmi* of Woods.

In the Horn Collection specimens of this species are included both with *torquata* in his *carinata* series and with his *ignita* series. The former association is difficult to understand, as they do not at all closely resemble one another, but it explains two confusing statements in his Synopsis. In the table of species *carinata* is characterized as having the ante-basal groove of the thorax moderately deep, evanescent at the extremities and never entire. In the remarks preceding the table of species he says that specimens of *carinata* occur with the impressed line as entire as in *chalybea*. The former statement, as well as the words "bright coppery red with bluish or purplish reflections," is evidently drawn from *torquata*, while the latter statement applies to the true *carinata*. Incidentally it may be remarked that the expressions, "ante-basal groove deep and entire" or "moderate and not entire," which look quite definite and satisfactory on the printed page, are really very difficult to apply in practice. Looked at from one position you unhesitatingly pronounce the groove entire, but viewed from a different angle you are quite as positive it isn't. The only course left to you is to try both roads, but this is no unusual thing in the use of taxonomic keys. But to come back to the *H. torquata* of Woods; if this is not the true *torquata*, what is it? Malloch has assumed it to be an undescribed species, and has proposed the name *sylvia*. This action I fear is premature. A specimen taken by myself at Tyngsboro, Mass., September 1, 1916, has been compared by me with Blatchley's type of *cuprascens* and proved so closely similar that I felt no hesitation in attaching that name to it. A Michigan example sent me by Dury, and others from Michigan, recently seen in the National Museum Collection are quite certainly the same thing, and I have little doubt are identical with Blatchley's type.

That very careful and painstaking work was done by Mr. Woods on the biologies of the Maine Halticas is obvious from a perusal of his report, which constitutes a valuable contribution to the recorded life histories of our coleoptera. The results of his work have thoroughly convinced him of the specific distinctness in all stages of three forms "that in Horn's Monograph would fall under the single species *ignita* Illig." To these he gave the names *corni*, *rosæ* and *ulmi*. As has been stated above, *ulmi* is to the best of our belief the *carinata* of Germar, so that two only are created at the expense of *ignita*. The writer has for some time inclined to the belief that the *ignita* complex would ultimately be broken up into a number of distinct species by more careful study coupled with an association with their food plants; he is, therefore, disposed to accept the conclusions of Mr. Woods, at least until further evidence is forthcoming. On the other hand it must be conceded, that aside from color and size, which may mean much or very little, the differences as presented are all very small and not entirely constant. While a difference in food plant is always suggestive, it is of course by no means necessarily indicative of specific distinctness, the accompanying differences in color, etc., being quite conceivably no higher than racial in character. Mr. Woods' experiments show that the larvæ of all the forms studied could be induced to feed more or less readily on a considerable variety of plants. Apparently no effort was made to carry them through to maturity on any other than their preferred food plant, though the results of such effort, especially if successful, would have been of great interest, as would the results of attempts at cross breeding. Such experimentation is often difficult of accomplishment, and under the most favorable conditions involves skilled handling and a great deal of time. It is to be hoped however that Mr. Woods or some equally competent investigator may continue the work so well begun.

It should be noted that two statements in Woods' "Key to the Adults," on page 154, are more or less misleading. The antennæ of *ulmi* are said to be "one-half the length of the body." This certainly is not always true, since in one of the two typical examples sent me the antenna is extended along the side of the body in good position for comparative measurement and is quite three-fifths as long as the body. Again, the so-called "*ignita* of Chittenden" is said to have "segment 3 of the antennæ longer than segment 4." This is not true of any Haltica in our fauna, unless possibly as an accidental individual variation.

In this connection it becomes of interest to know just what the "*ignita* of Chittenden" is. Referring to his article on "The Strawberry Flea-Beetle"[1] it appears that so far as the beetle is described, it is the broadly conceived *ignita* of Horn's Synopsis, varying in color "from bright metallic golden, coppery, golden brown or purplish, to green and blue" and ranging in distribution from ocean to ocean and from Canada to Mexico. This does not help us any, but some observations made further on in the account of the life history as worked out by the author, supplemented by numerous specimens and some additional data kindly submitted to me by

[1] Some Insects Injurious to Garden Crops, Bull. 23 N. S. U. S. Dept. Agric. 1900.

Dr. Chittenden himself, show conclusively the species which may properly be called the "*ignita* of Chittenden," that is to say, the species whose life history he portrays is the *H. litigata* described some ten years ago by the writer, from Florida specimens. In the material from the Department Collections, sent me for examination by Dr. Chittenden, there are many of this species which so far as known to me ranges from the District of Columbia and Ohio to Florida and Texas, and is evidently common or even abundant in this region, and though partial to strawberry, the beetles at least are inclined to be quite polyphagous, especially when swarming. The pin labels on specimens sent by Chittenden indicate the occurrence of the species on rose at Biloxi, Miss.; on *Œnothera biennis*, "reared from egg indoors," Biloxi, Miss.; on crêpe myrtle at Norfolk, Va., and Melbourne, Fla.; on strawberry at Orlando, Fla., Bellemont and Paget, Bermuda, and Tickfaw, La.; on turnip, Bee County, Tex.; on lettuce and on *Gaura sinuata* at Brownsville, Tex.; on Fuchsia at Washington, D. C. There is no mention whatever of larvæ in the departmental notes relative to the above, except in the case of *Gaura sinuata* at Brownsville, where on March 5, 1909, were found "larvæ eating leaves" and eggs also collected. Gaura is nearly related botanically to Œnothera, and both are undoubtedly natural food plants of this insect.

Referring now to the biologic records, pages 74–76 of Bulletin 23, we may say with considerable certainty that in all mentioned cases of injury to strawberries in Florida, North Carolina, Maryland and Indiana, and to Fuchsia at St. Louis, Mo., the culprit was *H. litigata*. The species reported as feeding on grape at Tempe, Ariz. (Insect Life, Vol. I, p. 220) is without much doubt the *H. torquata*. This, under the name *carinata*, is also reported by Coquillet as feeding on grape at Los Angeles, Calif., and one of his specimens is now before me. The Minnesota "lesser grape vine flea-beetle" of Lugger is in all probability the "sixth" Maine species referred to by Woods, pages 150–151, and found by him on two occasions on woodbine. To this species Woods gave a manuscript name and sent me specimens suggesting that I describe it. On a recent visit to the National Museum at Washington, Mr. Schwarz showed me a long series of a new Haltica of which the life history had been worked out and a description written and already submitted for publication by Mr. Iseley of the Department of

Agriculture. I believe this to be the same as Woods' sixth species and Lugger's grape vine species. As for Bruner's Nebraska species and Gillette's Colorado species nothing definite can be said; Chittenden's brief references give no clue and probably the original articles would be insufficient for identification even if they were accessible to me.

The species occurring on laurel, the *kalmiæ* of Melsheimer, I believe as did Horn, notwithstanding the mysterious "plica submarginali," to be the typical *ignita* of Illiger. It is highly improbable that a distinct species of Haltica with a normal submarginal elytral plica, but otherwise agreeing with our laurel species, can exist in the Atlantic region and no specimens of it have turned up in the more than one hundred years since Illiger published his description. In a recent conversation with Mr. Schwarz, he expressed the opinion that this elytral fold was apt to appear fortuitously in any species of Haltica, more especially in the females. Apropos of this observation, there are now before me three examples of a small Haltica (2♂'s 1♀) recently sent me by Chittenden, in the female of which there is a tolerably well defined lateral elytral plica, while the males show slight traces of it. These specimens were collected at West Springfield, N. H., on Lombardy plum. They resemble greatly and probably are the *H. rosæ* of Woods; however, they diverge slightly from my typical examples of *rosæ*, and in the direction of *ignita* (*kalmiæ* Melsh). What I take to be typical examples of the latter differ from typical *rosæ* in their more brilliant color, slightly larger size, more coarsely punctate elytra, and in having the hind margin of the thorax slightly sinuate each side of the middle so as to present a small median lobe. In my typical *rosæ* there is no trace of such a lobe, but this character is probably not entirely constant, nor are either of the others very dependable. In addition to typical *rosæ*, *corni* and *ulmi*, I received from Mr. Woods specimens of another form, of which he wrote as follows: "I have taken another member of the *ignita* group on laurel and am sending specimens under separate cover. I am calling it *kalmiæ* MS. This runs close to *rosæ* in every character, as far as eggs, larvæ and pupæ are concerned." From the above it must be obvious that *rosæ* and *ignita* (*kalmiæ* Melsh = *kalmiæ* Woods MS.) are exceedingly close if actually distinct, and that the Lombardy plum female with the submarginal plica might serve very well for the type of Illiger's description. It will be of interest to note that laurel was not among the food plants offered the *rosæ* larvæ in Woods' experiments, but that wild plum was offered and refused.

The following additional biologic notes gleaned from the material sent me by Chittenden may well be put on record at this time, but it should be borne in mind that unless otherwise stated it is only the beetles that were found upon the plants, and that in some instances, at least, the visitation probably has no economic significance whatever.

H. bimarginata Say. Intervale, N. H., bred from alder; Gardiner, Me., collected on alder; Brownsville, Tex., feeding on willow; Guadalupe, Cal., on willow. This is the well-known alder flea-beetle; its occurrence on willow is more exceptional.

H. carinata Germ. Mont Alto, Pa., on elm.

H. chalybea Ill. Orlando, Fla., and Warrenton, Va., on grape.

H. evicta Lec. Moscow, Idaho, on strawberry.

H. foliacea Lec. Tecumseh, Okla., "Coll on apple"; Garden city, Kans., "feeding on weeds"; Childress, Tex., "on sugar beets."

H. knabii Blatch. Marshall Hall, Md., reared from larvæ taken in field on *Œnothera biennis*. The specimens bear the label *H. fuscoænea* Melsh, as they probably do in other collections.

H. probata Fall. San Luis Obispo, Calif., "on wild rose."

H. suspecta Fall. Corcoran, Calif., "on sugar beets."

H. vicaria Horn. Fort Collins, Colo., "Sugar beets." I do not think it likely that either of the last two species attack beets in the larval stage or that the beetles will prove a menace to crops.

To the systematist the genus Haltica offers very great difficulties; hence the especial need for the illumination which the complementary work of the biologist may shed upon the obscure relationships of the *ignita* group. While we have as yet no record of the food plant or habits of *H. inærata* Lec. of the Manitoba region, an examination of the type convinces me that it should be restored to specific standing. It should probably be associated with *ignita* and allies, but it differs more from either *ignita*, *rosæ* or *corni* than they do from each other. The ante-basal groove of the thorax, though entire, is less deep than in either of these, the form rather narrower and less broadly shouldered, the color brown bronzed, the elytra typically with a faint greenish reflection which is often lacking. The resemblance of *inærata* to *obolina* of the Pacific region is more marked than to any of the eastern forms, but the basal impression of the thorax is much stronger than in the latter. I have seen a good series of *inœrata* collected at Winnipeg and Husavick, Manitoba (Wallis).

There are yet a considerable number of probably new species in my collection, of which the following four may I think be described at this time in a recognizable manner.

Haltica purpurea sp. nov.

Oval, moderately elongate, dark bronze, the elytra with distinct purple lustre, surface shining. Head and thorax very finely alutaceous, varying to scarcely visibly so; elytra distinctly alutaceous. Antennæ piceous, about $\frac{3}{5}$ as long as the body, 4th joint slightly to scarcely longer than the 3d, fully twice as long as wide; 10th not quite twice as long as wide. Head $\frac{3}{5}$ as wide as the prothorax, eyes only moderately prominent, their width as seen from the front evidently less than half the interocular distance; vertex contiguous to the flattened tubercles smooth, almost without punctures. Prothorax $\frac{2}{3}$ as long as wide, sides narrowly margined, narrowed in front, subparallel in basal half and either with or without a feeble sinuation before the hind angles; punctuation sparse and minute, ante-basal impression fine and sharply defined, but not deep and not quite attaining the sides. Elytra distinctly oval in outline, widest at the middle, not quite $\frac{1}{2}$ wider than the thorax in the male, the female a little stouter; punctuation much more distinct than that of the thorax, but rather fine, the punctures separated on the average by about twice their own diameters, intermixed finer punctures almost entirely lacking. Body beneath and femora piceous, more or less distinctly purpureous; tibiæ and tarsi scarcely metallic. Last ventral of male with the usual apical lobe and smoother median impression. Length, 3.3 to 3.8 mm.; width, 1.8 to 2.1 mm.

Described from a series of 3♂'s, 1♀, taken at Tyngsboro and near Lowell, Mass., by the late Frederick Blanchard, from whom I received them.

An attempt to place this species by Horn's table through a strict interpretation of the characters there used is likely to prove abortive. The oval form of the elytra is quite suggestive of the much larger *californica* and *obliterata*, as well as *cuprasceus* Blatch.

and the smaller *fuscoænea.* My suggestion would be that these five species together with *heucheræ* sp. nov., the description of which follows, should be associated in the following order: *obliterata, californica, cuprascens, purpurea, heucheræ, fuscoænea. Purpurea* is probably nearest *cuprascens*, the latter differing in its cupreous coloration, rather larger size and more elongate form, feebler pronotal groove, usually finer elytral punctuation and longer fourth antennal joint, which is three times as long as wide and decidedly longer than the third joint. There are numerous specimens of this species in the Blanchard Collection, now in the Museum of Comparative Zoölogy at Cambridge, Mass. The type is a male labeled "near Lowell, Mass."

Haltica heucheræ sp. nov.

Moderately elongate, head and thorax cupreoæneous, with feeble violaceous lustre, elytra distinctly purpureo-violaceous. Antennae scarcely more than half the length of the body, piceous, joints 2–4 testaceous, several of the following joints more or less rufous basally; joints 3 and 4 subequal, the latter at most only slightly longer, 4th joint twice as long as wide, 10th scarcely more than $\frac{1}{2}$ longer than wide. Head smooth, polished; eyes smaller than usual, feebly prominent, their width as viewed from the front much less than half the interocular distance. Prothorax quadrate, less than $\frac{1}{2}$ wider than long, sides parallel, rather strongly margined, feebly arcuate medially, surface finely alutaceous, and finely rather sparsely punctate; ante-basal groove moderately deep and practically entire. Elytra suboval, humeri narrow and broadly rounded, sides feebly arcuate or (♂ type) straight and parallel for a short distance at middle; surface distinctly alutaceous and rather coarsely punctate, intermixed finer punctures scarcely evident. Body beneath and legs, except tarsi, piceous with purplish surface lustre. Male with the last ventral segment lobed and impressed as usual. Length, 3.5 to 3.8 mm.; width, 1.7 to 1.85 mm.

Described from four examples (type ♂) collected by Mr. Norman Criddle at Aweme, Manitoba "25–IX–1916," on *Heuchera hispida.* The specimens were sent me by Mr. J. B. Wallis, in whose collection are paratypes. The quadrate thorax and oval elytra suggest association with *fuscoænea*, before which this species may be placed as indicated in the remarks following the preceding description. It is much larger than *fuscoænea*, of different color, with smaller less prominent eyes, more distinctly punctate thorax with deeper ante-basal groove, and entirely dark legs.

Haltica blanchardi sp. nov.

Elongate oblong, green, elytra slightly, thorax rather strongly æneous. Antennæ a little longer than half the body; piceous, with slight metallic lustre; joints 3 and 4 subequal. Eyes prominent, their width as seen from the front nearly equal to half the interocular distance. Head above the frontal tubercles not visibly alutaceous and nearly impunctate. Prothorax $\frac{1}{3}$ wider than long, sides parallel in basal half, convergent in front, subangulate medially, side margin moderate, surface plainly alutaceous, distinctly though finely punctate, basal groove rather wide, vaguely attaining the sides, sharply impressed at bottom, this sharper impression terminating before reaching the margins; hind margin broadly angulate at middle. Elytra oblong, not quite twice as long as wide, sides parallel for $\frac{3}{4}$ their length, surface distinctly alutaceous and rather coarsely and closely punctate with scattered minute punctures intermixed. Body beneath and legs piceous with distinct purple metallic lustre. Length, 3.1 mm.; width, 1.4 mm.

Three examples only of this species are known to me; the type, taken by myself at Tyngsboro, Mass., July 6, 1893, and two other examples in the Blanchard Collection, also taken at Tyngsboro. In size and form it agrees very closely with *amœna* Horn and *vaccinea* Blatch., and with them only. In both these species the color is more decidedly cupreous, and in neither of them is the surface sculpture so marked as in *blanchardi*, which has a finely scabrous aspect. In *amœna*, described from a unique example from Georgia, the elytral punctuation is about as coarse but less dense than in *blanchardi*, the thorax obsoletely punctulate, the basal impression not quite so strong though quite sharply defined. Horn's statement that the antennæ are slightly longer than the body is a manifest inaccuracy, nor should I describe the humeri as oblique. The Floridian species *vaccinea* differs notably from *blanchardi* in its smaller less transverse prothorax, with nearly straight feebly converging sides, and with polished almost imperceptibly punctate surface.

Haltica vialis sp. nov.

Oblong oval, color above and beneath including the legs purpureo-violaceous; sutural region especially toward the base, with greenish reflections. Antennæ dark throughout, feebly metallic, third and fourth joints subequal. Eyes not very prominent, their width viewed from in front less than half the interocular distance. Head smooth posteriorly; vertex, contiguous to the flattened tubercles coarsely punctate from side to side. Prothorax moderately transverse, a little narrower in front, widest behind the middle, sides broadly arcuate, feebly convergent basally, more noticeably so anteriorly; surface scarcely visibly alutaceous, closely comparatively coarsely punctate; ante-basal groove rather feeble, shallow and incomplete. Elytra oblong, slightly oval, sides very broadly arcuate, surface a little more coarsely punctate than the thorax but scarcely as closely so. Body beneath often with greenish reflections. Male with last ventral lobed as usual and with an unusually deep polished median longitudinal impression in posterior half. Length, 4.7 to 5.1 mm.; width, 2.2 to 2.5 mm.

The type is a male and is one of two examples taken by myself at Raton, New Mexico, November 8, 1889. The specimens were taken, if I remember correctly, under shelter of some sort near the railway station while stopping for lunch on my first transcontinental trip to California. I have since similarly taken the species at Seligman, Ariz., and have an example from Flagstaff, Ariz., taken by Dr. Fenyes. There are examples in the Le Conte Collection from Colorado and western Kansas (Popenoe), and in the Horn Collection from Colorado, in both cases placed with the superficially rather similar *torquata*, and both combined with the very different eastern *carinata*, a mix-up that it is certainly difficult to comprehend. Compared with *torquata* the present species is rather larger and more robust, with a much larger thorax and conspicuously coarser punctuation throughout. The ante-basal groove of the thorax is also less sharply defined and the last ventral of the male more deeply impressed.

DESCRIPTIONS OF SOME NEW TROPICAL PACHYGASTRINÆ.

By Charles W. Johnson,
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In describing a species of Psephiocera from Jamaica, my attention was called to two apparently new species, representing one Psephiocera and one Chalcidomorphina from British Guiana. The above genera by Dr. Enderlein cover these forms, while a paper by Dr. Kertész enables us positively to determine Cynipimorpha. With the limited material at hand, it is with some misgivings that I offer this paper, but the difficulty of obtaining smaller species from that region is so great that years slip by and they remain undescribed. For instance, the specimens at hand have been in my possession over eighteen years. It is to be hoped that the following bibliography and table of species will aid future workers.

Cynipimorpha bilimeki Brauer. Fig. 1.

C. bilimeki Brauer, Denkschr. der K. Akad., Wien, XLIV, 75, 1882; Kertész, Ann. Mus. Nat. Hung., VI, 343, Tab. 6, Figs. 1, 2, 1908.

In the latter paper Dr. K. Kertész has carefully redescribed Brauer's type and figured the antenna, thus enabling one to readily identify this species which otherwise would have continued to cause confusion among the closely related genera and species. I herewith reproduce the figure given by Kertész. The genus has been emended to *Cynipomorpha* by Enderlein, but the original spelling will have to stand.

Psephiocera Enderlein.

Zoölogischer Anzeiger, 1914, Band 43, p. 300. Type *P. flavipes* Enderlein.

Table of Species.

1. Tomentum forming lines on the disc of the thorax 3
   Tomentum covering the entire thorax 2
2. Scutellum and part of the pleura with light tomentum (Mexico) *minuta* Will.
   Scutellum with black tomentum, pleura shining black without tomentum (S. Brazil) . . . . *flavipes* Enderl.

3. Thorax with three lines of light tomentum which is also present on the sides, and on the middle of the pleura (Jamaica) *metzi* Johns.

Thorax with a dorsal line of light tomentum, expanding into a large patch in front of the scutellum, also present on sides and on part of pleura (Brit. Guiana)....*dorsata* sp. nov.

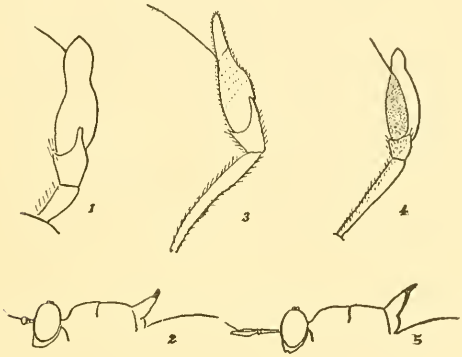

Fig. 1. Antenna of *Cynipimorpha bilimeki* ♂, after Kertész; Fig. 2, scutellum of *Psephiocera minuta;* Fig. 3, antenna of *Chalcidomorphina aurata* ♀, after Enderlein; Fig. 4, antenna of *Chalcidomorphina crewi* ♀, Fig. 5; Scutellum of same.

Psephiocera minuta (Williston). Fig. 2.

Cynipimorpha minuta Williston, Biol. Cent. Amer., Vol. I, p. 252, Tab. 4, Figs. 19, 19a, 1901; Kertész, Ann. Mus. Nat. Hung., Vol. 4, p. 343, 1908.

Psephiocera minuta Enderlein, Zoöl. Anz. Band 43, p. 302, 1914.

Eucynipimorpha minuta Malloch, Ann. Ent. Soc. Amer., Vol. 8, p. 312, 1915.

As pointed out by Dr. K. Kertész this species cannot be placed in the same genus with *Cynipimorpha bilimeki* Brauer on account of the great difference in the antennæ. It was later placed by Dr. Enderlein in the above genus. A specimen in my collection from Mexico agrees with Williston's description except that the femora are yellow with a slight brownish tinge below, and not "except the tips, nearly black." This is evidently a variable character and the specimen probably represents the extreme range of variation in this respect. The third joint of the antennæ under a hand lens (12 diameters) is "finely roughened" but under the binocular with an enlargement of from 25 to 60 diameters the annuli show distinctly and the roughening is due to rows of minute granules on the annuli; the third joint is yellow with a dark brown spot at the base. In this respect the genus seems to be closely related to Neopachygaster, the glossy brown spot on the antennal joint, which Malloch refers to as "possibly of a sensory nature," is here largely developed. The only other character that seems to separate the two genera is the form of the scutellum. The side view given of *C. minuta* (fig. 19a) shows two small dorsal protuberances at the suture that are not mentioned in the description, nor are they shown in the dorsal view (fig. 19).

Psephiocera metzi Johnson.

Diptera of Jamaica, Amer. Mus. Nat. Hist., Vol. 41, p. 427, 1919.

The apex of the scutellum is slightly shorter and less attenuated in this and the following species, than in *P. minuta* Will.

Psephiocera dorsata sp. nov.

♀ Front black, orbital margins whitish, face white, antennæ yellow, the third joint with five narrow annuli, with a small brown basal spot, arista yellow. Thorax black when viewed from above, the yellowish tomentum forming a dorsal line extending just beyond the suture where it expands into a broad patch in front of the scutellum; there is also an obsolete transverse band in front of the suture; from the humeri large patches of whitish tomentum extend to the base of the wings and across the pleura; base of the scutellum with yellowish tomentum. Abdomen black, looking from behind the fourth segment has three lines of white tomentum, with only the dorsal line showing on the fifth segment, third segment with only a lateral patch when viewed from the side. Legs yellow, femora except at the tips dark brown, front tibiæ also brown, halteres white. Wings hyaline, costa and first longitudinal vein dark brown, stigma yellow, length, 3 mm.

One specimen, Bartica, British Guiana, May 28, 1901 (R. J. Crew). Type in the author's collection.

Chalcidomorphina Enderlein.

Zoologischer Anzeiger, 1914, Band 43, p. 298. Type *C. aurata* Enderlein.

Chalcidomorphina aurata Enderlein. Fig. 3.

Zoologischer Anzeiger, 1914, Band 43, p. 299, figs. 4, 5. Columbia.

The principal character that separates this from the following species is the form of the antennæ. The scutellum of the genotype was missing, but it is probably similar to the following species which is here figured.

Chalcidomorphina crewi sp. nov. Figs. 4, 5.

♀ Face black, whitish pollinose, front black shining, with white orbital spots midway between the vertex and antennæ, from these very narrow orbital lines extend to the face, ocelligerous tubercle prominent, ocelli yellow, antennæ situated about the middle of the head in profile, blackish above and yellow below, first joint slender, about as long as the second and third combined, third joint broadened and somewhat flattened above and minutely flecked with white. Thorax black, with a dorsal line, a narrow transverse band at the suture, and a broad band near the base of the scutellum of yellow tomentum, on the humeri and pleura whitish, scutellum black, the tip longer and more attenuated than in the species of the genus Psephiocera, abdomen black, with a grayish pollinose arcuate band at the posterior margin of the third and anterior margin of the fourth segment, and a V-shaped marking at the end partly on the fourth and partly on the fifth segment. Legs yellow, the anterior femora brownish, halteres white. Wings hyaline with a slight brownish tinge, more noticeable toward the tip, veins brown, stigma yellow, middle portion of the costa and tip of the first vein dark brown, third vein branched. Length, 3 mm.

One specimen collected by Mr. R. J. Crew, at Bartica, British Guiana, July 3, 1901. Type in the author's collection.

NOTES ON THE LINES OF DESCENT OF LOWER WINGED INSECTS.

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In the February issue of the *Entomological News* for 1919 (Vol. XXX, p. 42) the lines of descent of the Orthoptera and their immediate relatives, were discussed from the standpoint of the comparative morphology of recent forms; but no attempt was made at that time to bring the results into harmony with the conclusions of Handlirsch, 1909 (Die Fossilen Insekten), who has attacked the problem from the standpoint of palæontology. I would, therefore, offer the following brief suggestions as to the location of the lines of descent of certain of the fossil forms described by Handlirsch, in the general scheme of the interrelationships of living insects. It should be borne in mind, however, that since the earlier fossil forms are known almost exclusively from their wing-venation, the position they are assigned in the general scheme is largely conjectural, and must remain so until more of their anatomical details than the few incomplete fragments thus far brought to light are known—for the wing-venation alone (or any other one set of structures) is entirely insufficient evidence upon which to base one's conclusions as to the interrelationships of insects. A good illustration of this point is furnished by the fossil insect *Eugereon*, in which the wings are very conservative (*i. e.*, but slightly modified) while the head has proceeded far along the road to specialization—so much so, in fact, that it would be practically impossible to place *Eugereon* correctly in the general scheme, if it were known only through the venation of its wings. In the recently discovered winged Zoraptera (Proc. Ent. Soc. Washington, Vol. 22, p. 84, and p. 98), on the other hand, the wings are quite highly specialized, while the body structures are quite conservative, and if the detached wings were the only structures known, it is very doubtful if we would be able to place these insects in their correct position next to the line of development of the Isoptera.

As was pointed out in the August, 1919, issue of the Transactions of the Entomological Society of London (p. 93), the Ephemerida, Odonata, and certain Palæodictyoptera form a group characterized by their inability to fold their wings flat along the top of the abdomen, and in an article in the May, 1920, issue of the Proceedings of the Entomological Society of Washington (Vol. 22, p. 98) these insects, together with their immediate relatives (*i. e.*, the Protephemerida, Ephemerida, Protodonata, Odonata, certain of the Palæodictyoptera, etc.), were grouped in an ancestral superorder of insects called the Panpalæodictyoptera, or Panplectoptera (from Packard's term "Plectoptera," applied to the Ephemerida). The lines of development of these insects are shown in Fig. 1, although all of the fossil forms are not represented in the diagram.

As is indicated in Fig. 1, the fossil Palæodictyoptera occupy a position at the base of the lines of descent of other winged insects, and have apparently departed as little as any known forms from the first types of winged insects to be evolved. Some of the insects usually included in the order Palæodictyoptera are apparently more closely related to the insects grouped about the Plecoptera, and should be included in the next superorder (Panplecoptera).

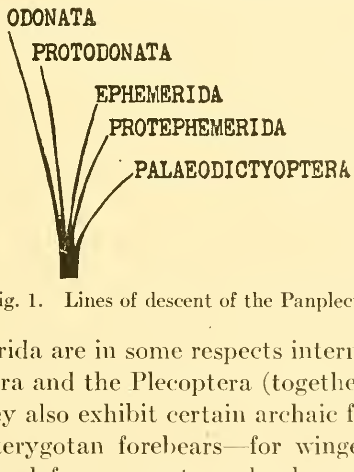

Fig. 1. Lines of descent of the Panplectoptera.

The Ephemerida are in some respects intermediate between the Palæodictyoptera and the Plecoptera (together with certain other forms), and they also exhibit certain archaic features carried over from their Apterygotan forebears—for winged insects were undoubtedly derived from ancestors closely resembling the Lepismidæ and other Apterygota, and could not possibly be derived directly from the Trilobita as Handlirsch would have us believe! The Ephemerida have also retained certain features suggestive of Crustacean affinities, and a study of their anatomy (particularly of the immature stages) is of considerable value in tracing the evolution of the higher forms. Handlirsch considers that the Ephemerida were derived from the fossil Protephemerida, and that the Odonata were derived from the fossil Protodonata, and the lines of development of these forms were therefore placed close together in the diagram. The Odonata are apparently fairly closely related to the Ephemerida, but their line of development leads away from that of most of the other insects, and they are such highly aberrant forms that a study of their anatomical features is of but little value in attempting to trace the lines of descent of winged insects in general.

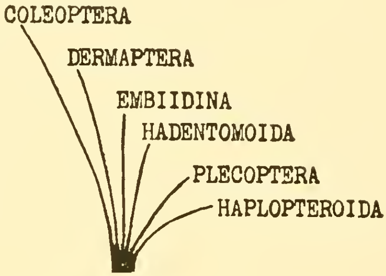

Fig. 2. Lines of descent of the Panplecoptera.

In Fig. 2, the lines of descent of the insects comprising the superorder Panplecoptera (*i. e.*, the Haplopteroida [fossil], Plecoptera, Hadentomoida [fossil] Embiidina, Dermaptera, Hemimeridæ, etc., and possibly including the Coleoptera as well) are shown. If we take into consideration only the Plecoptera, Embiidina, and Dermaptera, the group is characterized in general by a tendency toward the prognathous type of head (*i. e.*, mouthparts directed forward), the presence of three segments in the tarsi, and the absence of styli on the posterior margin of the hypandrium, or sternal plate beneath the genitalia of the male insect. The mesothoracic coxæ are usually as broad, or broader than long in these insects, and there is a marked tendency toward the retention of the longitudinal, rather than the cross veins of the wing in the members of the group.

Handlirsch states that the fossil Haplopteroida are closely related to the Plecoptera and that the fossil Hadentomoida are closely related to the Embiidina, so that the lines of descent of these forms have been represented as though extending rather close together in the diagram. The Haplopteroida are in some respects more specialized than the Plecoptera, and their line of descent should have possibly been placed above that of the Plecoptera in the diagram.

Of the living forms, the Embiidina are the closest relatives of the Plecoptera, the two lines of development paralleling one another remarkably closely. The Plecoptera are the more primitive of the two, however, and have departed as little as any known living insects, from the condition typical of the ancestors of the other insects of the group—and of the remainder of winged insects as well. The Dermaptera are related to both Embiids and Plecoptera, and are intermediate between these insects and the Isoptera in many anatomical features. The Dermaptera are also extremely like the forms ancestral to the Coleoptera in regard to their maxillæ, antennæ, terga, wing bases, elytra, cerci (compare larvæ of Carabidæ with immature earwigs such as *Dyscritina*, *Karschiella*, etc.), etc., and the members of the superorder Panplecoptera exhibit many other features which must have been present in the ancestors of the Coleoptera (compare head region of *Harpalus* and *Embia*, leg structures etc.). On the other hand, the Neuroptera (and in some respects the Hymenoptera also) are remarkably like the Coleoptera especially with regard to the structural details of the larvæ, so that the Coleoptera could equally well be placed in the superorder Panneuroptera (to which the Neuroptera, Hymenoptera, etc., belong) as in the superorder Panplecoptera, and on this account the Coleoptera have been grouped with the Neuroptera only provisionally, until I am able to find the forms which will enable me to determine definitely whether the closest affinities of the Coleoptera are with the Dermaptera and their allies, or with the Neuroptera and their allies. Anatomically, the Coleoptera are clearly intermediate between the Neuroptera and Dermaptera, and the ancestors of the Coleoptera were apparently intermediate between the Isoptera on the one hand, and the Dermaptera, with their allies, on the other, although the "roots" of the Coleopteron stem strike down deeply toward the Embiid and Plecopterous types of insects.

The Zoraptera, Isoptera, Mantida, Blattida, and the fossil Protoblattida, with their immediate relatives, constitute the superorder Panisoptera, whose members are characterized chiefly by the markedly asymmetrical development of the genitalia of the male insect, although this does not hold true of the Isoptera, in which the genitalia of the male are not sufficiently well developed to be readily seen. The hypandrium, or sternal plate below the genitalia of the male, frequently bears a pair of styli on its posterior margin, in these insects, and cerci are present in practically all of them. The mesothoracic postscutellum is vestigial in the winged forms of most of these insects (excepting the Zoraptera) and the mesothoracic coxæ are longer than broad in the greater part of the insects constituting this superorder. The lines of descent of these insects are represented in Fig. 3.

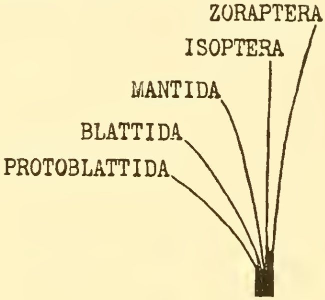

Fig. 3. Lines of descent of the Panisoptera.

Since Handlirsch maintains that the Protoblattida are intermediate between certain of these insects and the Palæodictyoptera, the line of development of the Protoblattida has been represented as the lowest in the diagram (Fig. 3), although not very much is known of the structural details of the Protoblattida, to justify this. The more immediate ancestors of the insects comprising this superorder (Panisoptera) were doubtless very like the Plecoptera and their allies, although the *ultimate* ancestral types of these insects and the Plecopteroid forms as well, are doubtless to be sought among the members of the Palæodictyopteroid group. Indeed, the more the Protoblattida depart from the Blattid and Mantid type, the more closely do they approach the Plecopteroid type, thus indicating that the latter forms resemble the immediate ancestral forms from which the Panisoptera were derived.

The Blattida and Mantida are extremely closely related and their lines of descent have been represented quite close together in the diagram. Taken alone, it would be rather difficult to determine what living insects are the nearest to the ancestral type from which they were derived; but their near relatives, the Isoptera, are intermediate between the Mantid-Blattid forms and the insects related to the Plecoptera, such as the Dermaptera and Embiidina, and thus serve to connect the two groups. The Isoptera are in some respects more highly specialized than the Blattida; but in other features they are much nearer the ancestral Plecopteroid type, and might, therefore, be considered as in a sense more "primitive" than the Blattida. The Zoraptera are very close to the Isoptera; but have preserved many characters present in the Plecopteroid group. In fact, they are anatomically intermediate between the Isoptera on the one hand, and the Plecoptera (such as *Leuctra*, *Capnia*, etc.) on the other, as was pointed out in a recent article in the Proceedings of the Entomological Society of Washington (Vol. 22, p. 98). They thus serve to connect the Isoptera with the Plecopteroid group, and the Isoptera in turn serve to connect them with the Mantida and Blattida. Furthermore, the Zoraptera are remarkably similar to the ancestors of the Psocidæ, the Thysanoptera, and the Psyllid Homoptera, and are very suggestive of the forms leading to the Hymenoptera and Neuroptera, so that a study of their anatomical details is of the utmost importance in attempting to determine the paths of evolution of the higher forms.

The fossil Protorthoptera, the Grylloblattida, Phasmida, and saltatorial Orthoptera, with their immediate relatives, constitute the superorder Panorthoptera, whose lines of descent are represented in Fig. 4. The ovipositor of the female insect is unusually well developed in many members of this group, and many of them exhibit a tendency toward a thickening of the forewings, which are typically parchment-like in character. The cerci are usually reduced to a single segment (but not in *Grylloblatta*) and there is a tendency toward a reduction of the number of tarsal segments to four or less, in many members of the group. The males of some of these insects have retained a pair of styli on the posterior margin of the hypandrium (ninth sternite), and the genitalia are for the most part of a peculiar, highly modified type (excepting *Grylloblatta*).

Since Handlirsch maintains that the fossil Protorthoptera are very like the ancestors of the insects in question, their line of descent is represented as among the lowest of those shown in Fig. 4. Such forms as *Grylloblatta* and the interesting little Phasmid

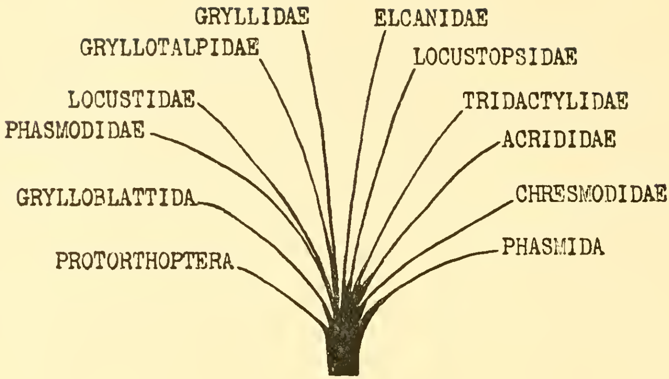

Fig. 4. Lines of descent of the Panorthoptera.

Timema, however, give us a much better idea of the structural details of the lower representatives of the group, since the fossil forms are too poorly preserved for this purpose. *Grylloblatta* is structurally intermediate between the Zorapteron-Isopteron group and the Dermapteron-Embiid group of insects, while *Timema* exhibits more Plecopteroid characters than *Grylloblatta* does. In fact *Timema* exhibits such pronouncedly Plecopteroid features that there can be no doubt that the Plecoptera and their relatives represent the ancestral forms from which such insects as *Timema* (and hence those insects grouped with it) were derived. Of the other Orthopteroid insects, the Gryllidæ and "Locustidæ" (Tettigoniidæ) are very like *Grylloblatta*, while the Acrididæ (*i. e.*, true Locustidæ) and Tridactylidæ are nearer the Phasmidæ.

According to Handlirsch, the fossil Chresmodidæ are very closely related to the Phasmidæ, and are intermediate between the Phasmidæ and the fossil Elcanidæ, from which Handlirsch would derive the Tridactylidæ. Handlirsch derives the Acrididæ from the fossil Locustopsidæ, and he considers that the Elcanidæ and Locustopsidæ are somewhat intermediate between the Acrididæ and the Locustid-Gryllid group, so that they have been assigned this position in the diagram shown in Fig. 4—although the diagram in question is somewhat different from that given by Handlirsch to illustrate the interrelationships of the forms in question, especially with regard to the position assigned to the Phasmidæ, which Handlirsch considers as derived forms, rather than as primitive representatives of the types ancestral to the saltatorial Orthopteroids. Handlirsch, however, has reversed the evolutionary sequence in other instances as well, since he would derive the anatomically and embryologically more primitive Dermaptera from Gryllidæ, and the fact that he derives the Hemimeridæ (which are really a suborder of the Dermaptera) as a distinct offshoot of the Gryllidæ, would make it seem probable that he is not very familiar with the anatomy of the insects in question.

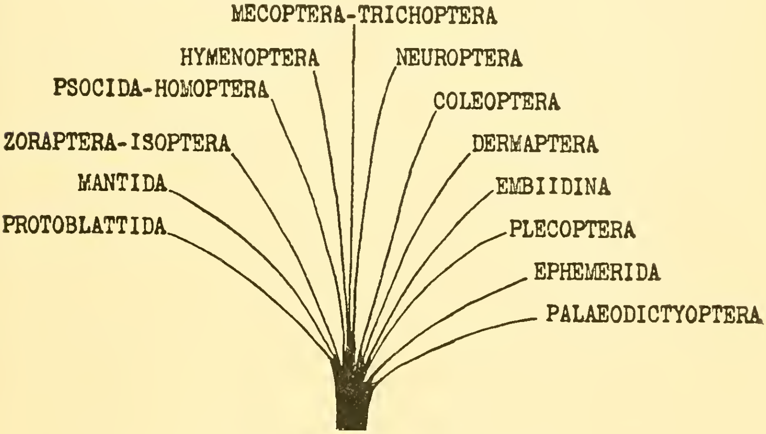

Fig. 5. Lines of descent of higher insects.

In Fig. 5, are shown the interrelationships of the insects occupying a position near the base of the lines of descent of the higher forms. The most important of these are the Zorapteron-Isopteron group, and the Coleoptera with the Dermaptera, since the lines of descent of the Zoraptera, the Hymenoptera and the Neuroptera were derived from ancestors intermediate between these insects, while the Psocidæ, Hymenoptera and Neuroptera are in turn intermediate between these insects and the higher forms such as the Homoptera, Mecoptera, Trichoptera, etc. Thus, the Psocida were evidently derived from ancestors extremely similar to the Zoraptera,[1] while the Psocida are in turn very like the ancestors of the Homoptera (which gave rise to the Hemiptera). The

[1] As has been pointed out in a short paper soon to be published, the wing-veins of the Zoraptera are remarkably similar to those of certain Psocida Thysanoptera and Homoptera.

Hymenoptera occupy a position somewhat intermediate between the Psocida and Neuroptera, but they are also very closely related to the Coleoptera, and it is very probable that their ancestors were anatomically intermediate between the Zoraptera (with the Isoptera) and the Coleoptera (with the Dermaptera). The Mecoptera (and Trichoptera) are quite closely allied to the Hymenoptera on the one hand, and the Neuroptera on the other, although their closest affinities are with the Neuroptera, such Neuroptera as *Nemoptera* being extremely like the forms giving rise to the Mecoptera and to the Diptera, which were derived from Mecoptera-like forebears. The Trichoptera and Lepidoptera, although related to the Mecoptera also, were probably derived from Neuropteroid ancestors closely resembling the Ithoniidæ (such as *Oliarces*). The Neuroptera themselves are extremely closely related to the Coleoptera, and doubtless arose from ancestors intermediate between the Coleoptera (with the Dermaptera and Embiidina) and the Zorapteron-Isopteron group—in other words, the lines of descent of the Psocidæ, Hymenoptera, Neuroptera and other insects at the base of the stem of the higher forms converge to a point intermediate between the Zorapteron-Isopteron group on the one side, and the Coleopteron-Dermapteron group (with the Embiidina) on the other; so that these groups are of the greatest phylogenetic interest, not only from this fact, but also from their position on either side of the stem forms from which the Orthopteroid insects were likewise developed.

With regard to the grouping of the different insect orders into superorders,[1] there are apparently eight principal superorders in the class Insecta. Of these, the superorders Panprotura and Panthysanura belong in the subclass Apterygota, while the other six belong in the subclass Pterygota. The principal representatives of these superorders are as follows:

Proturoid Superorder (Panprotura)

  Protura, Entomobryoida, Sminthuroida, etc.

Thysanuroid Superorder (Panthysanura)

  Campodeoida,[2] Lepismatoida, Machiloida, etc.

[1] If it be advisable to restrict the termination "*ptera*" to groups of ordinal rank, the above-mentioned eight superorders might be termed the Poduriformia, Lepismiformia, Ephemeriformia, Perliformia, Phasmiformia, Blattiformia, Psociformia, and Sialiformia.

[2] A study of the anatomical details of *Campodea*, *Projapyx*, *Japyx*, etc., has shown that these insects belong to a single order, and that the division into Rhabdura and Dicellura is of subordinal value only.

Palæodictyopteroid Superorder (Panpalæodictyoptera)
  Protephemerida, Ephemerida, Protodonata, Odonata, Palæodictyoptera, etc.
Plecopteroid Superorder (Panplecoptera)
  Haplopteroida, Plecoptera, Hadentomoida, Embiidina, Dermaptera, etc.
Orthopteroid Superorder (Panorthoptera)
  Protorthoptera, Grylloblattoida, Phasmoida, Orthoptera, etc.
Isopteroid Superorder (Panisoptera)
  Protoblattoida, Blattoida, Mantoida, Isoptera, Zoraptera, etc.
Psocoid Superorder (Panhomoptera)
  Psocoida, Mallophaga, Pediculoida, Homoptera, Hemiptera, Thysanoptera (?), etc.
Neuropteroid Superorder (Panneuroptera)
  Neuroptera, Hymenoptera, Mecoptera, Protomecoptera, Paramecoptera, Paratrichoptera, Trichoptera, Lepidoptera, Diptera, Siphonaptera, (and possibly Coleoptera and Strepsiptera?).

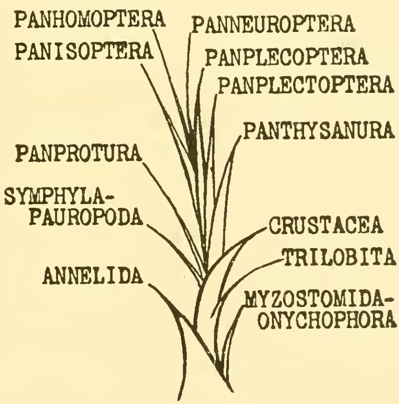

Fig. 6. Grouping of superorders in general scheme.

The interrelationships of these superorders, and their positions in the general scheme, are represented in Fig. 6. As is indicated in the diagram, the Annelida represent as nearly as any known forms, the ancestral types giving rise to the Arthropoda. The Myzostomida-Onychophora group (including the Tardigrada) arose very near the point of origin of the Arthropoda, but these forms are of less interest than the Annelida themselves (*e. g.*, *Dujardina*, and other Syllidæ) in the study of Arthropodan development.

The Trilobita and such Crustacea as the Apodidæ (together with the Copepoda) are among the most primitive representatives of the Arthopoda, and the Crustacea in particular furnish us with a series of forms from the lowest type to the ancestors of the "Myropoda" and Insecta, and some of them, such as the Isopoda, Tanaidacea, etc., have paralleled the insectan line of development in the most remarkable fashion, the resemblances in many cases extending even to the minutest details, as I am hoping to show in a series of papers dealing with this subject. The "Myriopoda" apparently branched off from the Crustacean stem from ancestors resembling *Bathynella* and other Anomostraca, and the Insectan line of development arose near the same point. Some of the lower Apterygota carried over in their development many features inherited by such "Myriopoda" as the Symphyla and Pauropoda (as is the case with the Protura, Campodeoida, etc.); but many more Crustacean features were inherited by the forms leading up to winged insects, such as *Machilis*, *Lepisma*, etc., and were carried over in the Ephemerida.

As is shown in the diagram (Fig. 6), the members of the Palæodictyopteroid superorder (*i. e.*, the "Panplectoptera") arose from forms resembling the Panthysanura, or Thysanuroid superorder of Apterygotan insects, and are intermediate between the latter and the Panplecopteroid superorder (with the Panisoptera). The higher insects (*i. e.*, the Psocoid and Neuropteroid superorders) in turn, arose from ancestors intermediate between the Panisoptera and Panplecoptera, although the "roots" of these stems strike downward into the Palæodictyopteroid forms also, as is indicated by the carrying over of certain Palæodictyopteroid features in their lines of descent.

The occurrence of annectent forms intermediate between two or more superorders makes it extremely difficult in some cases, to determine exactly where these forms belong. Thus the Coleoptera might be grouped either with the Neuropteroid insects or with the Plecopteroid insects (Dermaptera, etc.), while it is extremely difficult to determine whether to place the Grylloblattoida with the Isopteroid insects, or with the Orthopteroid insects—or even with the Plecopteroid forms. Similarly, the balance of characters in the Isoptera (with the Zoraptera) and Dermaptera is so evenly divided between the Blattoid and Plecopteroid groups that it is only after careful consideration that one can make up his mind where to place them. On the other hand, such strongly aberrant forms as the Thysanoptera and Strepsiptera are also extremely difficult to place, and until more is known of the embryology, internal anatomy, and further anatomical details of these forms than is at present available as evidence for determining their closest affinities, the groupings here proposed must be regarded as purely provisional, and subject to further revision in the light of subsequent investigation. It may be stated, however, that none of the facts thus far brought forward would indicate that the views here proposed are untenable, and a further study of the forms in question has in each case merely served to confirm the correctness of the conclusions concerning the groupings here proposed.

PROCEEDINGS OF THE CAMBRIDGE ENTOMOLOGICAL CLUB

At the meeting June 8, 1920, Mr. Parker of the U. S. Entomological Laboratory at Arlington, Mass., gave an account of the effect of the hymenopterous egg parasite, *Trichogramma minutum* on the European corn-borer in this country. Last year 28,000 eggs of the corn-borer were examined and 43 per cent. were found parasitized by Trichogramma. Collecting notes were read by several members and notice was given of expected appearance of the periodical Cicada at several localities in Massachusetts, Connecticut and Rhode Island. It was voted to hold the next meeting on the second Tuesday in September.

At the meeting of September 14, 1920, Mr. C. W. Johnson read a paper on the New England brood of the periodical Cicada and its failure to appear this year. Mr. Johnson had visited the place near the Logue reservoir in Washington, R. I., where the insect was found in large numbers in 1903 as described by A. S. Packard in Psyche for December of that year, but found none. He read a letter from Mr. George Dimmock who visited the place at Suffield, Conn., where he had collected the Cicada in 1869 and found none at this time. Inquiries were made and letters received from the following places where the insect was seen in 1903 without any appearance of them this year: Freetown, Mass., near Fall River, Russell, Mass., Tolland, Conn., State Line near Monson, Mass. Mr. Johnson concludes that the brood has become extinct.

Mr. J. H. Emerton spoke of a visit to the summit of Mt. Washington during the first week of July. Two new species of spiders were found under small stones at about 5,000 feet elevation.

Mr. L. W. Swett said that he and Mr. S. E. Cassino had visited Mt. Washington as early as May 28 and again in August and found many rare lepidoptera.

Mr. C. V. Blackburn showed a gynandromorph of the Gypsy Moth with the right side male and left side female, each half with the usual size and colors of its sex.

At the meeting of October 12, 1920, R. Heber Howe, Jr., mentioned the finding of eight species of Dragon-flies new to New England and showed maps giving their known distribution in North America.

Prof. W. M. Wheeler gave an account of his visit last summer to the station of the New York Zoölogical Society 50 miles up the Essequibo River in the forests of British Guiana. One of the great sources of entomological interest was a leguminous tree, Tachigalia, with long pinnate leaves in the hollow petioles of which live great numbers of Coccids, the excretions of which attract swarms of ants and other insects, including a social beetle, and these insects draw around them dipterous and hymenopterous parasites of many kinds. As these trees become larger and their wood harder they become the homes of great colonies of ants.

Dr. Wheeler found one morning a decayed tree filled with a great colony of the ant *Eciton burchelli*. As they were driven out by smoke, clusters of them held together around large cocoons containing male pupæ. The colony finally settled in two large masses in each of which was a freshly matured female. Specimens of the ants were exhibited.

Collecting notes were read and discussed by several members.

Mr. A. F. Burgess, Secretary of the Association of Economic Entomologists, said that enough copies of the Record of Economic Entomology to 1915 had been sold to pay the expense of printing and he was now soliciting subscriptions to a supplementary volume bringing the record up to 1920, the manuscript of which was ready to publish.

BOOK REVIEWS.

THE ORTHOPTERA OF NORTHEASTERN AMERICA, by W. S. Blatchley. The Nature Publishing Co., Indianapolis, Ind., 1920.

In this volume Professor Blatchley has added another to his valuable series of entomological treatises, useful alike to the specialist and the general student of entomology, and one which was much needed, so many scattered descriptions having appeared in recent years at the hands of a number of authors that their collation and correlation by a special student of the order was greatly to be desired. Professor Blatchley's residence in Indiana and Florida and his long familiarity with the group enabled him to bring to the task an equipment possessed by few; and his views on the synonymy, etc., of the various forms should accordingly receive the consideration they deserve, even though it is, perhaps, too soon to decide definitely the standing of some of the less known forms.

The notes on songs, habits and distribution naturally constitute the most attractive part of the book to the biologist, but the bibliography and synonymy are equally helpful to the student.

The volume is well illustrated with text cuts, and well printed except for several instances of inversion of cuts, cases apparently of mistaken humor (?) on the part of the printer's devil (or should it read *vice versa?*). So flagrant are these in character that one might truthfully say that Professor Blatchley owes it to his fellow-scientists, having manuscripts to publish, to acquaint them with the name of the firm responsible for such actions.

The book is a very presentable, readable, and useful account of the order as found in eastern North America, indispensable to every student of the orthoptera, the first of its kind in its field, and we bespeak for it the welcome it deserves.

A. P. M.

EXCHANGE COLUMN.

Notices not to exceed four lines in length concerning exchanges desired of specimens or entomological literature will be inserted free for subscribers, to be run as long as may be deemed advisable by the editors.

Cynipidæ,—galls or the bred makers,—of the world desired for exchange or purchase. Will determine North American material. Address: Alfred C. Kinsey, Bussey Institution, Forest Hills, Mass.

Wanted: Insects of any order from ant nests, with specimens of the host ants, from any part of the world; also Cremastochilinæ of the world. Will give cash or Coleoptera, Hymenoptera and Diptera from the United States.—Wm. M. Mann, U. S. National Museum, Washington, D. C.

Wanted: To exchange, or purchase for cash, specimens of the Genus Apantesis from any locality. Also to purchase rare Catocalæ.—Samuel E. Cassino, Salem, Mass.

Wanted for cash: Lowest representatives of all families of insects, preserved in fluid.—G. C. Crampton, Amherst, Mass.

Wanted: Syrphidæ (Flower-flies) from all parts of the world. Exchanges solicited. Will determine on the usual conditions.—C. L. Metcalf, Ohio State University, Columbus, Ohio.

Largest Expanse—one each ♂ and ♀ Lepidoptera wanted for transfer purposes. Those not good enough for collections will do. Will buy, or exchange for local Lepidoptera, etc.—C. V. Blackburn, 12 Pine St., Stoneham, Mass.

Butterflies of Japan and Formosa, will be exchanged by S. Satake, 48 Aoyama-minamimachi 5-chome, Tokyo, Japan.

For Sale: Psyche, complete set, $40. Volumes 3 to 20, newly bound in 11 volumes, red half calf, with black cloth sides; also Ann. Ent. Soc. Amer., complete, $12. Volumes 1 to 6, newly bound in black half calf, cloth sides.—A. C. Hansen, 945 Margate Ter., Chicago.

For sale, or exchange for entomological items not in my library—American Entomologist, complete; Dyar, List of N. A. Lepidoptera; Redi, Experimenta, circa Generationem Insectorum, 1686; many others.—J. E. Hallinen, Cooperton, Okla.

Wanted: To examine, determine and exchange Cicadellidæ or "Jassidæ" from all parts of North America.—J. G. Sanders and D. M. DeLong, State Capitol, Harrisburg, Pa.

Cochineal Insects: Wish to obtain living specimens of cochineal scales. Will purchase or exchange as may be desired.—C. T. Brues, Bussey Institution, Boston 30, Mass.

Wanted: Species of Rhynchophora from Eastern North America not represented in my collection, in exchange for duplicates from Indiana and Florida. Lists of desiderata and duplicates on application.—W. S. Blatchley, 1530 Park Avenue, Indianapolis, Ind.

CAMBRIDGE ENTOMOLOGICAL CLUB

A regular meeting of the Club is held on the second Tuesday of each month (July, August and September excepted) at 7.45 P. M. at the Bussey Institution, Forest Hills, Boston. The Bussey Institution is one block from the Forest Hills Station of both the elevated street cars and the N. Y., N. H. & H. R. R. Entomologists visiting Boston are cordially invited to attend.

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VOL. XXVII DECEMBER 1920 No. 6

NOTES ON THE FUNGUS-BEETLE, *CIS VITULA* MANN.

By Harry B. Weiss,
New Brunswick, N. J.

The following notes are the results of observations made on *Cis vitula* Mann.,[1] collected in *Polyporus versicolor* L., at Alma, Calif., during January by Mr. Hartman and forwarded to me together with a large quantity of the fungus by Mr. H. E. Burke. *Polyporus versicolor* is a common and widely distributed polypore and in this particular instance, it was taken on dead almond (*Prunus amygdalus*).

At the time of the receipt of the infested fungus, only adults were found. Several months later, however, after having been kept in a warm room, larvæ and pupæ were secured. The larvæ work in the context of the fungus especially in the thickest parts at the base, riddling it in all directions. Pupation also takes place in the basal context. The beetles range over the entire polypore consuming all parts of it. On account of the hairiness of the larvæ, they become covered with particles of excrement and borings found in their channels, but on account of the dryness of these materials few particles adhere to a larva after it has been removed from the fungus.

Full-grown larva. Length, 3.5 to 4 mm. Width, 0.8 mm. Whitish, sometimes slightly creamy, except for mouth parts, tarsal claws, dorsal abdominal plates of the eighth and ninth segments and posterior hooks which are brownish to brownish black; elongate subcylindrical, tapering slightly at anterior and posterior ends; body flattened beneath. Dorsal surfaces of head and body covered with minute, fine hairs. Head and each body segment also bear several, comparatively long, fine hairs. Ventral surface bears only a few, long, fine hairs. Head narrower than posterior edge of prothorax. Dorsal surface of eighth abdominal segment bears a slightly chitinized, somewhat brownish plate with a few minute tubercles. Dorsal surface of ninth abdominal segment bears a

[1] Kindly identified by Mr. Charles Dury.

larger, more strongly chitinized, light brownish plate with numerous minute tubercles and terminating in two comparatively prominent chitinous, acutely pointed spines or hooks which are curved upward.

Pupa. Length, 3 mm. Width, 1.1 mm. Whitish, somewhat elongate, sides subparallel, anterior and posterior ends tapering slightly. Dorsal surfaces of thorax and abdomen clothed with minute fine hairs. Dorsal surface of prothorax bears several long, fine hairs. A transverse row of long, fine hairs on dorsal surfaces of meso and metathorax and each abdominal segment. Anterior edge of prothorax bilobed. Dorsal surface of prothorax bears numerous, uniformly minute, brownish tubercles, a few of which bear long, fine hairs and the remainder, minute hairs. Last abdominal segment bears a pair of dorsal, acutely pointed, brown-tipped, diverging spines. Ventral surface and wing cases bearing a few hairs.

Polyporus versicolor appears to be a favorite food plant of members of the *Cioidæ*, many species occurring by hundreds in a small group of sporophores. It does not appear likely that the beetles play anything except possibly an accidental part in the distribution of the spores which are normally wind borne. The beetles frequent the interior of the fungus, appear to shun the light except when in search of fresh food and remain in the sporophore until it is almost all consumed. On account of the abundance of *Polyporus versicolor*, fresh food is usually within easy reach and requires only a migration of several inches or less on the part of the beetles. Examinations of the trunks of trees in various degrees of health and which were close to stumps covered by *Polyporus versicolor* infested by *Cioidæ* failed to reveal the presence of any beetles belonging to this family.

NOTES ON THE LIFE-HISTORY OF *ANTHOPHORA STANFORDIANA.*

By H. H. Nininger,

McPherson College, McPherson, Kans.

Early in June of 1916 I chanced upon a small aggregation of these large mining bees on the sunny slope of a moist clay bank in the foot hills of the San Gabriel Mountains of southern California. Their burrows were placed close together and in an almost vertical position, and over the entrances of many of them were constructed very peculiar bent-over chimneys of clay. In these particulars they fit very well the description given by Kellogg. It was a bright spring day and the warm sunshine kindled the vital spark in these insects to the greatest activity. They were scurrying in and out of their burrows and flying to and from a nearby spring in what seemed to be feverish haste, until the hundred or more individuals produced as much buzzing and humming as one would witness at the entrance of a very strong colony of honey bees.

They were engaged in digging tunnels, excavating nest-chambers, building nesting cells within the nest-chambers, depositing eggs, and provisioning nest cells. All of these activities were being pursued most industriously.

At the bottom of a tunnel five to seven inches deep, the bee excavated an oval chamber about three-fourths inch in diameter by one inch deep, and then built up within this a nest-cell to fit, made of pellets of clay and worked smooth on the inner side, after which it was coated with a thin layer of water-proofing which seemed to be a salivary secretion. The top of the cell was, of course, left open until the task of provisioning was completed. When all completed but the cover, *stanfordiana* carried pollen and made it into a very dry kind of bee bread on which an egg was laid. Then she carried from the spring several drops of water which were added to the mass without mixing. Having thus provided the entire food supply for her young, she walled the cell over and sealed it on the inner surface with the water-proofing, doubtless by inserting her long tongue through a minute pore left in the center of the lid, as evidenced by its structure, then sealed the pore, first with water-proofing and afterwards with clay. Thus all communication with the outside world was cut off before the egg ever hatched.

I do not know how to account for Mr. Kellogg's observation that "food is carried to the young in the open cell." (*cf.* Kellogg, American Insects, p. 516.) I observed two hundred or more of these cells and all were sealed tightly with egg and provisions. More than a hundred of these sealed cells were kept in my laboratory until the emergence of the adult the following spring.

After provisioning one cell, the same bee probably constructed and provisioned others, as there were usually found from two to five cells at the bottom of each tunnel, some placed one above another, while others were set side by side. A large number of cells were opened and were found to contain all stages of the young insects from the egg to the almost mature larvæ. These young were kept in open cells or transferred to artificial wax cells, or, in a few cases, the mature larvæ were placed upon dry sawdust and kept in the laboratory until they matured or were destroyed by fungi. In this way their development was observed thru all of its stages. About a hundred cells were preserved unopened in a cigar box.

Upon hatching, the larvæ feed and grow rapidly for about three weeks, by which time their growth is complete. Then they enter upon a resting stage which lasts about nine months. During the early part of this period of inactivity there is a gradual and slight change in form, resulting in the partial disappearance of segmental rings in the anterior region of the body, but there is no movement exhibited during the entire nine months save a slow return of the larva to its natural form when pressed out of shape. At the end of this period or at the age of about ten months it accomplishes its first moult and enters upon the pupa stage. About seven or eight weeks later it moults again, reaching the adult stage but a few days less than a year old, whereupon the bee chews its way out of the cell.

On Angel Island, two years later, a very extensive aggregation of these bees was found by the writer but further study was at the time impossible. On a steep bank, facing south at the shore of the bay, extending over several square rods, several thousands of these bees were nesting. The appearance of their burrows was the same as that already described.

To the writer these studies revealed some very interesting facts:

First: In their natural state these bees are subjected to from seven to twenty inches of rainfall during the winter. The majority of these cells in the laboratory were allowed to become dry within a few days after sealing and never received any moisture other than that which they could get from the air in an ordinary school room, yet these bees seemed to emerge normally and at approximately the same time as control specimens which were watered several times.

Second: Those left in broken cells, some of which were allowed to lie on dry sawdust in no cell at all, emerged normally, differing in this respect from Xylocopa orpifex and X. varipuncta, which were subjected to the same test and which failed to emerge normally when left out of contact with an enclosing cell wall.

Third: Several larvæ were left exposed during the entire season in a cabinet in which were kept chemicals, including HCl, HNO_3, and NH_4OH, and tho kept in stoppered bottles the fumes from these chemicals were plainly perceptible each time I opened the cabinet. These specimens all emerged normally in the spring.

The distribution of this species as given by Lutz and Cockerell in their forthcoming catalog is as follows:

Anthophora stanfordiana Cockerell, 1904 *c*, p. 32. ♀, ♂; Stanford University, California; V; Nests. Viereck, 1905, p. 314. Corvallis, Ore.; III, V, VI (Cordley). Kellogg, American Insects, 1908, p. 516. Description of Nest. Bray, Pomona Journal Zoöl., 1917, p. 93. Claremont, Calif.; V; at *Amsinckia intermedia*.

COLEOPTERA ASSOCIATED WITH *POLYPORUS VERSICOLOR* L. IN NEW JERSEY.

By Harry B. Weiss,
New Brunswick, N. J.

The following notes relate to observations made during a year's collecting on the sporophores or fruiting bodies of *Polyporus versicolor* L., in various parts of New Jersey. Eighty percent of some fifty species of polypores found in New Jersey were observed to be infested by insects and *Polyporus versicolor* appeared to attract the largest number of species all of which belonged to the Coleoptera.

This polypore is extremely common in most parts of New Jersey, occurring on all kinds of dead wood, many stumps being completely covered by it. According to Murrill[1] it also causes a serious root-rot in many trees and is a wound parasite in *Catalpa*. The pileus or shelf-like part of this fungus is thin and leathery, densely imbricate, variable in color and marked by narrow multicolored zones of various colors ranging from white to yellow, brown, reddish, greenish, blackish, etc. The context or inner substance of the pileus is white and it is this portion which appears to furnish most of the food for insects although at times the entire fungus is riddled.

It is difficult to explain why *versicolor* harbors so many insects unless it is the qualities of the context which attract them. Other polypores having a much thicker and fleshier context attract considerably fewer species. Altogether twenty-four species of Coleoptera, representing thirteen families, were found associated with *versicolor* as shown by the following table:

COLEOPTERA ASSOCIATED WITH *POLYPORUS VERSICOLOR.*

Family.	*Species.*	*Location.*
Carabidæ	*Tachys flavicauda* Say	on
Scaphidiidæ	*Scaphidium 4-guttatum* Say	on
Erotylidæ	*Megalodacne fasciata* Say	in
Mycetophagidæ	*Mycetophagus flexuosus* Say	in
Histeridæ	*Hister lecontei* Mars.	in
itidulidæ	*Phenolia grossa* Fab.	on
	Rhizophagus bipunctatus Say	in
Trogositidæ	*Tenebriodes corticalis* Melsh.	on
Bostrychidæ	*Endecatomus rugosus* Rand.	in
Cioidæ	*Cis fuscipes* Mell.	breeds in
	Cis wenzeli Dury	breeds in
	Xestocis levettei Csy.	in
	Sulcacis lengi Dury	breeds in
	Strigocis opacicollis Dury	in
	Octotemnus lævis Csy.	in
	Ennearthron oblongus Blatch.	in
Scarabæidæ	*Onthophagus hecate* Panz.	on

[1] Northern Polypores, p. 6, 1914.

Tenebrionidæ	*Hoplocephala bicornis* Oliv.	in
	Hoplocephala viridipennis Fab.	in
	Boletotherus bifurcus Fab.	on
Melandryidæ	*Penthe obliquata* Fab.	on
	Eustrophus bicolor Say	on
	Orchesia castanea Mels.	in
Anthribidæ	*Euparius marmoreus* Oliv.	in

This table also indicates whether the species were found in, on or actually breeding in the fungus. Probably all of the *Cioidæ* mentioned develop in the fungus and it is believed that the remainder of the species mentioned except those belonging to predaceous groups such as the *Carabidæ* and *Histeridæ* are fungus eaters. In fact, in addition to the *Cioidæ* listed, such species as *Mycetophagus flexuosus*, *Phenolia grossa*, *Hoplocephala bicornis*, *H. viridipennis*, *Boletotherus bifurcus* and *Euparius marmoreus* were observed feeding on the context.

Most of the species listed were taken during the summer months but many of the *Cioidæ* can be found in the partly eaten fungus during the winter either in the larval or adult stages or both. Some of the other species can be found overwintering in the fungus or beneath the bark of fungus covered logs. Except for a species of thrips and several Hymenopterous parasites of beetles, only Coleopterous insects were found on or in *Polyporus versicolor* although other species of polypores were found to be inhabited by a few members of the *Lepidoptera*, *Diptera* and *Hemiptera* in addition to *Coleoptera*.

HEMIPTERA COLLECTED IN WESTERN NEW ENGLAND, CHIEFLY FROM MOUNTAINS.

By H. M. Parshley,
Smith College.

An opportunity of collecting in new localities was lately afforded me, when, through the kindness of Mr. C. S. Neumann of New Britain, Conn., I took part with my colleagues Professors Gorokhoff and Kennedy in an automobile trip through northwestern Massachusetts and southern Vermont. The non-entomological members of the party good naturedly consented to frequent pauses where conditions seemed favorable for collecting, and thus I was enabled to gather the material reported on below. Among the records presented, all of which contribute to widen our knowledge of the distribution of Hemiptera in New England, a few are of especial significance.

The known range of *Rheumatobates rileyi* is extended considerably to the northward, showing that this species is by no means austral in habitat, as for a long time seemed probable. Hussey[1] has lately reported it as occurring in northern Michigan, and I have found it recently in Massachusetts[2] and now in southern Vermont. Another interesting case is that of *Nabis limbatus*, occurring in numbers on the summit of Mt. Greylock, where it was found also by Professor A. P. Morse in 1894. The known distribution of this species provides us with a striking instance not only of boreal habitat (in North America) but also of holarctic range. In the Old World it extends from Britain far into Siberia and southward to the warm climate of Algeria, but in North America it is met with only in the north or on mountains, in situations where its presence is clearly due not to recent introduction but to ancient migration. Still, we must emphasize the fact that the geographical distribution of but few species of Hemiptera is known in sufficient detail to warrant valid generalization, and thus a fruitful field of research is offered, especially to the careful collector. Nothing will contribute more effectually to this important branch of science than the publication of local lists, if the chief defect in past work of this character, inaccuracy of identification, is adequately guarded against.

Mt. Greylock,[3] *Massachusetts, September 4, 1919.*

Cydnidæ.

Thyreocoris ater (Amyot et Serville).

Sehirus cinctus (Palisot de Beauvois).

Pentatomidæ.

Podisus maculiventris (Say).

Alydidæ.

Alydus pilosulus (Herrich-Schaeffer).

[1] Waterbugs of Douglas Lake Region, Occas. Papers Mus. Zoöl., Univ. of Michigan, No. 75, 1919, p. 12.

[2] Ethological Remarks on New England Water-striders, Bull. Brooklyn Ent. Soc., Vol. 15, 1920, p. 69.

[3] From the boreal summit, 3,500 feet, unless otherwise stated.

Lygæidæ.

Nysius thymi (Wolff).
Nysius ericæ (Schilling).
Ischnorhynchus geminatus (Say).
Cymus angustatus Stal.
Ligyrocoris diffusus (Uhler).
Ligyrocoris contractus (Say).
A northern species found but once before in Massachusetts.
Perigenes costalis Van Duzee.
Plinthisus americanus Van Duzee.

Long-winged form ♀.—General form more broadly and evenly ovate than in the short-winged phase. Posterior lobe of pronotum somewhat elevated posteriorly, distinctly broader than anterior lobe, the lateral margins strongly sinuate posteriorly. Hemielytra but slightly broader at middle than at base; claval suture very distinct, slightly depressed together with adjacent area; corium acute at apex, the lateral margin straight in basal half, rounded apically, the membranal (apical) margin oblique, slightly convex; membrane hyaline, extending slightly beyond apex of abdomen, broadly rounded at apex, with four rather irregular veins evanescent just beyond middle of membrane. Length, 3.67 mm.; width, 1.63 mm.

Phymatidæ.

Phymata erosa (Linné).

Nabidæ.

Nabis subcoleoptratus Kirby.
Nabis limbatus Dahlbom.
Nabis roseipennis Reuter.

Anthocoridæ.

Triphleps insidiosa (Say).

Miridæ.

Adelphocoris rapidus (Say).
Lygus pratensis var. *oblineatus* (Say).
Lygus vanduzeei Knight.
Lygus pabulinus (Linné).
Plagiognathus spp.

Veliidæ.

Microvelia americana (Uhler).

The wingless form was present in considerable numbers on the surface of a spring halfway up the mountain. The common occurrence of several species of this genus in such isolated situations indicates the importance in the economy of the race of the fully winged phase, which, though very rare, must appear with sufficient frequency to provide for a favorable rate of dispersal.

Haystack Mountain,[4] *Vermont, September 5, 1919.*

Pentatomidæ.

Euschistus tristigmus (Say).
Podisus modestus (Dallas).

Neididæ.

Neides muticus (Say). New to the Vermont list.

Lygæidæ.

Ligyrocoris contractus (Say).

Reduviidæ.

Sinea diadema (Fabricius).

Nabidæ.

Nabis roseipennis Reuter. New to the Vermont list.
Nabis rufusculus Reuter.

Miridæ.

Collaria meilleurii Provancher.
Phytocoris lasiomerus Reuter.
Phytocoris eximius Reuter. Summit. New to the Vermont list.
Lygus vanduzeei Knight. Summit.
Lygus pabulinus (Linné). Summit.
Lygus fagi Knight. Halfway.
Lygus belfragei Reuter. Halfway.

Woodford, Vermont, September 5, 1919.

Tingidæ.

Corythucha heidemanni Drake. New to the Vermont list.

Specimens taken on alder closely agreeing with an example of the species collected by Drake in the type locality. Drake has reported birch as a food plant.

[4] From near the base unless otherwise stated.

Gerridæ.

Gerris remigis Say.

Gerris marginatus Say. New to the Vermont list.

Rheumatobates rileyi Bergroth. New to the Vermont list. On a quiet pond.

In his Douglas Lake paper (*l. c.*) Hussey gives some interesting observations on color variation in this species, which have led me to examine some hundreds of specimens in my collection, representing localities as follows: Plummers Island, Md.; Cold Spring Harbor, Long Island, N. Y.; White Plains, N. Y.; Northampton, Mass., and Woodford, Vt. I find that in the east, just as in Michigan, specimens from northern localities show a reduction in the extent of yellow pigmentation, and a few of the Vermont examples agree perfectly with Hussey's description of his Douglas Lake form. It would serve no purpose to give varietal names in this case, since almost every imaginable intergradation and permutation of spotting exists. In consulting Bergroth's review[5] of the genus, the student must bear this variation in mind, since the color characters given for *rileyi* and *tenuipes* will not always hold. For example, in *rileyi* the median mesonotal yellow spot is frequently narrower than the pronotal spot and may in fact be absent, while the diverging brown stripes of the mesosternum, stated by Bergroth to be characteristic of *tenuipes* Meinert, may occur also in *rileyi*, though abbreviated before the posterior margin of the sternite. These species may be distinguished with certainty by means of structural criteria much as given by Bergroth, as follows:

Mesonotum about as long as broad; male with hooked hairs of middle tibiæ confined to basal half, hind legs twisted
rileyi Bergroth.

Mesonotum longer than broad; male with hooked hairs of middle tibiæ extending nearly to apex, hind legs straight
tenuipes Meinert.

Searsburg, Vermont, September 5, 1919.

Saldidæ.

Pentacora ligata (Say).

Taken on bare boulders in a rapidly flowing stream.

[5] Fam. Gerridæ. Subfam. Halobatinæ. Ohio Nat., Vol. 8, 1908, pp. 371-382.

A NEW GENUS IN THE CHILOPOD FAMILY MECISTOCEPHALIDÆ.

By Ralph V. Chamberlin,

Museum of Comparative Zoölogy, Cambridge, Mass.

The new chilopod genus here described is interesting in being the third thus far known as belonging to the subfamily Arrupinæ, under which at present I group those mecistocephaloid forms having the coxæ of the second maxillæ completely separated and the palpus clawless, etc. It is based upon a good series of specimens of a previously undescribed species in the collection of the United States National Museum from South Celebes, where they were collected at Bua-Kraeng, elevation 5,000 feet, by H. Fruhstorfer on February 5, 1896.

Anarrup gen. nov.

Body narrowed caudad.

Head broader than in the Mecistocephalinæ, evenly rounded caudally. Frontal suture strongly marked. No indication of sublateral teeth. Areolated region of clypeus a narrowed band at anterior border, the non-areolated region not divided, its anterior portion bearing numerous setæ, thus contrasting sharply with the condition in Arrup in which the non-areolated area is very short and the setæ sparse.

Labrum tripartite, the median piece very narrow, the lateral pieces with margin smooth, with cilia but little exposed.

Mandible bearing several lamellæ. Teeth of first lamella few (four in genotype), stout. Teeth of median lamella on distal half long, very short and small on proximal part.

Palpus of second maxilla clawless; coxæ meeting at middle, separated by a rather long suture.

Prehensors exposed from above; joints armed within.

Ventral plate of pregenital segment narrow. Coxopleural pores small and numerous.

Anal legs composed of six articles beyond coxopleuræ, unarmed.

Genotype.—*A. nesiotes* sp. nov.

Anarrup nesiotes sp. nov.

Body in general light brown. Head and prehensorial segment and typically also the first two tergites chestnut. Legs fulvous.

Head widest at level of frontal suture, a little narrowing to some distance caudad of middle and the posterior end semicircularly rounded. Head typically near 1.44 times longer than wide.

Non-areolated portion of clypeus extending forward to anterior margin at middle, a narrow areolated band along antennal socket on each side; anterior half of non-areolated area with numerous setæ.

Median piece of labrum very narrow, overlapped on each side by lateral piece, the exposed part linear. Each lateral piece convex over mesal region, the mesal angle rounded, scarcely projecting; margin smooth.

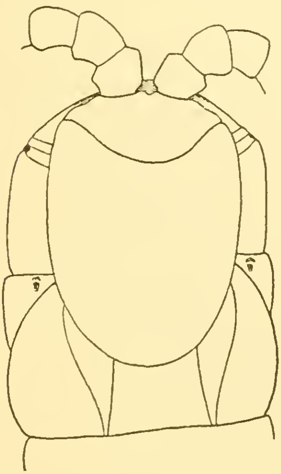

Fig. 1. *Anarrup Nesiotes*, sp. nov. Head and prehensors, dorsal view. x 12.

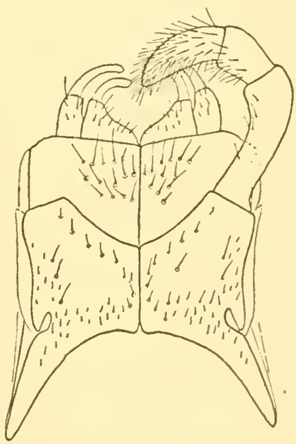

Fig. 2. *Anarrup Nesiotes*, sp. nov. Maxillae, ventral view, with right palpus omitted. x 24

Mandible with ten lamellæ. The first bears four teeth which are much stouter than those of the others. The median lamella bears about forty teeth, of which those of the distal region are very long and those of the proximal region very small. The inner margin of mandible below first lamella is finely toothed or fringed for a short distance.

Anteroectal corner of coxa of first maxilla strongly rounded. Distal joint of palpus of second maxilla densely setose. Posterior angles of coxosterna of second maxillæ rather long, slenderly acute.

Prosternum with two teeth truncate close to base, being very low and broad. Femuroid with a single tooth, this at distal end, noduliform. Next two joints also armed, the tooth of each small and nodular. Claw with a low, obtusely angular, prominence at base.

Sternal impressions distinct, furcate, the angle acute.

Sternite of pregenital segment strongly narrowed caudad, the sides a little incurved, the caudal margin narrow. Coxopleural pores numerous, small and very small.

Number of pairs of legs, forty-one.

Length, to about 60 mm.

A 1919 COLLECTION OF CICADELLIDÆ IN THE ENVIRONS OF BOSTON.

By George W. Barber,

Cereal and Forage Division, U. S. Bureau of Entomology.

The following list of leaf-hoppers represents a collection made entirely during the second half of the 1919 collecting season in towns usually nor further than fifteen miles distant from the State House in Boston, Mass. It represents only very incomplete collections, mostly specimens hastily taken at odd moments while engaged in other work.

Very little appears to have been done in determining the Cicadellid fauna of Massachusetts in any systematic manner, and the present list may be regarded as an introduction to a more complete study of these insects in the state.

It is well known that the years spent in actively combating injurious insects such as the gypsy and brown-tail moths, the elm leaf beetle, and the European corn-borer in this section have left a very noticeable effect on the prevalence of the leaf-eating insects.

It is interesting, therefore, to notice that the effect on sucking insects is evidently not so marked for the accompanying list of fifty-five species and varieties, representing twenty-six genera, taken so unsystematically during but half of one season, cannot nearly represent the total fauna, in this group, that are present.

Two European species, *Deltocephalus striatus* Linn., and *Allygus mixtus* Fabr., are herein reported both taken in the Town of Medford.

I am indebted to Mr. E. H. Gibson, U. S. National Museum, and especially to Mr. D. M. DeLong of Harrisburg, Pa., for kind assistance in determination of species unknown to me.

Cicadellidæ.

Bythoscopinæ.

1767—*Agallia sanguinolenta* (Prov.).
Medford, September 18; Everett, September 30.

1793—*Idiocerus scurra* (Germ).
Cambridge, September 13.

Cicadellinæ.

1854—*Cicadella hieroglyphica* (Say).
Medford, August 26; Woburn, September 26.

1855—*Cicadella gothica* (Sign).
Woburn, September 25.

1859—*Kolla bifida* (Say).
Medford, August 21–26.

1863—*Helochara communis* Fitch.
Medford, September 24; Woburn, September 26; Melrose, November 11.

1864—*Graphocephala coccinea* (Forst.).
Woburn, August 20; Medford, August 26; Cambridge, September 22.

1874—*Drœculacephala mollipes* (Say).
Medford, August 20, 21, 26, September 18, October 15.

1879—*Drœculacephala noveboracensis* Fitch.
Medford, August 21.

Gyponinæ.

1879—*Gypona 8-lineata* (Say).
West Medford, August 26, October 7.

1898—*Gypona cana* Burm.
Woburn, September 26.

1920—*Gypona puncticollis* Spangb.
Medford, September 12.

1930—*Xerophloea viridis* (Fabr.).
Medford, September 18.

Jassinæ.

1933—*Acucephalus nervosus* (Schrank.).
W. Medford, July 25; Medford, August 20.

1936—*Acucephalus albifrons* (Linn).
W. Medford, July 25; Medford, August 20.

1983—*Scaphoideus auronitens* Prov.
Arnold Arboretum, Boston, September 14.

1995—*Scaphoideus luteolus* Van D.
Concord, August 11.

1996—*Scaphoideus immistus* (Say).
Medford, August 26.

2014—*Platymetopius acutus* (Say).
Medford, September 12; Woburn, September 25–26; Everett, September 30.

2023—*Platymetopius frontalis* Van D.
Medford, September 18; Woburn, September 23.

2053—*Deltocephalus sayi* (Fitch).
Cambridge, September 4; Medford, September 18; Woburn, September 26.

2063—*Deltocephalus inimicus* (Say).
Medford, August 9; Cambridge, September 4; Everett, September 30.

2065—*Deltocephalus flavicosta* Stal.
Cambridge, September 4.

2073—*Dettocephalus pascuellus* (Fall) = (Minki Prov.)
Cambridge, September 4; Medford, September 18.

2097—*Deltocephalus balli* Van D.
Cambridge, September 4; Medford, September 8; Melrose, September 26.

Deltocephalus striatus Linn.
Medford, August 26.

2148—*Euscelis elongatus* (Osb.).
Saugus, October 7.

2156—*Euscelis curtisii* (Fitch).
Medford, August 20; Cambridge, September 7; Saugus, October 7.

2170—*Eutettix johnsoni* Van D.
Woburn, September 25.

2179—*Eutettix seminudus* (Say).
Lexington, October 12.

2195—*Phlepsius majestus* O. & B.
Arnold Arboretum, Boston, September 14.

2223—*Phlepsius incisus* Van D.
Arnold Arboretum, Boston, September 14.

2228—Phlepsius irroratus (Say).
Medford, September 12.

—*Allygus mixtus* Fabr.
W. Medford, July 21.

2265—*Thamnotettix clitellarius* (Say).
Saugus, September 8; Woburn, September 25–26; Lexington, October 12.

2312—*Thamnotettix fitchii* Van D.
Medford, September 24.

2314—*Thamnotettix nigrifrons* (Forbes).
Cambridge, September 4 and 13; Everett, September 30.

2324—*Chlorotettix unicolor* (Fitch).
Medford, September 18.

2327—*Chlorotettix tergatus* (Fitch).
Medford, September 26.

2331—*Chlorotettix galbanatus* Van D.
Medford, September 26.

2340—*Jassus olitorius* Say.
Woburn, August 20; Medford, August 26.

2359—*Cicadula lepida* Van D.
Woburn, September 25.

2362—*Cicadula sexnotata* (Fall).
Cambridge, September 13; Woburn, September 26; Everett, September 30.

2370—*Balclutha punctata* Thumb.
Woburn, September 25.

TYPHLOCYBINI.

2400—*Empoasca unica* (Prov.).
Woburn, September 25.

2421—*Empoasca mali* (LeB.).
Woburn, September 26.

2422—*Empoasca flavescens* (Fabr.).
Arlington, November 12.

2426—*Eupteryx melissæ* Curt.
Greater Brewster Island, Boston Harbor, October 27.

2430a—*Empoa querci* var. *gillettei* Van D.
W. Medford, August 26; Saugus, August 28.

2435—*Empoa tenerrima* (H. S.).
Woburn, September 26.

2437—*Empoa rosæ* (Linn).
W. Medford, August 26; Woburn, September 25.

2445—*Erythroneura comes* (Say).
W. Medford, August 26.

2445b—*Erythroneura comes* var. *ziczac* Walsh.
Cambridge, August 17.

2445d—*Erythroneura comes* var. *basilaris* (Say).
W. Medford, August 26.

The numbers used in the preceding list are those of the Van Duzee catalogue.

A DIMORPHIC SPECIES OF CEPHALONOMIA FROM TRINIDAD.

By Charles T. Brues,

Bussey Institution, Harvard University.

Cephalonomia urichi sp. nov.

Winged ♂. Length 1.6 mm. Pale honey-yellow; flagellum of antennæ piceous; tips of mandibles black, a rounded spot at base of first abdominal segment piceous, second segment near the middle with a transverse piceous band which is narrowed laterally and emarginate medially, third and fourth segment each with a similar band nearer the base, fifth segment with band narrowly indicated at the sides. Head one-third longer than wide, minutely scabrous, eyes one-third as long as the head, exclusive of mandibles; ocelli very distinct, in an equilateral triangle; head between antennæ with a short carina; antennæ 12-jointed, scape as long as the eye, pedicel one-half as long as the scape and nearly three times as long as thick, basal joints of flagellum quadrate-moniliform, apical ones longer, the penultimate joint one-third longer than thick, last joint twice as long as thick. Pro- and mesothorax and scutellum shining, faintly scabrous. Prothorax one-half longer than the mesonotum, narrowed anteriorly; mesonotum transverse, nearly twice as wide as long, without parapsidal furrows, but with a broad impressed longitudinal groove on each side next to tegulæ; scutellum large and distinct, oval and but slightly elevated, separated from the mesonotum by a narrow impressed line; at each side of the scutellum is a rounded impression which extends to the tegulæ which are large. Wings hyline to almost the middle, distinctly infuscated beyond. Subcostal vein one-third the length of the wing ending in a large, pale brown stigma. Base of propodeum very minutely roughened, middle portion with coarser, but less deeply impressed reticulations, apically almost smooth; the lateral margins are weakly carinate and the posterior edge forms a sharply rounded edge, but there are no discal carinæ. Abdomen smooth, rather shining, about as long as the thorax. Legs rather stout, especially the anterior femora; the tibiæ not spinous, tarsal claws slender, simple.

Wingless ♂. This form seems to be identical, except that the wings are not developed. The front wings are minute button-shaped discs smaller than the tegulæ, while the vestiges of the hind ones are whitish, elongate and longer than the diameter of the tegulæ. Some specimens, however, show no trace at all of wings.

♀ (Wingless.) Length 2 mm. Pale brownish-yellow, the last six antennal joints, the extreme base of the first abdominal segment and the tubular last segment of the abdomen, dark fuscous sometimes the sides of the abdomen are infuscated. Head fully one-half longer than wide, its sides parallel, hind angles rounded and the hind margin slightly excavated medially. Eyes one-fifth as long as the side of the head; ocelli indicated but imperfectly formed, the posterior ones only one-half as far from one another as from the anterior ones. Antennæ about as long as the head, 12-jointed; scape half as long as the width of the head; pedicel as long as the width of the eye, twice as long as thick; flagellum increasing in thickness from the base; the first four joints short, particularly the second and third which are strongly transverse; fifth and following, except the last, quadrate-moniliform, increasing in size. Thorax one-fourth longer than the head, slightly constricted at the hind angles of the prothorax and base of the propodeum, the latter widened at apex, with rectangular, slightly rounded angle, mesonotum not attaining the sides of the thorax, nearly twice as wide as long. Abdomen one-half longer than the thorax, broadest near the base and gradually tapering beyond the apex; last segment narrow, tubular, nearly three times as long as wide. Legs stout, but none of the tibiæ spinous.

Port of Spain, Trinidad, B. W. I.

Described from numerous specimens reared from a Psocid by F. W. Urich, and sent to me several years ago for identification.

This is a most remarkable species on account of the dimorphic males; in fact, so far as I am aware, it is the first time that such a condition has been found to exist in this or allied families. I took the wingless males at first for females, but from fresh material mounted in balsam, find that some of the apterous individuals are males with the thoracic structure antennæ and gential armature of the winged males. The remainder are females with the reduced thorax characteristic of the females of this genus.

Although the apterous males possess nothing but the most minute vestiges of wings, the structure of the thorax is not affected, suggesting that the loss of wings is not due to parasitism of any kind, but that it is a normal condition, and that the male sex of the species is truly dimorphic.

I have referred this species to the genus Cephalonomia, although the female is without wings and has large ocelli. Kieffer[1] refers all wingless females with ocelli, 12-jointed antennæ and non-spinous tibiæ to Bethylus (=*Perisemus*). In the present species, however, the portions of the thorax are fully developed as in the winged forms of Cephalonomia, which have ocelli, and the tarsal claws are simple as in Cephalonomia, not bifid as in Bethylus.

THE FEMALE OF *GLUTOPS SINGULARIS* BURGESS.

By Charles W. Johnson,

Boston Society of Natural History.

A female of this rare fly was taken by the writer along the "Red Cross Trail," on Mt. Monadnock, N. H., June 10, 1920, at an elevation of about 1,800 feet. It has not been described, and as it differs considerably from the male, seems to warrant a description.

The bluish-gray coloring of the entire insect is noticeably lighter and the hairs of the face, thorax and abdomen about one-third the length of those of the male, antennæ yellow, the hairs on the first and second joints about one-third the length of those on the male, outer half of the annuli black, and the hairs on the palpi much shorter. Front slightly wider than the width of each eye, flat, with numerous short, black hairs, except at the lower angles and above the base of the antennæ, ocelligerous tubercle prominent, ocelli shining black, occiput more protruding than in the male, and the hairs about one-third as long. The vertical angle is obsolete and the area below is not depressed as in the male, but protruding, with narrow depressions on each side extending toward the margin below the inner corners of the eyes. The rounded facial prominences are not as "conical" as in the male, and are separated by the width of the base of the antennæ. On each side of the antennæ extend deep furrows diverging towards the mouth, forming a rounded, elevated epistoma, with a narrow contracted area above

[1] Gen. Ins., fasc. 76, p. 16 (1908).

extending to the base of the antennæ. The thoracic stripes are brown and narrower than in the male, the metanotum just below the scutellum white. The base of the first abdominal segment shows two depressed, subdorsal areas, base of the second and the fifth, sixth and seventh segments, and tip of the ovipositor, brown. The halteres and legs as a whole are slightly lighter in color and wings broader than in the male. Length the same, 8 mm.

The male was described by Edward Burgess (Proc. Boston Soc. Nat. Hist., 1878, vol. 19, p. 320), from a specimen collected about 1872 near the U. S. Arsenal, Springfield, Mass., by Dr. George Dimmock. It was next captured by Mr. William Reiff near Ellis Station, Norwood, Mass., April 18, 1909 and recorded by the writer (Psyche, 1909, vol. 16, p. 132).[1] It was again taken by Mr. Reiff April 21, 1912, and by the writer at the same locality, May 3, 1918. I have also received a specimen for determination from Mr. H. L. Johnson, collected at South Meriden, Conn., April 17, 1915.

Among the species of the family Xylophagidæ, *Glutops singularis* is not the only rare species. The following are represented only by single specimens in the collection of the Boston Society of Natural History: *Arthropeas americana* Loew, Cheshire, Mass., June 30; *Rhachicerus nitidus* Johns., Bar Harbor, Me., July 24; *Solva aterrima*, Johns., Franconia, N. H. (Mrs. Slosson); *S. tenthredinoides* v. d. Wulp, Bretton Woods, N. H., June 29; *Xylophagus nitidus* Adams, Mt. Washington (Mrs. Slosson); *Ptiolina edeta* Walk., "Alpine Garden," Mt. Washington, July 4. There is a single record for New England of two other species, *Rhachicerus fulvicollis* Halid., Beverly, Mass. (Edw. Burgess) and *Xylophagus longicornis* Loew, Mass., but neither are represented in the Society's collection.

Two Interesting Additions to the Odonate Fauna of Concord, Mass.

In the Entomological News (30: 10–14, 1919) I published a list of eighty-seven species collected in Concord, Mass., and during the past spring I have made two interesting additional captures:

Nasiæschna pentacantha (Ramb.) One male taken June 15, 1920, at Bateman's Pond. The second New England record,—I

[1] In 1917, Mr. Arthur Gibson (47th Ann. Rept. Ent. Soc. Ont., 1916, p. 154), recorded this species from Agassiz, B.C., June 1915, collected by R. C. Treherne.

having taken one at Moultonboro, N. H., on July 9, 1916 (see PSYCHE 24: 51, 1917), and a specimen has since been sent me taken at Dedham, Mass., by Miss Eleanor Clark on June 14, 1920. Dr. Needham I find also records its capture at Wellesley, Mass. (see Bull. Ill. State Lab. Nat. Hist. 6:34, 1901).

Tetragoneuria canis MacLach. Seven males taken on May 31 and June 2, 1920, at a small pond near the township border of Carlisle. The fourth New England record,—having been taken at Franconia, N. H., by Mrs. Slosson; at Jaffrey, N. H., by Mr. C. W. Johnson; and in Connecticut based on an undated and unstationed specimen in the collection of the Connecticut Agricultural Experiment Station at New Haven. This species only represented by males was almost common at this little pond on both dates. The pond is one that I have visited every year regularly at this season for the past five or six years. All the other species found flying there were ones always noticed before. I am wondering whether the nymphs of *T. canis* transform every year or whether the larval stage may cover several years. An explanation of the presence of the species at the pond this year seems difficult to explain on other grounds.

R. HEBER HOWE, JR.

Thoreau Museum of Natural History.

EXCHANGE COLUMN.

Notices not to exceed four lines in length concerning exchanges desired of specimens or entomological literature will be inserted free for subscribers, to be run as long as may be deemed advisable by the editors.

Cynipidæ,—galls or the bred makers,—of the world desired for exchange or purchase. Will determine North American material. Address: Alfred C. Kinsey, Bussey Institution, Forest Hills, Mass.

Wanted: Insects of any order from ant nests, with specimens of the host ants, from any part of the world; also Cremastochilinæ of the world. Will give cash or Coleoptera, Hymenoptera and Diptera from the United States.—Wm. M. Mann, U. S. National Museum, Washington, D. C.

Wanted: To exchange, or purchase for cash, specimens of the Genus Apantesis from any locality. Also to purchase rare Catocalæ.—Samuel E. Cassino, Salem, Mass.

Wanted for cash: Lowest representatives of all families of insects, preserved in fluid.—G. C. Crampton, Amherst, Mass.

Wanted: Syrphidæ (Flower-flies) from all parts of the world. Exchanges solicited. Will determine on the usual conditions.—C. L. Metcalf, Ohio State University, Columbus, Ohio.

Largest Expanse—one each ♂ and ♀ Lepidoptera wanted for transfer purposes. Those not good enough for collections will do. Will buy, or exchange for local Lepidoptera, etc.—C. V. Blackburn, 12 Pine St., Stoneham, Mass.

Butterflies of Japan and Formosa, will be exchanged by S. Satake, 48 Aoyama-minamimachi 5-chome, Tokyo, Japan.

For Sale: Psyche, complete set, $40. Volumes 3 to 20, newly bound in 11 volumes, red half calf, with black cloth sides; also Ann. Ent. Soc. Amer., complete, $12. Volumes 1 to 6, newly bound in black half calf, cloth sides.—A. C. Hansen, 945 Margate Ter., Chicago.

For sale, or exchange for entomological items not in my library—American Entomologist, complete; Dyar, List of N. A. Lepidoptera; Redi, Experimenta, circa Generationem Insectorum, 1686; many others.—J. E. Hallinen, Cooperton, Okla.

Wanted: To examine, determine and exchange Cicadellidæ or "Jassidæ" from all parts of North America.—J. G. Sanders and D. M. DeLong, State Capitol, Harrisburg, Pa.

Cochineal Insects: Wish to obtain living specimens of cochineal scales. Will purchase or exchange as may be desired.—C. T. Brues, Bussey Institution, Boston 30, Mass.

Wanted: Species of Rhynchophora from Eastern North America not represented in my collection, in exchange for duplicates from Indiana and Florida. Lists of desiderata and duplicates on application.—W. S. Blatchley, 1530 Park Avenue, Indianapolis, Ind.

PSYCHE.

Index to Vol. XXVII. 1920.

Index to Authors.

Index to Subjects.

All new genera, new species and new names are printed in bold face type.

CAMBRIDGE ENTOMOLOGICAL CLUB

A regular meeting of the Club is held on the second Tuesday of each month (July, August and September excepted) at 7.45 P. M. at the Bussey Institution, Forest Hills, Boston. The Bussey Institution is one block from the Forest Hills Station of both the elevated street cars and the N. Y., N. H. & H. R. R. Entomologists visiting Boston are cordially invited to attend.
