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CONTENTS.

The Growth of Insect Blood Cells in Vitro.  R. W. Glaser  ........  1
Notes on Rearing Insects for Experimental Purposes and Life History
  Work.  A. M. Wilcox  ........................................  7
Notes on North American Tingidae (Hemiptera).  H. M. Parshley  ..  13
A New Malayan Ant of the Genus Prodiscothyrea.  W. M. Wheeler  29
Anthocyanin in Pterocomma smithiae.  R. W. Glaser  ................  30
Exchange Column  ..................................................  31
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THE GROWTH OF INSECT BLOOD CELLS IN VITRO.¹

By R. W. GLASER.

In order to obtain an insight into various pathological changes taking place in diseased insect tissue, I undertook a series of experiments dealing with the cultivation of such tissue in vitro. The degenerative changes occurring in normal and in pathological blood cells were especially studied for the reason that the blood is frequently used in diagnosing the health of a particular insect. In the polyhedral diseases of insects a general picture of the progress during the later stages of the disease can be obtained by examination of the blood. This type of disease is recognized by the fact that nucleoprotein reaction bodies, termed polyhedra, are formed within the nuclei of the blood and certain other tissue cells. It was also of considerable interest to ascertain whether slides with growing insect tissue could be infected with the polyhedral disease virus and whether polyhedra would form within the nuclei of cells thus infected. By way of comparison, it was also of interest to see through what changes normal cells pass when permitted to degenerate naturally.

Incidentally, a number of observations were made in regard to the morphology and behavior of growing insect blood cells and I will present the observations in the hope of stimulating work along these lines. Although the cultivation of insect tissue is not new, this method of studying various embryological, morphological, and physiological questions pertaining to entomology has been almost entirely neglected and I am convinced that the cultivation of tissues will greatly simplify the solution to many difficult problems.

Goldschmidt in 1915, by means of the tissue culture method,

¹ Contribution from the Entomological Laboratory of the Bussey Institution in cooperation with the U. S. Bureau of Entomology. (Bussey Institution No. 125.)
studied the spermatogenesis of *Samia cecropia* L. Spermatogonia or young spermatocytes were kept alive for about three weeks, and the follicle membrane for some weeks more. This piece of work and that of Lewis and Robertson, 1916, on the male germ cells of *Chorthippus curtipennis* Scudd (*Stenobothrus curtipennis* Harris) seem to be the only examples of insect tissue cultivation found in the literature.

For the experiments here described the larvæ of *Malacosoma americanum*, *Cirphis unipuncta*, *Laphygma frugiperda* and *Portherzia dispar* were used. My method did not differ materially from those of Harrison, Carrel, Goldschmidt, etc. However, since most of my experiments dealt with the cultivation of insect blood I will briefly outline the method of procedure. The larvæ to be operated upon are held upside down in one hand and the anterior and posterior halves bent back. A proleg is then thoroughly washed with 80 to 95 per cent. alcohol after which it is clipped with very fine aseptic scissors. The drop of blood which oozes out is caught on a sterile cover slip which is then placed on a sterile depression slide and the edges sealed up with sterile vaseline. A great many slides were prepared in this manner, *i.e.*, the blood corpuscles were simply mounted in their own plasma. In other cases Locke’s solution,¹ or a mixture of Locke’s solution and plasma was found satisfactory. In general Locke’s solution is isotonic with insect tissue and can be very freely used for cultivation and for the washing out of old cultures in order to free them of harmful by-products. Locke’s solution has no particular advantage over the plasma, except that the preparations are a bit more transparent, owing to the fact that large amounts of fibrin have been eliminated.

Blood was obtained from healthy *Malacosoma americanum* larvæ and six slides prepared. In a few days some of the blood cells disintegrated, but the majority lived and multiplied. In ten days beautiful synecytia had formed (Pl. I, fig. 1). At the end of this time three of the slides were inoculated with some polyhedral material which had been passed through Berkefeld Grade “N” candles. The other three slides were kept as checks. All slides were observed for forty days. After this the cells in both experiments and checks ceased growing and disintegrated normally.

¹ Locke’s solution consists of NaCl 0.9 per cent., CaCl₂ 0.025 per cent., KCl 0.042 per cent., NaHCO₃ 0.02 per cent., Dextrose 0.25 per cent., Peptone 0.2 per cent.
The inoculated slides showed no indications of the formation of polyhedral bodies within the nuclei of the blood cells. This experiment was repeated twice more and with the same result; no difference between the experiments and checks was observed.

Twelve healthy *M. americanum* larvae were fed with polyhedral virus passed through Berkefeld Grade "N" filters. As checks the same number of larvae were infected with the virus sterilized by autoclaving. At the end of ten days tissue culture preparations were made with blood taken from the experimental animals and from the checks. The slides were studied at once and it was found that two thirds of them, representing blood taken from animals fed with the unsterilized virus, showed infection. The early stages of polyhedra were discernible within the nuclei of many of the blood cells. Other cells still seemed to be in a normal condition. The slides representing blood taken from the checks appeared perfectly normal. The next day all of the slides were again examined, but no change was noticed with the exception that some of the cells had divided. In one day more nearly all of the experimental blood cell nuclei were beset with large and small polyhedra. In six to seven days the blood cells from the experimental animals began to disintegrate with the liberation of small and large, well formed, typical polyhedra. The cells on the check slides disintegrated normally five days later.

A large number of the blood cells of *M. americanum* are of the mulberry corpuscle type (Pl. I, fig. 2). These are not so well adapted to cultivation as the ordinary blood cells (Pl. I, figs. 3 and 4). For this reason the experiments were repeated with the blood of *Porthetria dispar* in which the mulberry cells are in the minority. In these experiments it was likewise impossible to infect growing blood cells with the polyhedral virus, but if animals were first infected the formation of the polyhedra could be traced very nicely by taking the blood from the infected animals in about ten or twelve days and studying by means of the tissue culture method.

What do these experiments signify? Several possibilities at once suggest themselves, but I will merely outline the two most probable. First of all let us suppose that I have actually cultivated the polyhedral virus on the tissue culture slides. Then why is it impossible to infect such tissue directly with the virus? Why is it necessary to give the virus "a start" within the insect itself? Per-
haps the early stages of the virus require some particular organ or tissue or some particular condition. The insect itself fulfills the required condition, but the blood cells growing in vitro do not. The later stages of the virus, however, find the conditions suitable on the tissue culture slides.

Then again I may not have cultivated the virus at all. The caterpillars were infected with the polyhedral virus which may have a strong affinity for some particular tissue other than the blood. Toxins may be elaborated and getting into the blood may start the degenerative changes which culminate in the formation of polyhedral bodies. These degenerative changes, after beginning within the animal, may later proceed outside of it on the tissue culture slides in the absence of the virus. I think that a series of passage infections would clear up the whole matter. This I have not yet attempted. A series of animals should be infected with fresh virus. In ten or twelve days tissue culture slides should be prepared from the blood. When polyhedral bodies begin to form, another series of animals should be infected from the slides. In ten or twelve days the blood should be taken from these animals and kept on slides and if polyhedra form, a fresh series of animals should be again infected and so on. Such a series must, of course, be accompanied by suitable checks. If the animals in the later experimental series die typically and if there is no increase in the period from infection to death (about twenty days) it would be fairly certain that the virus has been cultivated and that one is not dealing with a partial recovery of the amount of the virus originally used.

In cultivating insect tissue it is always well to prepare a great many slides. A few become contaminated with bacteria, but many disintegrate normally without showing the least inclination towards growth. The ability of the tissue to grow well also seems to a slight degree to vary according to the species of insect. The tent-caterpillar blood, for instance, does not grow as readily as the blood taken from the true army or fall-army worm. The blood from these two species does not grow nearly so well as the blood of the gipsy-moth caterpillar. One should never discard slides for at least a week or more. Very frequently nearly all of the cells will disintegrate during the first five or six days. A few, however, live and these later increase and multiply forming beautiful
syncytia. I have frequently given up slides as hopeless on account of what seemed to me to be complete disintegration, yet on reexamination in about two weeks, I was astonished to find clusters of healthy-looking, growing cells.

I have kept true army and fall-army worm blood preparations alive for one month without washing out the cultures or transferring them to a fresh medium. Gipsy-moth blood cultures have been kept alive for as long as seventeen weeks without washing or transferring. It is true, the cells were no longer vigorous and showed signs of beginning degeneracy, but they were alive. After washing out these old cultures with sterile Locke’s solution and filter paper, as is usually done, and transferring to a fresh medium like Locke’s solution the cells grew and multiplied as before.

In so far as the morphological elements contained in insect blood are concerned, the ordinary amoebocytes (Pl. I, figs. 3 and 4) are the only ones which multiply in tissue cultures. The minute amoebocytes (Pl. I, fig. 5), the mulberry corpuscles (Pl. I, fig. 2), and the cytoplasmic free cells (Pl. I, fig. 6) described by me in 1915 always disintegrate. A difference of opinion seems to exist in the literature as to the origin of the blood corpuscles of larval and adult insects. From my studies it appears that the blood cells, after their differentiation from the mesoderm during embryological development, simply maintain their numerical equilibrium in larvae and adults by dividing mitotically at certain intervals. I cannot find any so-called blood corpuscle forming tissue at least in sections of caterpillars.

Some of the visible changes observed on the culture slides in normal degenerating blood cells have proved instructive and have further helped to strengthen my views (published elsewhere) in regard to the nature of the polyhedral bodies found in the nuclei of certain pathological cells. Normal disintegration of insect blood cells is always accompanied by the formation of protein crystals within their cytoplasm. Crystalline disintegration accompanied by granular disintegration seems to be the rule in normal disintegrating insect tissue. Granular disintegration alone seems to be exceptional in blood cells at least. In the polyhedral diseases of insects protein crystals are likewise formed within the

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degenerating cells, but here the crystals are formed within the nuclei instead of within the cytoplasm.

Normal blood cells in the early stages of disintegration show distinct granulations and also small highly refractive greenish crystals within the cytoplasm (Pl. I, fig. 7). The nucleus does not show any changes till rather late. In a few days the cytoplasmic crystals become more and more numerous and likewise grow in size (Pl. I, fig. 8). Still later they reach the size of 5 and 6μ and assume a shape very closely simulating polyhedra. In a few days more the cells disintegrate, completely liberating granules and crystals (Pl. I, fig. 9). Some of these liberated crystals measure 15μ or more in diameter (Pl. I, fig. 10). Millon's reagent demonstrates their protein nature and I believe that they are similar in many ways to the polyhedra. Of course, the composition of the polyhedra is different, since they are formed within the nuclei under pathological conditions, but what I wish to emphasize is that insect tissue has a normal tendency towards crystalline disintegration. Is it, therefore, so surprising to find crystals (polyhedra) within the degenerating nuclei in a series of insect diseases?

Literature List.


EXPLANATION OF PLATE.

Fig. 1. Syncytium of growing amoebocytes.
Fig. 2. A type of mulberry corpuscle.
Fig. 3. Amoeboid amoebocyte.
Fig. 4. Round amoebocyte.
Fig. 5. Minute amoebocyte.
Fig. 6. Cytoplasmic free cell.
Fig. 7. Degenerating amoebocyte with a few small, refractive crystals in cytoplasm.
Fig. 8. Degenerating amoebocyte with numerous large, refractive crystals in cytoplasm.
Fig. 9. Disintegrated amoebocyte showing liberated granules and crystals.
Fig. 10. Double crystal formed by a normally disintegrating amoebocyte.

NOTES ON REARING INSECTS FOR EXPERIMENTAL PURPOSES AND LIFE-HISTORY WORK.¹

By A. M. Wilcox,²

Gipsy Moth Assistant, U. S. Bureau of Entomology.

INTRODUCTION.

During the past two years I have been rearing insects for experimental and life-history studies. While engaged in this work it became necessary to develop new rearing methods and to modify some of the old ones.

The rearing of insects from egg to adult is not always an easy task. Unforeseen difficulties arise anew with every species, in consequence of which I am offering these notes with the hope that entomologists will find them serviceable.

During the life history of insects reared artificially, the following must be observed:

¹ Contribution from the entomological laboratory of the Bussey Institution in cooperation with the U. S. Bureau of Entomology. (Bussey Institution, No. 121.)
² The writer desires to express his thanks to those who rendered valuable assistance in the preparation of this paper: Prof. William M. Wheeler, Dean of the Bussey Institution, Harvard University, and Mr. A. F. Burgess, in charge of gipsy-moth work, for their helpful criticisms; Dr. R. W. Glaser and Dr. J. W. Chapman of the Bureau of Entomology, for their suggestions; and Mr. Harold A. Preston of the same Bureau for the preparation of the illustrations.
1. Provision for an abundance of normal food.
2. Provision for a suitable larval environment.
3. Provision for a suitable pupal environment.
4. Provision for a suitable adult and egg laying environment.
5. Regulation of temperature and humidity.
7. Prevention of parasitism by other insects.

**The Use of Fruit Jars with Tin Covers.**

The general use of shallow fruit jars (Pl. II, fig. 1) has been found extremely successful for many species of insects. By altering conditions slightly for each stage (egg, larval, pupal and adult), these jars can be used throughout the life of many forms. The jars are four inches deep and four inches in diameter. The tin tops can be screwed on tightly without the use of rubber bands. Insects confined in these jars cannot escape, nor can parasites enter.

It is easy to duplicate conditions required by insects fond of a moist environment or which pupate in the soil. If at any time an excess of moisture forms, it may be diminished by loosening the screw tops or by adding a small quantity of dry sand.

The following constitutes the method used successfully for rearing lepidopterous larvae:

**Care of the Eggs.**

The eggs are placed in a jar containing a piece of filter or blotting paper to absorb the excess moisture. The cover is screwed on tightly to prevent any larvae from escaping when they hatch. Once in every three or four days, the cover is removed for a moment to permit the circulation of air.

**Care of the Larvæ.**

As soon as hatching commences, a small amount of food is placed in the jars. Several hundred caterpillars may be placed in one jar, but as they increase in size the number per jar should be decreased in order to prevent overcrowding. After the larvæ have molted once or twice, the filter paper may be removed, and a fourth of an inch of dry sand substituted. The sand is changed every three or four days before it becomes foul or mold develops. The jars should be kept shaded to ensure a nearly even temperature.
Care of the Pupae.

As soon as the larvae have pupated, the jars are cleaned and moist sand is put in. When moistening the sand, just enough water is added to darken it. The covers are screwed down tightly, but are removed every few days to allow a circulation of fresh air. If the sand becomes too moist, the covers are loosened; if too dry, a few drops of water may be added.

Care of the Adults.

Before emergence, some bits of coarse hay, dry moss or pieces of paper are inserted into the jars to provide a resting place for the adults as soon as they appear. If perfect specimens of large species are desired the lidless jars are placed in a large wooden or pasteboard box. A stiff piece of paper or cardboard is inserted into each jar so the adults may easily crawl out. This arrangement will provide sufficient room for them to expand their wings and dry perfectly.

Mating the Adults.

Some species of insects mate in almost any situation, but the majority prefer a simulation of their natural environment. These conditions may be provided in a number of ways. One of the most satisfactory methods is to grow the food plant of the species of insect concerned in a box of soil. When matings are desired, a small cylindrical wire screen or lamp chimney is placed over some of the food and the males and females placed thereon. When it is necessary for the adults to feed before mating, sugar-water may be provided. The mating cages should be shaded and left undisturbed until after the deposition of the eggs.

Hibernating Pupae.

The fruit jars have been used with great success in caring for hibernating pupae. Species that normally hibernate in the soil are placed in jars filled nearly half full of moist sand. This moisture will ensure sufficient humidity for several weeks. The jars should be opened every week or two to allow a circulation of fresh air. This also assists in the prevention of mold development. Jars with hibernating pupae have been kept in a greenhouse where the temperature ranged from 60° to 80° F. during the day and from 45° to 55° F. at night with success. The jars should be shaded.
Fruit Jars for Rearing Borers.

The jars may be used successfully for rearing borers from twigs, rotten wood, bark and fungi. Moist sand should not be added in this case, otherwise mold will develop.

Fruit Jars with Cheese-cloth Tops.

The jars may be used with cheese-cloth covers especially during damp or rainy weather. Such covers have disadvantages compared with the tin tops. Much time is consumed in tying on the cheese-cloth, or if rubber bands are used, they are apt to break and allow the insects to escape. In dry weather the food does not remain fresh by the use of the cheese-cloth tops.

Other Methods.

Caterpillars Reared in Bulk.

If several hundred larvæ of a species, that normally pupate in the soil, are to be reared together, the following method has proven successful:

A pen or corral was made of sheet tin or zinc. This was placed in the soil to a depth of two inches, while the upper edges were tanglefooted or the top covered with cheese-cloth. The tanglefoot prevents the larvæ from crawling out, but cheese-cloth is at times preferable if parasites are abundant.

The mortality from wilt and other diseases is generally quite high in this type of rearing cage because the crowding aids the spread of infection.

Tin Boxes.

Isolated material is often desired, especially in experimental studies. For this work, I make use of small tin boxes with tightly fitting covers, one inch deep and two and a half inches in diameter. These boxes take up very little space, are easily cleaned by boiling in water or by sterilizing, and can be used repeatedly. They prevent parasites from entering and the larvæ seem not to suffer in the least from the confinement. If the boxes are shaded the food keeps fresh for several days or until eaten.

When the larvæ are nearly ready to pupate, a little sand is placed in the boxes. Moisture emitted by the food and larvæ is generally sufficient, but a few drops of water may be added to the sand when needed.
Battery Jars.

Battery jars (Pl. III, fig. 1) with pieces of glass for covers have been quite useful for rearing some insects. The glass covers ensure a high humidity and this naturally keeps the food fresh. Such jars were found to be very satisfactory for rearing silkworms, many hundred having been reared during the summers of 1915 and 1916.

Sand was placed in the bottom of the jars. During damp weather, or when there was an excess of water of condensation, the covers were removed to facilitate evaporation. Silkworms, as is known, do not ordinarily leave their food, so the covers could be removed with impunity.

For rearing wood-boring insects, the battery jars have also been found very useful.

Trays.

Several types of trays, designed at the Gipsy Moth Laboratory at Melrose Highlands, Mass., have been used quite extensively in rearing gipsy moths during the past few years. I have used trays of various sizes and shapes. The trays (Pl. III, fig. 2) were usually made entirely of cardboard or wood with cheese-cloth or paraffin paper bottoms. To prevent larvae from escaping, the edges of the trays were smeared with tangle-foot. These trays are used extensively, but when a large number of larvae are reared in a single tray, some difficulty is experienced, for the larvae often get caught in the tangle-foot and eventually form a bridge over which others escape. The tangle-foot must be repeatedly combed or stirred with a stiff brush. This cleans the tangle-foot and also forms ridges over which it is difficult for the larvae to escape.

Diseases frequently develop and the mortality is generally high in such trays.

Riley Cages.

I have used a modified type of the Riley cage built for the Gipsy Moth Laboratory, with considerable success. The frames are built of wood, covered with a fine wire mesh. They are provided with removable wooden bottoms and have a door on one side. The cages are sixteen inches square and twenty-four inches in height.

Considerable material, especially Cerambycids and their para-
sites, have been reared in these cages, from dead wood, etc. The cages were kept in a green-house, in a shaded position, and the wood containing the insects was moistened about once a week.

The cages have also been utilized to some extent for rearing army-worms out of doors. In this case the bottoms were removed and the cages set in soil in a shaded place. If only a small number of larvae are to be reared, the cages may be placed over the insects' natural food plant, but if one is dealing with great numbers, the food must be renewed daily. The cages are also useful in making matings. Some trouble was experienced by the swelling or shrinking of the cage doors, depending on weather conditions.

**Test Tubes.**

For rearing fruit-flies of the genus *Drosophila*, test tubes (Pl. II, fig. 2) have proven very successful. An artificial food, banana agar, was used. This was made by crushing four ripe bananas and allowing them to infuse in 500 cc. of distilled water. The liquid was strained and 7½ grams of powdered agar added. The whole was then cooked until the agar was dissolved. The mixture was poured into test tubes, after which the tubes were sterilized and permitted to cool in a slanting position. Non-absorbent cotton plugs were used. The flies will readily oviposit on this medium and many generations a year may be reared. A piece of filter paper was placed in the tubes for the maggots to pupate upon. Fresh tubes are used for each generation. When newly hatched flies are to be transferred, they are first stupefied with ether.

The banana agar is nearly transparent which enables one to note the feeding habits, etc., of the larvae.

**Explanations of Plates II and III.**

Plate II, Fig. 1. Fruit jars used for rearing various insects.
Plate II, Fig. 2. Test tubes used for rearing flies of the genus *Drosophila*.
Plate III, Fig. 1. Battery jars used for rearing various insects.
Plate III, Fig. 2. Tray with paraffin paper bottom, for rearing insects.
Wilcox—Methods of Rearing Insects.
Fig. 1

Fig. 2

Wilcox—Methods of Rearing Insects.
NOTES ON NORTH AMERICAN TINGIDÆ (HEMIPTERA).¹

By H. M. Parshley.

A number of highly interesting forms of the Hemipterous family Tingidæ have recently been submitted to me for study by Mr. Nathan Banks of the Museum of Comparative Zoology and others mentioned below. In treating this material it has been necessary to take into account the recent publications of Osborn and Drake,² in which there is much requiring comment, as hereafter noted in part. Most of the conclusions were reached by a study of the papers cited in the light of Tingid material in my hands, and they have been verified by an examination of the type specimens concerned, through the courtesy of Professor Osborn.

The eminent European Hemipterist Bergroth has recently remarked on several occasions that the modern system of specific type fixation is likely to promote inadequate describing, and although many will not be able to approve his resultant refusal to designate definite type specimens, the force of his remarks must yet be strongly felt when it becomes necessary to deal with descriptions which are not only inadequate but even seem, in some particulars at least, to have been based upon a study of highly inaccurate figures rather than specimens—work which without some revision puts serious obstacles in the way of later investigators. Of course the designation of type specimens is not entirely to blame for this, but the feeling that species, however inadequately characterized, and genera, even without any description, are firmly established if only types are designated, tends to belittle the importance of the written record. After all, the printed word, capable of indefinite reduplication, accessible to everyone, and permanent, is of prime importance; while type specimens, limited in number, generally inaccessible, and perishable in nature, should be treated as of merely supplementary value. For this reason I am in accord with Van Duzee and others who

¹Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 127.
maintain that where description and type disagree in important particulars, the former should take precedence.

Acalypta lillianis Bueno.

In their first paper Osborn and Drake properly treat the long- and short-winged forms as conspecific, but the drawing on page 221 is very inaccurate as regards the structure of the head, which, of course, is precisely similar in the two forms of the species. The differences in head and antennal structure to be noted in comparing this figure with that on the next page do not exist in nature. This is no doubt due in part to the fact that the artist, being unfamiliar with the subject, drew the two specimens from somewhat different points of view. The authors are then entirely unjustified in announcing, on page 9 of their second paper, that de la Torre Bueno's species is composite, the more so as they have not studied his extensive type series which I can state, after careful examination, to be perfectly homogeneous, as is a good series of the species in Mr. H. G. Barber's collection. Moreover, there is nothing in the original description on which the assumption can be based, and it thus appears that as in some other cases undue attention has been given drawings of doubtful accuracy. Whether or not the type specimen of A. ovata O. & D. represents a species distinct from lillianis is another question. It is a little broader posteriorly than is usual in the short-winged form of the latter species and the first antennal segment is slightly different in form, but it agrees with the figure little better and presents no characters that I would consider of specific importance.

Fenestrella O. & D.

In their description of this extraordinary genus the founders omit to mention the following important characters: the bucculae are contiguous anteriorly, much as in Melanorrhopala, for instance; the metasternal orifices are obsolete; the surface of the hemielytra is deeply channelled, the main veins being raised on very prominent roof-like elevations, a condition which would be somewhat modified in the as yet unknown long-winged form. The drawing of the type species on page 223 of the first paper is inaccurate in numerous particulars: the general form is in reality much less elongate, the

costal margin being more abruptly curved posteriorly than the
figure would indicate; the base of the third antennal segment is
slightly capitate; the eyes project laterally less than one third their
width beyond the antenniferous tubercles, etc. Fenestrella is
extremely isolated, having no close relationship with any Pala-
artic or American genus known to me. It differs from Acalypta
in some of the most important characters, and yet it cannot be
placed elsewhere with much greater propriety. Further material
in the genus will be awaited with great interest.

Corythucha Stal.

As I am hoping to treat the North American forms of this genus
in a later paper, I shall make no other comment here than to point
out that while most of the new species recently described by Osborn
and Drake are very distinct and well known forms, there are some
which cannot be located without reference to the types, because
it is impossible to deduce from the descriptions an adequate notion
of the important characters derived from exact relative width and
height of the hood and from the altitude of the median carina with
reference to that of the hood.

Galeatus peckhami Ashm.

Of the two examples of this species known to me to have been
taken in New England, one was found at Princeton, Me., and the
other near the Glen House, Mt. Washington, N. H., both col-
lected by Mr. C. W. Johnson. I have already published the latter
record,\(^1\) which may be what Osborn and Drake erroneously refer
to on page 237 of their first paper. Uhler in his paper\(^2\) on the
Hemiptera of Las Vegas Hot Springs, N. M., makes reference in-
definitely to Massachusetts in discussing the distribution of this
species, but as is the case with so many of the faunistic generali-
zations of this author, confirmatory records of actual capture are
desirable if one is seeking exact knowledge.

Leptobyrsa rhododendri Horv.

Champion has recently shown\(^3\) that \(L. \, explanata\) Heid. is synon-

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ymous with Horváth’s previously published name. The species was first described from Holland where it was found infesting rhododendrons, probably as a visitor from the United States, and recently it has similarly occurred in England. As noted by Champion, Heidemann’s generic reference is correct, as the lateral pronotal carinae are percurrent in this species and not abbreviated as in *Stephanitis* Stal.

**Leptoypha** Stal.

The rather common misspelling, *Leptophya*, is perpetuated by Osborn and Drake on page 241 of their first paper. In their generic diagnosis it is the posterior “tip” of the rostral sulus which is described as open, though in reality it is nearly or quite closed by the convergent ends of the metasternal ridges. In *L. mutica* Say the head is provided with five spines as in related forms.

The chief characters separating *Leptoypha* from closely allied genera may be stated as follows: Entire surface very finely and evenly reticulate; antennae short, cylindrical, the third segment not greatly longer than the others together; hood absent; lateral carinae absent or vestigial; paranota linear, cariniform; costal area linear or narrow and uniseriate; subcostal area with 4–6 rows of areoles.

**Leptoypha costata** sp. nov.

Long-winged form.—Brown, shining, evenly and finely reticulate; more or less variegated with vague darker markings; pronotum with a black transverse suture interrupted at middle; body beneath chestnut brown, sternal region infuscated.

Head broad; vertex punctate at middle; basal spines short, reaching base of anterior spines, which are short and curved with apices meeting that of median spine; antenniferous tubercles moderate in size, oblique, rounded exteriorly; antennae short, cylindrical, minutely pubescent, first and second segments nearly equal, slightly longer than broad, thickest, third slightly more slender, cylindrical, a little less than twice as long as the first two together, fourth somewhat longer than the first, fusiform. Pronotum convex at middle, narrowed anteriorly, depressed behind the narrow raised apical collar; median carina slightly raised but appreciably percurrent; lateral carinae parallel, exceedingly faint, beginning just anterior to summit of pronotal convexity and extending to margins of angu-
late process. Paranota\textsuperscript{1} linear, cariniform, exterior margin straight, somewhat broader anteriorly. Hemielytra at middle distinctly broader than pronotum, extending a little beyond apex of abdomen; costal area narrow, distinctly uniseriate, biseriate anteriorly; subcostal area with 5 or 6 rows of areoles at most, obtusely angulate at apex of discoidal, which extends beyond middle of hemielytra; sutural with slightly larger areoles apically. Legs rather robust. Rostrum scarcely reaching middle coxae. Orifices but slightly elevated, narrow, transverse. Pleuræ largely reticulate. Abdomen shining, the segments roughened posteriorly. Hind wings almost as long as hemielytra. Form obovate, broadest behind middle, costal margin nearly straight in apical half. Length ♂, 2.8 mm.; width 1.3 mm.

Holotype and paratype, two ♀♀, Marshall Hall, Md., 1 August, 1891 (N. Banks), in M. C. Z. Collection.

This species is easily distinguished from \textit{mutica} by its shorter and broader form, slightly shorter antennæ with more slender third segment and distinctly shorter fourth, somewhat more prominent paranota, and especially by its distinct and completely reticulated costal area which in Say's species is cariniform and perceptibly reticulate only toward apex. The lateral pronotal carine are very inconspicuous in \textit{costata} and obsolete or nearly so in \textit{mutica}.

\textbf{Physatocheila} Fich.

In connection with my treatment of the North American species in a recent paper,\textsuperscript{2} it should be made clear that the arrangement of areoles in the costal area is somewhat variable and not always symmetrical, although a majority of specimens exhibit the conditions described. In cases of doubt the other characters mentioned are amply sufficient to insure recognition of the forms.

\textbf{Melanorhopala} Stal.

Our conception of this genus must be slightly modified to accommodate \textit{M. duryi} O. & D. and the new form described below, which, though in my opinion congeneric with \textit{clavata}, exhibits certain marked differences. According to this view the chief characters

\textsuperscript{1} See Jour. New York Ent. Soc., Vol. 24, 1916, p. 8. Crampton in a morphological paper has proposed this convenient name for the lateral expansions of the pronotum.

\textsuperscript{2} Psyche, Vol. 23, 1916, pp. 163–168. The holotype of \textit{D. tricornis americana} is in the collection of the Boston Society National History, not in mine, as erroneously stated on p. 164.
of *Melanorhopala* may be stated as follows: Form elongate, depressed, the hemielytra flat or showing only the slightest convexity. Antennæ usually rather long and slender, the third segment cylin
drical, usually somewhat curved and enlarged toward the apex in varying degrees. Pronotum tricarinate; hood small and not produced anteriorly; paranota narrow, uniseriate, reflexed vertically or against the pronotal surface. Hemielytra in the long
inged form widely overlapping and broadly rounded at apex, in the short-winged form very slightly overlapping, acute and distinct
ly divaricate at apex; main veins distinctly costate; costal area usually uniseriate, sometimes irregularly biseriate; subcostal area biseriate.

The following table will assist in separating the species:

1. Third antennal segment slender, not thicker than the fourth except sometimes at extreme apex; size larger.............2

   Third antennal segment rather thick, cylindrical, slightly clavate toward apex which is one third thicker than the fourth segment; form very broad; length, 3.5 mm

   *duryi* O. & D.

2. Costal area (costal membrane of Stal) uniseriate, evenly reticulated; color pale and uniform in general..................3

   Costal area bi- or triseriate in part, irregularly reticulated; color variegated.........................*infuscata* sp. nov.

3. Third antennal segment very slender, much thinner than the fourth, abruptly and strongly clavate at apex; fourth seg
gment conical....................................................*clavata* Stal.

   Third antennal segment less slender, but little thinner than the fourth, less enlarged at apex; fourth fusiform..............4

4. Length less than 5 mm.; form narrow; paranota vertically reflexed; antennæ distinctly though not strongly clavate

   *obscura* Parsh.

   Length more than 5 mm.; paranota reflexed almost or quite against pronotal surface; antennæ scarcely clavate...........5

5. Antennæ very long, extending beyond apex of abdomen; second segment distinctly narrowed at base; form narrow

   *lurida* Stal.

   Antennæ much shorter; second segment less narrowed at base; form broad...............................*uniformis* Stal.
The shape of the antennæ in this species is not correctly represented in the figure given by the authors on page 15 of their second paper. In the type specimen the first and second segments are nearly equal in size, the third almost perfectly cylindrical with some slight enlargement toward the apex, decidedly longer in proportion to its thickness than indicated, and slightly curved as in all the other species of the genus except infuscata, and the fourth is thinner than the figure shows and fusiform, not conical. The anterior spines of the head are short and decidedly curved, the main veins of the hemielytra though strongly costate are unusually irregular, tending to follow the outlines of the areoles, and the general form is very broad, even for a short-winged form.

M. lurida Stal and M. uniformis Stal.

I believe that these species have been correctly located by Osborn and Drake, as from Stal's descriptions it is impossible to suppose that these species differ from clavata in any characters of importance beyond those drawn from the form of the antennæ. I have seen infuscata sp. nov. in several collections determined as uniformis, but the former differs so strikingly from clavata, to which the latter is compared by Stal, that such a view cannot be entertained unless examination of Stal's type should unexpectedly demonstrate its truth.

Melanorhopala infuscata sp. nov.

Long-winged form.—Dark yellowish brown with conspicuous darker markings. Head uniform brown, the spines paler; antennæ dark brown, the fourth segment and apex of third slightly darker. Pronotum broadly and variably infuscated, lateral margins and hood excepted; apex of angulate process yellowish white. Hemielytra variegated with very irregular and variable infuscation of veinlets here and there in all the areas, the infuscation sometimes extending to large portions of the surface; sutural area with a large paler region at apex. Body beneath brown, abdomen broadly pale along median line, narrowly at the lateral margins; genital segment darker. Legs brown; tarsi black. Hind wings fuscous.
Head much as in *clavata*, the median spine arising more posteriorly, between the eyes. Antennæ minutely pubescent, very slender, longer than head and pronotum together; first segment oblong, about as thick as the eye is wide as seen from above, second segment smaller, evenly enlarged toward apex, third very long and slender, thinner than the second, cylindrical, with an almost imperceptible enlargement at extreme apex, almost or quite straight, apex oblique; fourth as long as the first and second together, very slightly thicker than the third, fusiform but not quite regular in shape. Pronotal hood roof-like, a little more elevated than in *clavata*; convexity of pronotum bounded posteriorly by a continuous transverse impression; carinæ very low, uniseriate; paranota reflexed closely against pronotal surface. Costal margin of hemielytra slightly curved in male, more strongly so in female; costal area broader behind middle, irregularly reticulate, uniseriate anteriorly, biseriate at middle, triseriate behind middle, uniseriate at extreme apex; subcostal area almost perfectly and regularly biseriate; discoidal area a little more sinuate exteriorly than in *clavata*, extending much beyond middle of hemielytra; sutural area with larger areoles at apex and along inner margin. Legs and structures of ventral aspect much as in *clavata*, except that the bucculae are more rounded ventrally, rostrum extends beyond hind coxae, and the female genitalia encroach farther upon the disc of the abdomen. Wings extending beyond apex of abdomen. Form broader than in *clavata*, male narrower than the female. Length ♂ 5.4 mm., ♀ 5.5 mm.; width ♂ 1.5 mm., ♀ 1.7 mm.
Holotype ♂, allotype, and two paratypes, ♂ and ♀, Falls Church, Va., 27, 30 July, 2 August (N. Banks) in M. C. Z., Barber's, and my collection. From bark of tulip tree (Liriodendron).

This species is easily distinguished by its slender inclavate antennae (fig. 1, A), irregularly reticulate costal area, dark and variegated coloration, and broad form. These characters are not of subgeneric value according to the standards established in the treatment of Palaearctic genera.

**Hesperotingis gen. nov.**

Form ovate, broadly so in the short-winged forms; surface of hemielytra distinctly but not strongly convex in both forms. Head with two basal spines and three anterior as in allied genera; vertex with a narrow punctate area behind the median spine; antennae incrassate, the third segment very distinctly clavate, subcylindrical at base and apex. Hood very feebly developed, prothorax otherwise as in *Melanorhopala*. Hemielytra somewhat convex, the areas distinctly limited by moderately costate veins; costal area uniseriate, subcostal almost perfectly biseriate in known species; discoidal narrow, four or five areoles wide at most, slightly sinuate exteriorly, extending beyond middle of hemielytra, similar in long- and short-winged forms; sutural as in *Melanorhopala*; apices of hemielytra not divaricate in the short-winged form. Bucculae almost or quite contiguous anteriorly, not fused. Metasternal orifices distinct.

This genus is most closely related to *Melanorhopala* Stal and *Alveotingis* O. & D., but I have found it impossible to unite it with either even as a distinct subgenus. From the former it is distinguished by the incrassate, almost evenly clavate antennae, convex oval form, and nondivaricate hemielytral apices in the short-winged condition, while in habitus it is totally unlike the latter, though similar in antennal structure, the form being much less convex, the hemielytral areas more distinctly defined, and the reticulation less uniform.

Type of the genus *Hesperotingis antennata* sp. nov.

**Hesperotingis antennata** sp. nov. (Fig. 2).

Long-winged form.—Brown; head, pronotum, and antennae beyond the middle, infuscated; membranous portions between the
veinlets opaque white. Anterior margin of pronotum, hood, anterior portion of paranota, and margins and apical region of angulate process, yellow. Veinlets of hemelytra light brown, a few irregularly darker; veins defining discoidal area, sometimes one running obliquely across it, one extending from its apex, and one near and parallel with sutural margin, dark brown. Abdomen

Fig. 2. *Hesperotingis antennata* gen. et sp. nov. A, long-winged ♀; B, short-winged ♀; 1, antenniferous tubercle; 2, paranotum; 3, pronotal carinae; 4, angulate process of pronotum; 5, costal area (costal membrane of Stal); 6, subcostal area (costal of Stal); 7, discoidal area; 8, sutural area (apical of Puton in long-winged form).

beneath chestnut brown, shining, sutures darker; bucculae, sternal ridges, and pleural margins pale.

Spines of head somewhat variable in length and shape, the two anterior short, strongly curved, and almost or quite meeting over apex of median; eyes strongly granulated, as seen from above longer than wide; antenniferous tubercles as seen from above prominent, convex exteriorly, acute at apex, obliquely truncate. Antennae almost as long as head and pronotum together; first
segment oblong, almost glabrous; second shorter and a little narrower than the first, wider toward apex, with minute decumbent pubescence; third very large, clavate, in basal third more slender than the second, in apical third about as wide as the first is long, with fine pubescence becoming denser toward apex; fourth segment small, conical, more slender than the third at apex, with long dense pubescence. Pronotum transversely convex; narrowed, subcylindrical, and depressed anteriorly, margins and apical half of angulate process depressed, flat; anterior margin arcuate, with a slightly elevated collar of one or two rows of areoles; hood represented by a small backward extension of the collar; paranota reflexed closely against pronotal surface; carinae low, slightly divergent posteriorly, the extreme apices of the lateral outcurved, terminating at the level of the posterior margin of hood, the median percurrent. Hemelytra extending much beyond apex of abdomen, the marginal vein depressed, the costal area reflexed; sutural area with somewhat enlarged areoles. Bucculae large, curved ventrally, angulate posteriorly; rostral sulcus deeper and wider posteriorly. Rostrum reaching hind coxae. Hind wings extending beyond apex of abdomen. Segments of abdomen faintly and irregularly striate on apical half. Genitalia much as in allied species. Form elongate oval. Length ♀ 4.5 mm.; width 1.5 mm.

Short-winged form (fig. 2, B).—Similar in every way to the preceding, except that the general form is broadly oval; pronotum is flat and less broadened posteriorly; the carinae parallel; hemelytra but slightly longer than abdomen, the costal margin strongly curved, apices narrowly rounded, and sutural area much reduced. Length ♀ 3.7 mm.; width 1.5 mm.


A specimen from Hampton, N. H., 15 August, 1909 (S. A. Shaw) differs from the others in having very slightly shorter and uniformly dark antennæ and the subcostal area somewhat irregularly and asymmetrically reticulated with three rows of areoles in places
behind the middle. It does not appear to me to be specifically distinct and in the absence of further material may, for the sake of exact reference, be called var. borealis nov. Holotype in M. C. Z collection.

The example from the Delaware Water Gap, recently submitted to me by Barber, bears the MS. name Melanorhopala slossoni Heid.

**Hesperotingis fuscata** sp. nov.

Short-winged form.—Uniform dark fuscous, pronotum somewhat paler, membrane of areoles opaque gray, main veins of hemelytra black.

Anterior spines of head short, separated, but slightly curved. Antennae shorter and thicker than in the preceding, the third segment more evenly clavate, being subcylindrical only toward apex, not at base. Hood still more reduced, scarcely noticeable as distinct from the raised pronotal margin; paranota vertical, not applied to pronotal surface; carinae more strongly elevated, as are the chief veins of the hemelytra; subcostal area biseriate but having a few extra areoles along the middle. Other characters as in the preceding. Form broadly ovate. Length ♀ 3.4 mm.; width 1.4 mm.

Holotype: short-winged ♀, Golden, Colo. (W. J. Gerhard) in Barber’s collection.

Easily distinguished from antennata by its uniform dark color, antennal shape, and vertical paranota.

**Alveotingis** O. & D.

This genus is notable for a very peculiar habitus arising from the extremely convex form and shining surface. In most of its characters it closely approaches Melanorhopala and Hesperotingis, while bearing a certain superficial resemblance to the Serenthiini although it of course lacks the pronotal and femoral structure characteristic of this tribe. It approaches the European Oncochila in having the hemelytral areas poorly defined, but differs widely in paranotal structure and in facies. The more important characters of Alveotingis may be stated as follows: form elongate oval, hemelytra very convex, their surface smooth and shining, without costate main veins, although the outlines of the areas are traceable. Head as in related genera, the antennal tubercles of
the usual structure, as in *Melanorhopala* for instance; antennæ (fig. 1, B) shaped much as in *Hesperotingis*, the third segment clavate, smallest at base and cylindrical toward apex. Thorax as in *Melanorhopala*. Costal area of hemielytra uniseriate in the only known species; subcostal biseriate; discoidal extending beyond middle of hemielytra. In the short-winged form the hemielytra are rounded at apex, not divericate, in the long-winged they are broadly rounded at apex and widely overlapping. Buccula closed anteriorly. Metasternal orifises distinct.

**A. grossocerata** O. & D.

Probably this specific name must stand for the present, although Oshanin in his catalogue of Palaearctic Hemiptera rejects such on grammatical grounds. The type specimen of this species is a short-winged male. The figure on page 246 of Osborn and Drake’s first paper is incorrect in certain important details. The antenniferous tubercles are in reality constructed just as in related genera, and have no very striking similarity to an antennal segment. The third antennal segment is almost evenly clavate (fig. 1, B) and not fusiform as in Osborn and Drake’s drawing. The hemielytral areas are traceable, though stated in the description to be undifferentiated, but the main veins are scarcely elevated. The general form is more elongate and narrowed posteriorly than the drawing would indicate. In this species the rostrum reaches the middle coxae.

Long-winged form.—Pronotum enlarged and convex as in related genera. Hemielytra ample, extending considerably beyond apex of abdomen; costal margin slightly curved; sutural area with areoles grading larger inwardly and toward apex. Hemielytra distinctly more convex than in related genera, and habitus just as in the short-winged form except for structures affected by dimorphism. Length ♀ 3.4 mm.

Described from a female specimen lacking the third and fourth antennal segments and otherwise somewhat mutilated, taken on Mt. Washington, N. H. (W. F. Fiske), and sent to me for examination by Drake. The basal antennal segments are somewhat smaller than in the short-winged type specimen of the species, but this is no doubt due to individual variation as indicated by a short-winged male example intermediate in this regard but otherwise identical, submitted to me by de la Torre Bueno.
THE NORTH AMERICAN ANTS DESCRIBED BY ASA FITCH.

By William Morton Wheeler, Bussey Institution, Harvard University.

Asa Fitch, in his well-known report on the insects infesting fruit and forest trees, first issued in 1855 in the Transactions of the New York State Agricultural Society and in 1856 as a separate volume, published descriptions and ethological notes on six species of common North American ants which he named the “cherry ant” (*Myrmica cerasi* Fitch), the “troublesome ant” (*Myrmica molest* Say), the “silky ant” (*Formica subsericea* Say), the “wood-eating ant” (*F. herculeana* L.; *F. ligniperda* Latr.), the “New York ant” (*F. novoehoracensis* Fitch) and the “walnut ant” (*F. caryae* Fitch). Hymenopterists have bestowed little attention on Fitch’s work and have even misinterpreted some of his descriptions. A recent visit to the United States National Museum, where I found the types of his *F. novoehoracensis* and *caryae*, has led me to study the descriptions of these and the other species with a view to determining the names by which they should now be known.

1. There is no difficulty in regard to *Myrmica cerasi*, which Emery was undoubtedly right in regarding as a distinct and easily recognizable color-variety of what had been previously described by Say (1836) as *Myrmica lineolata*, now known as *Crematogaster lineolata* var. *cerasi* Fitch.

2. Fitch described at length the habits of *Myrmica molest* Say. Mayr, Forel, Dalla Torre and others believed Say’s species to be merely the common house ant, *Monomorium pharaonis* L., because Say mentioned its occurrence in dwellings, but as Fitch describes it as nesting also “in our pastures and plowed fields and sometimes doing much injury in cornfields, gnawing the blades of corn when they are but a few inches high, for the purpose of drinking the sweet juice which flows from the wounds,” it is evident that he refers to what Mayr later called *Solenopsis debilis*. The European myrmecologists were misled by their inability to believe that a small *Solenopsis*, closely allied to the European *S. fugax* Latr., could become a household pest. Many years ago I showed that this is really the case and supported Emery’s contention that Say’s
species should be known as Solenopsis molesta (= debilis Mayr). Fitch's observations, which were unknown to me at that time, are additional confirmation of our view.

3. The silky ant, Formica subsericea Say, is, of course, the common form now regarded as merely a more pubescent variety of F. fusca L.

4. Fitch's description of F. herculeana and ligniperda, which he evidently believed to be synonymous, shows that he referred to what we now call Camponotus herculeanus L. subsp. pennsylvanicus DeGeer. He was thoroughly familiar with this insect and its habits.

5. Fitch's description of F. noveboracensis is very clear and shows that he had before him specimens of what Forel later called Camponotus ligniperdus var. pictus. Some years ago Pergande proved this from examination of Fitch's types. As ligniperda is merely a subspecies of herculeanus, the ant is now called C. herculeanus L. subsp. ligniperda Latr. var. noveboracensis Fitch. It should be noted that the last name is spelled "noveboracensis" by Fitch. It is, perhaps, permissible to amend so obvious an orthographic error.

6. On examining the types of Fitch's F. caryo (several workers and females) in the National Museum I was surprised to find that they are identical with the form described by Emery in 1893 as Camponotus marginalis Latr. var. nearecticus. Emery subsequently discovered that Latreille's marginalis was a variety of C. maculatus Fabr. subsp. athiops Fabr. and that what Roger and later myrmecologists had been calling marginalis was really the form described by Nylander in 1856 as fallax. In my later papers I therefore referred nearecticus and a whole series of allied subspecies and varieties to Nylander's species. It is now evident that nearecticus becomes a synonym of caryo and that the closely related fallax of Europe, described a year later, becomes C. caryo var. fallax Nyl. Hence the synonymy of the typical caryo would stand as follows:

Camponotus (Camponotus) caryo Fitch.


Both Cresson (Synops. Fam. Gen. Hymen., 1887, p. 255) and Dalla Torre (Catalog. Hymen., 7, 1893, p. 247) assumed that Fitch’s F. carya was merely a synonym of Camponotus pennsylvanicus, but, as we have seen, Fitch was well acquainted with this ant under the old name F. herculana and we could hardly suppose that so competent an entomologist would redescribe it under a new name. And although some of the distinctive characters are omitted in the description of carya, it is, nevertheless, sufficiently explicit, even if the ethological notes and the types did not make the identification certain.

In conclusion the twenty described subspecies and varieties that must now be referred to the American carya, as the specific type, instead of to the European fallax, together with their known distribution, may be listed as follows:

North American Forms.

C. carya Fitch.—United States and British America.
  var. minutus Emery.—United States and British America.
  var. pardus Wheeler.—New York and New Jersey.
  var. tanquaryi Wheeler.—Illinois.
  var. decipiens Emery.—Indiana to Utah.
  subsp. rasilis Wheeler.—Gulf States to Arizona.
  var. pavidus Wheeler.—Gulf States.
  subsp. subbarbatus Emery.—New Jersey to California.
  var. paueipilis Emery.—Maryland.
  subsp. discolor Buckley.—Texas to Illinois.
  var. clarithorax Emery.—Pennsylvania to California.
  var. cnemidatus Emery.—Maryland.
Eurasian Forms.

C. caryæ var. fallax Nyl.—Southern Europe.
var. ruzskyi Emery.—Russia.
var. lameerei Emery.—Tashkund.
var. kamensis Ruzsky.—Kasan.
var. himalayanus Forel.—Himalayas.
var. quadrinotatus Forel.—Japan.
var. nawai Ito. Japan.
subsp. vitiosus F. Smith.—Japan.
subsp. brunni Forel.—Japan.

A NEW MALAYAN ANT OF THE GENUS PRODISCOTHYREA.

By William Morton Wheeler,
Bussey Institution, Harvard University.

Prodiscothyrea bryanti sp. nov.

Worker: Length, 2 mm. Very similar to the genotype P. velutina, which I recently described from Queensland, Australia (Trans. Royal Soc. South Australia, 40, 1916, pp. 33–37, Pl. 4), but differing in the following characters: The head is proportionally smaller and much less convex above, especially behind the frontal carinae, the eyes are much smaller and the cheeks have a more prominent blunt tooth in front of the eyes. The antennal scapes are less abruptly narrowed at the base and the funicular joints, with the exception of the last are even more transverse, so that the whole funiculus is shorter, being scarcely longer than the scape. Thorax shorter, not 1½ times as long as broad, less convex in front, with less angular humeri and with more distinct epinotal teeth and more nearly vertical epinotal declivity. Petiole much smaller and broader, nearly four times as broad as long and with a more pronounced, compressed, translucent tooth on its ventral surface. Postpetiole also shorter, less decidedly narrowed in front and less depressed above in front than in velutina. Sculpture, pubescence and color very similar to those of velutina but the dark median dorsal line on the postpetiole and first gastric segment is lacking.

Described from a single specimen taken on Penang Island in the Straits Settlements by Mr. G. E. Bryant and sent me by Mr.
Horace Donisthorpe. The discovery of this second species of *Prodiscothyrea* indicates that the members of the genus, like the species of *Discothyrea*, belong to a widely and discontinuously distributed and very ancient, hypogaeic relict fauna, all the components of which are very rare and evidently on the verge of extinction.

ANTHOCYANIN IN *PTEROCOMMA SMITHII* (Mon.).

By R. W. Glaser,
Bussey Institution, Harvard University.

*Pterocomma smithii* (Mon.), an aphid, found on the stems and twigs of willow trees, contains a red pigment which seems to be localized in the cytoplasm of the fat cells.

The pigment is soluble in water and alcohol, but especially in hydrochloric acid. A large number of aphids were rubbed up in a mortar with a few cubic centimeters of \( \frac{1}{10} \) molecular HCl. This solution was then poured into a test tube and placed in a water bath for ten or fifteen minutes to facilitate the extraction of the pigment. After this, the liquid which became an intense dark red was filtered. If a few drops of 26 per cent. ammonia are now added the solution becomes blue or bluish green. On adding more and more of the alkali, a light green color appears, gradually passing to yellow. The reaction may be reversed at any point by adding HCl. If, after obtaining the yellow color with the alkali, one adds enough \( \frac{1}{10} \) molecular HCl to the liquid the yellow will gradually pass back to the light green and bluish green.

These color reactions very strongly suggest the anthocyanins found in plants. Anthocyanins form red pigments with acids which turn blue on the addition of ammonia. I suggest the following possible series of reactions which might account for the red pigment in the aphids. The aphids suck up the hydroxyflavones from the plants to together with the sap. The hydroxyflavone is then reduced to anthocyanin in the body of the insect and later converted into the red pigment. The red pigment is deposited in the fat cells and may function as a respiratory pigment although this is not at all likely.

\[\text{Tests showed anthocyanin to be absent in twigs of willow.}\]
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.

The undersigned will greatly appreciate receiving records of New Jersey species not listed in Smith's Insects of New Jersey.—Harry B. Weiss, 272 Hale St., New Brunswick, N. J.

Offered for cash, but exchange preferred. Fitch and early Illinois reports; Insect Life; Harris's Insect; many others.—J. F. Hallinen, Cooperston, Okla.


Hemiptera-Heteroptera. I desire specimens of this group from all regions, especially New England. I will give in exchange species of this and other orders (except Lepidoptera), and will identify New England material. Correspondence desired.—H. M. Parshley, Bussey Institution, Forest Hills, Mass.

Wanted: Psychic, Vol. IX, No. 300 (April, 1901). Address, giving price, Librarian, Stanford University, Cal.

Sarcophagidse from all parts of the world bought or exchanged according to arrangement. North American material determined.—R. R. Parker, Entomological Laboratory, Massachusetts Agricultural College, Amherst, Mass.

Wanted: Transactions American Entomological Soc., Vol. 4; Entomological News, Vol. 2, Nos. 6 and 10; Vol. 8, Nos. 1 and 6; Vol. 9, Nos. 1 and 2; Vol. 10, No. 10; Vol. 11, Nos. 1, 3 and 5. Will purchase at reasonable price.—Howard L. Clark, P. O. Box 1142, Providence, R. I.

Wanted: Insects of any order from ant nests, with specimens of the host ants, from any part of the world; also Cremastochariidae of the world. Will give cash or Coleoptera, Hymenoptera and Diptera from the United States.—Wm. M. Mann, Bussey Institution, Forest Hills, Boston, Mass.

Wanted: Transactions American Entomological Society, vol. 4. Also will purchase specimens of Catocola Sappho.—Howard L. Clark, P. O. Box 1142, Providence, R. I.


Would appreciate receiving date, stage and mode of hibernation of insects of all orders. J. P. Baumberger, Bussey Institution, Forest Hills, Boston, Mass.

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Descriptions of a Few New Diaphorus from the Western States.  
M. C. Van Duzee .............................................. 33

Arthropods in Burmese Amber.  T. D. A. Cockerell ........ 40

Distributional Notes on New England Odonata.  R. Heber Howe  45

Cyclolepteron Theobald (Diptera: Culicidae).  C. S. Ludlow ........ 53

Notes on New England Tachinidae, with the Description of one New 
Genus and two New Species.  H. E. Smith ..................... 54

The Specific Differences Between Apantesis nais Drury, A. vittata Fabr, 
and A. phalerata Harris.  Werner Marchand .................. 59

Exchange Column .............................................. 61
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DESCRIPTIONS OF A FEW NEW DIAPHORUS FROM THE WESTERN STATES (DIPTERA).

By M. C. Van Duzee,
Buffalo, New York.

The seven species here described came into my hands soon after my revision of this genus was published in the Bulletin of the Buffalo Society of Natural Sciences, Vol. xi, No. 2, 1915.

I found the genus Diaphorus much better represented in California than was Chrysotus both as to species and individuals during my stay there from February to June, 1915. In the eastern states the Chrysotus are by far the more numerous.

One of the species included here is from Virginia; it came to hand after the others were described.

**Diaphorus californicus** sp. nov.

*Male*: Length, 3–4 mm. Front narrow, about as wide at the narrowest part as the width of the ocellar tubercle, wider below; face about as wide as long; face and front thickly covered with white pollen; antennae black, third joint small, rather flattened in outline at tip with the arista inserted at the upper corner; palpi and proboscis black. Thorax and abdomen green, dulled with rather thick gray pollen; venter black; hairs of the abdomen black; hypopygium concolorous with the abdomen, its appendages are rather large brown lamellae the outer part of which are nearly oval with a short slender stem and are fringed with long black hairs. Coxae and legs black with the trochanters, knees and base of fore tibiae yellowish brown (in the Alpine specimen almost wholly black): fore coxae with black hairs and a row of black bristles the whole length of the front surface; the black hairs on the under side of the femora long, those on the hind pair rapidly increasing in length towards the apex, those at its base very short;
pulvilli of fore tarsi as long as the fifth tarsal joint, those of middle and hind tarsi about equal in size but not nearly as large as those of fore tarsi. Tegulae and halteres pale yellow, the cilia of the former black. Wings tinged with gray, slightly brownish at extreme base; veins black; first vein reaching nearly half the distance to the tip of the second vein.

Described from three males from California. Two taken at Los Cerritos, Los Angeles Co., March 21, and April 3, and one taken at Alpine, San Diego Co., April 10.

This closely resembles D. lamellatus Loew but differs in the shape of the lamellae of the hypopygium and in having longer hair on the under side of the hind femora on their apical half. The lamellae of lamellatus are gradually narrowed towards their base while this species has them narrowed abruptly into a slender stem.

Diaphorus nudus sp. nov.

*Male*: Length, 2.5 mm. Face about as broad as long, covered with gray pollen; palpi black, eyes contiguous; antennae small, black, third joint rounded at tip about as long as broad; arista subapical; orbital cilia blackish. Thorax dark brown with brownish gray pollen and with a very slight greenish reflection posteriorly. Abdomen black; shining on the dorsum, in well preserved specimens with light gray pollen on the sides which contrasts strongly with the center of the dorsum; hairs of the abdomen black; hypopygium small with its appendages scarcely visible, the bristles at its tip of moderate size. Coxae and femora black; extreme tips of fore femora, tibiae and first two tarsal joints of all feet yellow, extreme tips of hind tibiae and tips of first two tarsal joints of all feet black; tarsi blackened from the third joint; fore femora nearly bare below; fore tarsi about one and one-half times as long as their tibiae; fore pulvilli enlarged; fore tibiae without bristles; middle tibiae with one minute bristle before basal third, a little shorter than their tarsi; hind tibiae with three or four small hair-like bristles above, slightly longer than their tarsi. Tegulae brown with brown cilia; knob of halteres pale yellow, stem dark brown. Wings grayish hyaline; veins brown; first vein reaching half way to the tip of the second vein; fourth vein ending a little back of the tip of the wing; last section of fifth vein about twice as
long as the cross-vein; costa somewhat enlarged from the tip of the first vein to beyond the tip of second vein; anal angle prominent.

**Female:** Front as wide as the face, covered with gray pollen, and with a black spot in the center which is quite conspicuous when viewed from in front; tarsi a little shorter than in the male, infuscated from the tip of the first joint. Abdomen and wings as in the male.

Described from two males and one female taken at Wallops Island, Va., May 25 and June 1, by W. L. McAtee.

This differs from *D. opacus* Loew in having the knobs of the halt- teres pale yellow, and having the first vein of the wing longer; from *D. adustus* V. D. it differs in having the tibiae, base of tarsi and knob of halteres yellow and the first vein longer. From *D. contiguus* Ald. to which it seems to be more closely related in having the tegulae brown and the femora nearly bare below.

**Diaphorus junctus** sp. nov.

**Male:** Length, 3–3.5 mm. Face blackish green, as wide as long; eyes contiguous on the front; antennæ small, black, third joint somewhat rounded at tip but slightly indented where the arista is inserted which is to one side of the center; orbital cilia black. Thorax and abdomen dark green, quite shining but dulled with grayish pollen which often leaves three shining vitæ on the thorax and a dark central line on the abdomen; incisures of the abdomen black; in some specimens there are coppery reflections on the thorax and in others the whole body is more steel-blue; pleure more black than the dorsum; hypopygium small, the bristles at its tip strong but somewhat variable as to length, its appendages usually invisible but in some specimens quite prominent, depending on the position of the hypopygium; they seem to consist of a claw-like hook directed toward the base of the abdomen and a pair of blunt appendages just back of this hook, a short central filament still further in, and outside of the hook a small rounded elevation fringed with hairs (this elevation can be seen in most species of the genus). Coxæ, feet, tegulae, their cilia and the halteres black. Fore femora with a row of black hairs along the lower posterior edge which are as long as the thickness of the femora; hind femora with only three or four below near the tip. Wings tinged with brown; veins black; first vein reaching half
the distance from the root of the wing to the tip of the second vein.

*Female*: Differs from the male in having the knob of the halteres yellow; the front as wide as the face and covered with yellowish white pollen; face as wide as long, divided near the center of its length by a sinuated suture, pollen of the face white.

Described from nineteen males and eight females taken in Los Angeles Co., Calif., April 3–29.

*D. junetus* is very much like *D. gibbosus* V. D. but has grayish pollen on the thorax, while that on the thorax of gibbosus is distinctly brown. The appendages of the hypopygium seem more complex than in *gibbosus* but these cannot always be seen and I have not seen the hypopygium of gibbosus stretched out to any extent. The pulvilli of the middle and hind feet seem a little more developed, it seems less variable than *gibbosus* which measures from 2–3 mm. and in which the tibiae vary in color from quite yellow to wholly black, while I have not seen any specimens of this species in which the tibiae were not black.

I think there is no doubt that this is a distinct species from that found in the east, the color of the pollen of the thorax seems to separate it and in life its brighter metallic color give it a very different appearance from our eastern species. I found it abundant in Los Angeles along the river on foliage, also took it at Los Cerritos by the Los Angeles river on foliage and on the wet sand.

**Diaphorus snowii** sp. nov.

*Male*: Length, 4 mm. Eyes contiguous on the center of the front, or nearly so; face a little longer than wide, almost black and with dark gray pollen; palpi and proboscis black; antennae black, third joint slightly wider than long, flattened at tip in outline and with a slight notch for the insertion of the arista; inferior orbital cilia delicate but rather long and of a sordid whitish color. Thorax green with thin gray pollen, sometimes with longitudinal coppery stripes; pleurae more blackish. Abdomen dark green, moderately shining; hypopygium conspicuous, concolorous with the abdomen, its appendages very small brownish lamellae with black hairs, bristles at tip rather large; venter black with brownish hairs. Coxæ and feet altogether black, except knees and fore trochanters which are more or less yellowish; all the pulvilli much enlarged;
fore tibiae without bristles; bristle near the base of the middle tibiae small; bristles of hind tibiae short but stout; fore and middle femora with a row of stout, bristle-like hairs below their entire length; hind femora with long brown hairs; all tarsi with a few longer hairs at tip of fifth joint, those of fore tarsi as long as that joint. Halteres yellow; tegulae yellowish with more or less of a black border and black cilia. Wings tinged with brown, especially in front, sometimes yellow at the root; costa a little stouter beyond the tip of the first vein; first vein reaching about two fifths of the distance to the tip of the second vein; fourth vein ending in the apex of the wing.

Described from two males; one taken in Oak Creek Canyon, Ariz. (6000 ft.), by F. H. Snow, to whom the species is dedicated. Type in the Kansas University Collection. Since returning this specimen I have received a specimen taken at Grant, Colo. (Alt. 10,000 ft.), by L. O. Jackson, which I have used in completing the above description; this paratype was received from the U. S. Dept. of Agriculture, Bureau of Biological Survey, Washington, D. C., and has been returned to them.

**Diaphorus sparsus** sp. nov.

**Male:** Length, 4 mm. Eyes contiguous on the front; third antennal joint small, scarcely as long as wide, rather flattened in outline at base and tip; arista apical. Thorax and abdomen dark metallic green; base of abdominal segments and three indistinct and rather broken lines on the thorax coppery; pollen of thorax gray; bristles at tip of abdomen rather large. Coxae, femora and hind tibiae and tarsi black; fore and middle tibiae and their metatarsi yellow; middle tibiae in type specimen without bristles; pulvilli of all feet enlarged. Tegulae and their cilia blackish; knobs of halteres pale yellow, their stems brownish. Wings tinged with brownish; veins dark brown.

Described from one male from Virginia, labeled Glencarlyn to mouth 4-in Run, June 11, 1916 (W. L. McAtee).

This species is very much like *D. spectabilis* Leew, but has the hind tibiae and tarsi deep, shining black; the pollen of the thorax is also gray, in *spectabilis* the pollen of the thorax is yellowish brown and all tibiae are light yellow, at most brownish yellow.

The name refers to the broken coppery lines on the thorax but
these may prove to be wanting in some specimens when the species is better known.

**Diaphorus inornatus** sp. nov.

*Male*: Length, 2.5–3 mm. Face a little longer than wide, silvery; front green with the pollen of the face extending onto the lower portion a little; palpi yellowish white, blackish at base, rather large; lateral and lower orbital cilia white, abundant; antennae black, third joint small with a short point near the center of the tip; arista apical. Thorax green, slightly dullened with gray pollen; pleurae more blackish. Abdomen green with gray pollen along the sides; hypopygium small, its appendages concealed, the bristles at tip small but distinct in some specimens, in others scarcely noticeable. Coxæ black; femora dark green; tips of femora, fore trochanters, tibiae and base of fore and middle tarsi yellow; tips of hind tibiae, hind tarsi and fore and middle tarsi from the tip of the first joint infuscated; pulvilli of fore tarsi scarcely enlarged. Tegulae, their cilia and the halteres whitish. Wings nearly hyaline; veins black; yellow at the extreme root of the wings; first vein reaching about one half the distance to the tip of the second.

Described from three males from California. Two were taken at Alpine, San Diego Co., April 10, and one taken at Fresno, May 6.

**Diaphorus vulsus** sp. nov.

*Male*: Length, 3 mm. Face a little narrower than the front, slightly wider below, covered with silvery white pollen; palpi white; front green with considerable white pollen; antennae black, third joint somewhat triangular, pointed, scarcely as long as the width of the base; arista apical; lateral and inferior orbital cilia white, those above the eyes black. Thorax and abdomen metallic green with grayish white pollen, which is thickest on the pleurae, metanotum and sides of thorax and abdomen; incisures of the abdomen very narrowly yellowish; venter yellowish brown at base; hypopygium concealed, its appendages very small, bristles at tip small. Fore coxae and all the legs yellow; hind femora very slightly brownish above at tip; tarsi brownish almost from their base, black at tip; pulvilli of fore tarsi large white, those of middle and hind tarsi small; fore tarsi with minute pale hairs and black bristles;
each femora with a few small bristle-like hairs at tip on the lower posterior edge; middle tibiae with only one bristle which is large, stout, black and inserted on the anterior side near the base; hind tibiae with several bristles above, three or four of which are larger than the rest, the one near the base is the largest; feet slender, the fore tarsi longer than their tibiae, middle tarsi about equal to their tibiae in length, and hind tarsi shorter than their tibiae. Tegulae and knob of halteres pale yellow, stem of halteres brownish; cilia of the tegulae yellow, yet appearing nearly black in certain lights. Wings grayish hyaline, tinged with yellowish brown in front of the third vein; first vein reaching about half the way to the tip of second vein; fourth vein ending in the apex of the wing; costa rather stout, black; veins brownish, yellow at the root of the wings.

Female: Agrees with the male except in sexual characters and that the face is wider and not silvery but rather thickly covered with white pollen and the third antennal joint is smaller.

Described from one male and two females taken at Bill William’s Fork, Ariz., Aug. and Sept., by F. H. Snow.

Type in the Kansas University collection.

This species agrees with D. variabilis V. D. in most characters but differs in having no small bristle on the top of the middle tibiae, there being no bristles on them except the large one near the base in front, in variabilis this small bristle is distinct as well as the preapical one on the outer side of the hind femora which is also lacking in this species; the body and legs are more slender and the wings and wing-veins more yellowish than in variabilis. Although these two species resemble each other so much yet I feel sure they are distinct.
ARTHROPODS IN BURMESE AMBER.

By T. D. A. Cockerell,
University of Colorado, Boulder, Colorado.

A study of a considerable quantity of Burmese amber, additional to that previously reported on, reveals a remarkably interesting fauna. Hymenoptera are represented by Bethylidae, which are abundant, though often fragmentary; Evaniiidae of several genera, and a Trigonalys. A very thorough examination fails to reveal a single ant. Hemiptera (Heteroptera) are represented by two genera and four species of Enicocephalidae. There are some Homoptera, not yet closely examined. The Diptera include Empididae, Sciara, Psychodidae (Trichomyia), and a Cecidomyiid. The Coleoptera include Elateridae, Dermestidae, Rhipiphoridae, Ipidae, and others not yet studied; but no Carabidae or Paussidae. There are many Blattids, young or fragmentary in every case; Termites are also frequent, but probably of few species. The mites are numerous and varied, but usually in poor condition for description; no spiders have yet been found. The Diplopods are represented by Polyxenus, and there is a good Pseudoscorpion, representing an apparently extinct genus. There is a very good Lepismatid, referred rather doubtfully to Lampropholis. The present paper puts on record a number of these discoveries. The amber (Burmite) was found in clay of Miocene age, but was derived from elsewhere, and may be much older. The specimens have been presented by Mr. R. C. J. Swinhoe of Mandalay to the British Museum. All the species described below were in a single large lump of amber, and therefore lived at the same time and place.

Pselaphognatha.

Polyxenus burmiticus sp. nov. (Polyxenidae).

Length about 2400 microns; antennae about 320; width of head about 560; longest lateral bristles about 560 microns long, longest caudal bristles about 720. Apparently sixteen pairs of legs. Antennae apparently 7-jointed, counting a very minute and rather doubtful apical joint; fifth joint longest; first, second, fourth and
sixth subequal; third shorter. Bristles exceedingly abundant and long, dark fuscous.

Burmese amber, from R. C. J. Swinhoe; in the same piece as *Electrocanthus gracilipes*, about 30 mm. from it. This appears to be a true *Polyxenus*, but it is remarkable for the very long and copious bristles. The species described by Koch and Berendt from Baltic amber have short bristles, and are entirely different. Our animal is curiously like an Anthrenid larva, and on account of its long bristles resembles the much more ancient *Palaeocampa* from the Pennsylvanian of Illinois. The structure figured at A, which I at first took for a pair of caudal appendages, is evidently the end of a piece of vegetable débris which appears on the other side.

**Acarina.**

*Cheyletus burmiticus* sp. nov. (Cheyletidae).

Length about 736 microns; shining reddish-brown, with very little hair; mandibles ordinary; palpi extremely stout, strongly elbowed at base; claw well-formed, curved, on left palpus, but the right one appears minutely bidentate at end; thumb-papillæ lengthened, long and slender, ribbon-like, but not pectinate; legs as usual in the genus, so far as can be seen; abdomen broadly rounded posteriorly. The following measurements are in microns: length of palpus about 208; second joint of anterior leg about 160, the third about 120; last joint of second leg about 160.

Burmese amber, from R. C. J. Swinhoe. In the same slab as the type of *Winnertziola burmitica*, and 3 mm. from it; also 6
mm. from the type of *Scleroderma quadridentatum*. Although I cannot make out any palpal combs, the animal is evidently not a *Cheyletiella*.

**Diptera.**

*Winnertziola burmitica* sp. nov. (Cecidomyiidae).

♀. Piceous, including legs and antennae; wings clear, nervures ferruginous; surface of wings not conspicuously hairy, margin with long hairs; thorax narrow; abdomen long and narrow, the caudal appendages long and slender; venation as usual in the genus, the cross-vein not very oblique; antennae apparently 11-jointed, but there is doubtless a second basal joint not seen, making 12 in all; antennal joints with long hairs, but no circumfili, whether with surface markings cannot be determined; the three joints before the last broader basally than apically; palpi large, apparently 3-jointed, but there is probably a small basal joint not seen, joint before the last not appreciably shorter than the last; tarsi with 5 joints, basal joint very short, second long; claws small, apparently simple, emporium so small that it cannot be clearly made out; halteres very large, the large club dark brown. The following measurements are in microns: total length about 1760; length of wing about 1120; length of antennae apparently about 400, but they are seen obliquely, and are probably about 480; last joint of palpus 57; width of club of halter 64; length of hind femur 400; hind tarsal joints (1) 64, (2) 240, (3) 112, (4) 80, (5) 64.

Burmese amber, from R. C. J. Swinhoe; in the same slab as the type of *Enicocephalus swinhoei*, and 10 mm. from it. This may possibly be separable from *Winnertziola* on account of the long caudal appendages, the form of the palpi, the probably simple claws, etc., but some of these differences are doubtful, and the others are slight, so a separate genus hardly seems to be required. The allied genus *Winnertzia* is known from Baltic amber.
Coleoptera.

Dermestes larvalis sp. nov. (Dermestidae).

A minute larva, about 750 microns long (not counting hairs); head, legs and hairs ferruginous; apical half of mandibles piceous, exactly as in modern Anthrenus larvae; body covered with spinulose hairs, the dorsal ones very long and abundant, not tufted; longest hair from vicinity of head about end of front leg; C, mandible; D, hair.

Fig. 4. Dermestes larvalis n. sp. A, hind leg; B, 960 microns; caudal end with extraordinarily long hairs, the longest 3200 microns, not forming a distinct tuft; legs as in modern Anthrenus larvae, with single sharp claw; femora with short hairs, tibiae with bristles, hind tibiae with small spines. The hind legs are about 320 microns long. The body is without corneous plates.

Burmese amber, from R. C. J. Swinhoe. In same slab as type of Cryphalites rugosissmus, and 33.5 mm. from it. The characters are exactly those of modern Dermestid larvae, but the generic reference is of course not precise. The long hairs suggest Dermestes rather than some of the other common genera. Evidently the museum curator and entomologist, had they existed in Tertiary times, would have been troubled by Dermestids as they are today.

Hymenoptera.

Scleroderma (?) quadridentatum sp. nov. (Bethylidae).

♀. Apterous. Head and thorax 1.7 mm. long; abdomen beyond first segment missing, but total length was probably about 3.5 mm.; head and thorax black, legs and abdomen ferruginous; antennae pale ferruginous at base, the flagellum darker; mandibles ferruginous, at least 3-dentate, the outer margin strongly and evenly curved; antennae 10-jointed, the scape extremely large and thick, fully twice as wide at apex as the next joint; head subquadrate,
narrowed and truncate posteriorly; eyes large and prominent; prothorax long, narrowly conical in outline, but the sides bulging, the whole thorax very long and narrow; metathorax posteriorly at sides with short but distinct teeth, four in all; anterior femora with upper margin concave, lower convex; hind femora very broad, cuneiform, the large end basad, the basal upper corner very prominent, obtusely rectangular; abdomen with a slender petiole, but rapidly widening, as in living forms. Hind tibiae with a single long spur. The following measurements are in microns: greatest width of head 440; length of eyes 224; width of thorax in middle 368; width first abdominal segment 592.

Burmese amber, from R. C. J. Swinhoe. In the same slab as the type of Winnertziola burmitica, and 7.5 mm. from it. The specimen shows the ventral view, and the palpi are not visible, so the generic reference may be somewhat doubtful. The insert is, however, of this immediate alliance, and the relatively large laterally placed eyes indicate a more primitive type than typical living Scleroderma. Species of this genus (S. tuberculata Magr. and S. luteicolle Kieff.) are known in the existing fauna of Burma. The great antiquity of the genus is indicated by the fact that although the females are wingless, species occur on the most remote islands; the Hawaiian Is. (many species), Guam, the Seychelles and St. Helena.

Apenesia electriphila sp. nov. (Bethylidae).

♂. Length about 2.5 mm.; black or piceous; wings clear, with light ferruginous stigma and nervures, venation typical for genus, stigma large, marginal cell open at end. Mandibles bidentate, the teeth stout; labial palpi 3-jointed; antennae apparently 12-jointed, but turned down at ends, and possibly only 11-jointed; scape broad and flattened, curved; flagellar joints short and broad, antennal joints 2–7 longer than broad, 8–10 as broad as long; head broad, occipital margin sharp; eyes rather large, prominent, about 144 microns long; width of head
about 528 microns. Thorax long and narrow, about 480 microns wide in middle; anterior legs about 704 microns behind head; anterior femora curved, convex above, concave below; their tibiae rather short (about 288 microns), with a single long spur; their tarsi long, the first joint longer than next three together, and strongly curved; hind femora extremely broad and flattened, the summit of the curve about half-way between base and middle; abdomen with a rather long petiole.

Burmese amber, from R. C. J. Swinhoe. In the same slab as the type of *Cryphalites rugosissimus*, and 24.5 mm. from it. Related to *Scleroderma (?) quadridentatum*, which may possibly belong to *Apenesia*, but on account of the black abdomen and various structural characters surely not its male.

**DISTRIBUTIONAL NOTES ON NEW ENGLAND ODONATA.**

**PART I.**

**By R. Heber Howe, Jr.,**

Thoreau Museum, Concord, Massachusetts.

Since Dr. P. P. Calvert’s List was published in October, 1905, the following published corrections and additions have been made:

*Argia apicalis* (Say) Selys recorded from Maine by Dr. Calvert on the authority of Prof. Harvey was expunged by Dr. Calvert following an examination of the Harvey specimens by Mr. Williamson (Ent. News 17: 31. 1906).

*Argia mastata putrida* (Hagen) was shown by Mr. E. B. Williamson to be synonymous with *Argia mastata* Hagen (Ent. News 23: 200. 1912.)

In Dr. E. M. Walker’s “The North American Dragon-flies of the Genus *Æschna* (Univ. Toronto Studies, Biol. Series, 1912) the following New England records for the genus were made:

*Æschna cærulea septentrionalis* Burm.

N. H. White Mts. (Scudder)

*Æschna juncea* Linn.

N. H. White Mts. (Scudder)
140. *Æshna interrupta* Walker. New species for New England
   Me. Portland (*Jones*)
   Vt. ——— (*Frost*)
   Mass. ——— (*Uhler*)

141. *Æshna eremita* Scudd. New species for New England
   Me. Six Ponds, Piscataquis Co. (*Harvey*)
   N. H. Franconia (*Slosson*)
   Hermit Lake, Mt. Washington (*Scudder*)

*Æshna clepsydra* Say
   Me. Manchester (*Wadsworth*)
   Mass. Brookline (*Shurtleff*)
   Provincetown (*Benedict*)
   Wilbraham (*Hagen*)
   Boston (*Uhler*)
   Salem (*True*)
   Natick (*Sanborn*)

   Me. Bradley (*Harvey*)
   Manchester (*Wadsworth*)
   Norway (*Smith*)
   Orono (*Harvey*)
   N. H. White Mts. (*Shurtleff*)
   White Mts. House (*Calvert*)
   Franconia (*Calvert*)
   Fabyans
   Vt. Newport (*Slosson*)
   Mass. ——— (*Needham*)

*Æshna verticalis* Hagan = *A. juncea verticalis* (Hagen) of Dr. Calvert’s List
   Me. Manchester (*Wadsworth*)
   West Beach (*Hagen*)
   Mass. Beverly
   Cambridge
   Nahant (*Moring*)
   Salem (*Lane*)
   Saugus
   Sherbourne
   Walpole (*Sprague*)
   Westborn (*Needham*)
   Wollaston (*Sprague*)
143. *Eshna tuberculifera* Walker

Me. Islesboro (*Dixon*)
Manchester (*Wadsworth*)
Mass. Walpole (*Sprague*)
Essex Co., (*Hagen*)
Provincetown (*Benedict*)
Hampden (*Needham*)
Westborn (*Needham*)

144. *Eshna umbrosa* Walker

Me. Manchester (*Wadsworth*)
Augusta (*Wadsworth*)
Norway (*Smith*)
Gorham
Millinocket (*Harvey*)
Russell Stream (*Corry*)
Bradley (*Harvey*)
Greenfield (*Harvey*)
Six Ponds (*Harvey*)

N. H. Franconia (*Slosson*)
White Mts. (*Sprague*)
Hermit Lake (*Scudder*)
Centre Harbor
Mass. Boston
Cambridge
Amherst (*Needham*)
Wilbraham (*Martin*)
Auburndale
Gor Head = Gay Head

*Eshna constricta* Say

Me. Manchester (*Wadsworth*)
Mass. Hampden (*Needham*)

145. *Eshna mutata* Hagen

Mass. Wilbraham (*Needham*)

In the Proceedings of the Thoreau Museum of Natural History, I: 41, 1915, Mr. E. L. Peirson recorded the capture of the following species in Concord, Mass., and Dr. Calvert in the Ent. News, 26: 238–239, 1915 again noted Mr. Peirson’s capture and added a record of a female taken by Mr. C. W. Johnson at Dedham, Mass.
Mr. E. J. Smith of Sherborn, Mass., kindly permits me to here record the capture of a male, on April 30, 1913, at Sherborn.

146. *Williamsonia lintneri* (Hagen) Davis

Mass. Concord (Peirson)

Dedham (Calvert)

In *Psyche*, 23: 12–15, 1916, the author recorded *Aeshna umbrosa* and *Aeshna canadensis* as new to New England having overlooked Dr. Walker’s records. *Libellula luctuosa* Burm., though not uncommon, was added to Dr. Calvert’s List.

147. *Libellula luctuosa* Burm.

Mass. Concord (Howe)

I now wish to record records of a few species sent me from Brandon, Vt., by Mr. D. Lewis Dutton; a small lot from North Guilford, Conn., sent by Mr. Geo. L. Howe; two species from Cataumet, Mass., sent by Miss Theresa Winsor; a summer’s catch in New Hampshire made with the continual aid and co-operation of Mr. David M. Little, and a spring and autumn catch at Concord, Mass., made with the help of my daughter, Miss Susan A. Howe, and the Misses Shaw.

*Anax junius* (Drury) Selys. May 27, 1912. New to Vermont

*Aeshna eremita* Scudd. Aug. 31, 1915. New to Vermont

*Aeshna umbrosa* Walker. May 6, 1915. New to Vermont

*Basiwshna janata* (Say) Selys. May 22, 1912. New to Vermont

*Plathemis lydia* (Drury) Hagen. July, 1912. New to Vermont

*Sympetrum rubicundulum* (or var. *obtrusum*), teneral female. July, 1912, in either case new to Vermont

On September 18, 1915, I collected at Bristol and Middletown, R. I., and again at Middletown on June 3, 1916, and at Bristol on October 2, 1916. The following species were taken:

*Lestes rectangularis* Say. Bristol, Sept.

*Enallagma civile* (Hagen) Selys. Both stations, Sept.

*Ishnura rambarii* Selys. Both stations, Sept., Oct. 2

Eshna tuberculifera Walker. Bristol, Sept. New to Rhode Island
Libellula pulchella Drury, Middletown, Sept.
Platthemis lydia (Drury) Hagen. Bristol, Sept.
Pantala flavescens (Fab.) Hagen, teneral. Bristol, Sept.
New to Rhode Island
Sympetrum rubicundulum (Say) Kirby. Both stations, Sept.
Ischnura posita (Hagen) Needham. Middletown, Sept. and June

The collection from North Guilford, Conn., contained the following:
Platthemis lydia (Drury) Hagen. July, 1916

The two species from Cataumet, Mass., were:
Erythrodiplax berenice (Drury) Ris. July, 1916
Epicordulia princeps (Hagen) Selys. July, 1916

I began collecting on Meredith Neck, N. H., on June 29 and visited various collecting grounds on the shores of Lake Winnipesaukee until August 23. These included Centre Harbor, Meredith, Moultonboro (Sanborn's Meadows), and made two trips to Lake Asquam, with one excursion to Newfound and one to Profile Lake. The list of species follows:

Agrion maculata Beauv. Meredith Neck, July 27. New to New Hampshire
Lestes disjunctus Selys. Meredith Neck and Moultonboro, Aug. 1–22
Lestes rectangularis Say. Meredith Neck, July 18–Aug. 15
Lestes vigilax Hagen. Meredith Neck and Moultonboro, July 6–Aug. 15. New to New Hampshire
Lestes inequalis Walsh. Meredith Neck and Moultonboro, July 6–Aug. 15
Argia mesta Hagen. Meredith Neck and Moultonboro, July 7–Aug. 23. New to New Hampshire
Argia violacea (Hagen) Selys. Meredith Neck, July 17–Aug. 23. New to New Hampshire
Nehalennia irene (Hagen) Selys. Meredith, July 5–24 and Moultonboro

Enallagma calverti Morse. Profile Lake, Aug. 12. New to New Hampshire

Enallagma hageni (Walsh) Selys. Meredith and Moultonboro, July 2–11. New to New Hampshire

Enallagma ebrrium (Hagen) Selys. Meredith Neck and Moultonboro, July 5–18


Enallagma minusculum Morse. Meredith Neck, Aug. 6–23. New to New Hampshire


Enallagma exsulans (Hagen) Selys. Meredith Neck, July 17–Aug. 7. New to New Hampshire

Enallagma signatum (Hagen) Selys. Meredith Neck and Moultonboro, July 2–Aug. 22. New to New Hampshire

Enallagma pollutum (Hagen) Selys. Moultonboro, July 2. New to New Hampshire

Ischnura verticalis (Say) Selys. Meredith Neck, Centre Harbor, Moultonboro, July 5–Aug. 22

Hagenius breristylus Selys. Meredith Neck and Moultonboro, July 12–Aug. 22

Gomphus exilis Selys. Meredith Neck and Moultonboro, June 30–Aug. 2

Dromogomphus spinosus Selys. Meredith Neck, Newfound Lake, Moultonboro, July 20–Aug. 14

Anax junius (Drury) Selys. Meredith, July 5–27

Æshna verticalis (Hagen). Meredith Neck, Aug. 7–18

Æshna clepsydra Say. Moultonboro, Aug. 14–27

Æshna canadensis Walker. Moultonboro, Meredith Neck, Jackson, Aug. 2–22

Æshna eremita Scudd. Profile Lake and Moultonboro, Aug. 12–14

Æshna umbrosa Walker. Meredith Neck, Aug. 7–18
New to New England  
*Basiashna janata* (Say) Selys. Meredith Neck, July 5–7  
*Didymops transversa* (Say) Hagen. Meredith Neck, July 11  
*Macromia illionoisensis* Walsh. Meredith Neck and Moultonboro, Aug. 2–7  
*Epicordulia princeps* (Hagen) Selys. Concord and Meredith Neck, June 29–Aug. 2. New to New Hampshire  
*Tetragoneuria spinigera* (Selys) Selys. Meredith Neck, June 29–July 11  
*Somatochlora elongata* (Scudd.) Selys. Centre Harbor and Jackson, July 14–Aug. 12  
*Cordulia shurtleffi* Scudd. Moultonboro, July 8–18  
*Dorocordulia libera* (Selys) Need. Moultonboro, July 8  
*Libellula exusta* Say. Moultonboro and Meredith Neck, July 6–25  
*Libellula palehella* Drury. Centre Harbor, Meredith Neck, Moultonboro, July 5–Aug. 20  
*Libellula quadriramaeulata* Linn. Meredith Neck, Moultonboro, Centre Harbor, June 30 July 18  
*Plathemis lydia* (Drury) Hagen. Centre Harbor, July 7  
*Sympetrum rubicundulum* (Say) Kirby. Meredith Neck, Centre Harbor, Moultonboro, Profile Lake, July 11–Aug. 23  
*Sympetrum rubicundulum obtusum* (Hagen). Meredith Neck and Centre Harbor, July 5–7  
*Sympetrum vicinum* (Hagen) Kirby. Meredith Neck and Jackson, Aug. 12–14
Leucorhinia frigida Hagen. Moultonboro, July 6–Aug. 14
Leucorhinia glacialis Hagen. Moultonboro, July 6–9
Leucorhinia intacta (Hagen) Hagen. Meredith Neck, and Moultonboro, Centre Harbor, June 30–July 27
Celithemis elisa (Hagen) Walsh. Moultonboro, July 18–Aug. 14. This species was also captured at Tyngsboro, Mass., on June 29.

I began collecting in Concord, Mass., with the first appearance of dragon-fly life and collected until June 28. On August 24 I returned from New Hampshire and collected until the end of the season. During these periods I added the following species to my Preliminary List published in Psyche (ibid.), bringing the number from 52 to 67.

Lesles uncatus Kirby. Common, June 27
152. (?) Argia sedula Hagen. Two specimens taken on June 2 were of doubtful determination by Mr. Williamson.
The species would be new to New England.
Ischnura posita (Hagen) Need. Male, Sept. 3
Cordulegaster diastalops Selys. One female, June 1
Cordulegaster maculatus Selys. One male, June 28
Leshna tuberculifera Walker. One male, Sept. 3–6
Leshna verticalis Hagen. Not uncommon, Aug. 15–Oct. 1
Epicordulia princeps (Hagen) Selys. Two males, June 23, July 28
Boyeria vinosa (Say) MacLachlan. One seen Sept. 13
Tetragonuria cynosura var. simulans Mutt. Several, June 23
Helocordulia uhleri (Selys) Need. One male, May 29
Cordidia shurtleffi Scudd. One female, June 27. New to Massachusetts
Libellula semifasciata Burm., teneral. June 23
Sympetrum rubicundulum var. obtrusum (Hagen). Male, Oct. 5
Leucorhinia intacta (Hagen) Hagen. Not uncommon, May 30–June 28

Through the kindness of Mr. C. W. Johnson, Curator, I have examined the collection of Odonata in the Boston Society of Natural History, and can add the following new records:
1917]

Ludlow—Cycloleppteron Theobald (Diptera: Culicidae) 53

Agrion maculata Beauv. New to Connecticut, Rowayton, and Rhode Island, Apponaug

Lestes uncatus Kirby. New to Connecticut, Darien

Lestes inequalis Walsh. New to Massachusetts, Cohasset, Blue Hills, No. Reading, Manomet

Gomphus parrulus (Selys) Need. New to Massachusetts, No. Reading and East Walpole

Cordulegaster maculatus Selys. New to Vermont, Bennington

Libellula semifasciata Burm. New to Connecticut, Darien

Erythrodiplax berenice (Drury) Ris. New to Connecticut, Rowayton

Tramea carolina (L.) Hagen. New to Connecticut, Darien


Pachydiplax longipennis (Burm.) Brauer. New to Connecticut, Darien

All my determinations for the above species have been verified by either Messrs. Ed. B. Williamson, R. A. Muttkowski or E. M Walker, and to these gentlemen I extend my most hearty thanks.

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CYCLOLEPPTERON THEOBALD (DIPTERA: CULICIDAE).

Some new, i. e. hitherto unreported localities for the group of Anophelines which Mr. Theobald placed together under the genus Cycloleppteron are: San Juan, Jajuga, Carolina, and Coamo Springs, Porto Rico, from which places specimens were sent by Dr. B. H. Dutcher, Lieut.-Colonel, Medical Corps, U. S. Army, during the period Sept. 11, 1914–July 15, 1915, since which time no collections from Porto Rico have been received.

C. S. LUDLOW.

NOTES ON NEW ENGLAND TACHINIDÆ, WITH THE
DESCRIPTION OF ONE NEW GENUS AND TWO NEW
SPECIES.

By Harrison E. Smith,
Entomological Assistant, Cereal and Forage Insect Investigations,
United States Bureau of Entomology.

Pseudotachinomyia gen. nov.

Head wider than thorax, antennæ inserted above the eye middle, 
as viewed from the side, the head projects in front of the eye, 
nearly one-half the horizontal diameter of the eye. Probosis 
robust, shorter than height of head, palpi large, vibrissæ strong, 
cruciate, placed slightly above the front edge of the oral margin. 
Facial ridges bristly on at least the lower half, antennæ nearly as 
long as face, frontal bristles descending below the base of the third 
antennal joint. Eyes bare (microscopically, sparsely hairy), sides 
of face on lower half bare, less than one-third as wide as the facial 
depression, ocellar bristles proclineate. Wings hyaline, the first 
longitudinal vein bare, apical cell open, ending well before the 
extra wing tip, bend of fourth longitudinal vein without distinct 
stump or long wrinkle. Abdomen short conical, male hypopygi-
um projecting, female with wide, shining black pseudo-ovipositor. 
Type, the following species:

Pseudotachinomyia webberi sp. nov.

Black, gray pollinose species. Length, 6–10 mm.

Front in male nearly as wide as, in female about one and one-
third times as wide as either eye, frontal vitta opaque brownish 
black, wider than sides of front. Parafrontals yellowish gray 
pollinose, frontal bristles in a single row, outside of these numerous 
fine, long, bristly hairs. Antennæ black, faintly tinged with rufous 
at base of third antennal joint, the third joint in male about five 
times as long as, in female from two and one-half to three times as 
long as, the second. Arista as long as the antennæ, microscopie-
ally sparsely pubescent, thickened on approximately the basal 
third, the penultimate joint two times as long as broad, cheeks at 
least one-fourth as wide as the eye height, palpi yellow. Thorax
grayish pollinose, as viewed from behind, marked with four wide black vitta. Three postsutural and three sternopleural macrochaetae. Scutellum black or reddish yellow at apex, densely gray pollinose, bearing three pairs of long marginal and a shorter cruciate apical pair of macrochaetae. Scutellar disk clothed with many fine long erect hairs and a pair of discal macrochaetae. Legs black, knees yellowish, front pulvilli in male about as long as, in female one-half as long as, the last tarsal joint. Middle tibiae on the outer front side each, bearing several long macrochaetae, the hind tibiae with a row of stout bristles of irregular length. Abdomen yellowish gray pollinose, marked with several distinct shining black reflecting spots and a median black vitta. First segment bearing a median marginal pair of macrochaetae, second segment a median discal and marginal pair, third segment a median discal pair and a marginal row, and the fourth segment a discal and marginal row. Fine, long, bristly hairs of abdomen sub-erect. Male hypopygium projecting, the genitalia curving forward beneath the fourth abdominal segment, the tip of the forceps resting in a sheath formed by a bisected flap-like projection on either side of the median venter of the fourth segment. Ventral aspects of forceps at base somewhat narrow, gradually broadening to their greatest width, whence they taper to a point at the tip. Inner margin of forceps on basal half, and the outer margin bearing bristly black hairs, the remaining surface shining brownish black with a few scattered black hairs. In the female the sheath of the ovipositor is similar in form to sheath of forceps in the male, but is not bisected on its front surface. The female ovipositor is not distinctly visible, but what appears to be this organ is shining black in color, broad at base and sharply pointed at tip. Wings longer than abdomen, small cross-vein far before tip of first longitudinal vein, third longitudinal vein bearing two to six bristles at its base, posterior end of hind cross-vein nearer to bend of the fourth longitudinal vein than to the small cross-vein. Calypteres milky white.

Described from 4 males and 9 females. (Holotype, U. S. N. M. Cat. No. 20201) a male taken at Melrose Highlands, Mass., May 16, '15. (Allotype, U. S. N. M.) a female taken at Malden, Mass., May 15, '15. (Paratypes) 1 male, 4 females taken at Malden, Mass., May 28, '15; 2 males, 3 females taken at Melrose High-

1 Vestigial first abdominal segment not considered.
Psyche

lands, Mass., June 15, ’14, and May 20 to June 2, ’15, placed in collection of author and the Gypsy Moth Parasite Laboratory. (Paratype) one female taken at Amherst, Mass., by unknown student at Massachusetts Agricultural College, during May or June, 1914, placed in collection of that institution. With the exception of the Amherst specimen, the others were taken by Mr. R. T. Webber, after whom this fine species is named.

**Sciasma frontalis** sp. nov.

Shining bluish black, destitute of pollen. Length, 4 mm.

Front one and one-third times as wide as either eye, frontal bristles descending to middle of second antennal joint, outside of these an anterior pair of proclineate and a pair of reclinate bristles. Ocellar bristles very weak, directed divergingly forward, frontal vitta about four-fifths as wide as sides of front. Parafrontals to base of second antennal joint opaque black, parafacials fulfous, eyes bare. Sides of face on lower half bare, about two-fifths as wide as the frontal vitta, facial plate deeply concave, hardly one-half as wide at base of antennae as at the vibrissæ. Antennæ orange yellow, the second joint nearly as long as the third, arista black, thickened on the basal fourth to one-third, the penultimate joint broader than long. Vibrissæ cruciate, placed on a level with the front edge of the oral margin, diameter of head at vibrissæ about as long as at base of antennae, cheeks one-tenth as wide as the eye height. Thorax shining bluish black, not vittate, one posttatural and two sternopleural macrochaetae. Scutellum bearing a single pair of long marginal and a shorter apical pair of macrochaetae. Legs black, except the front coxae and femora which are yellowish, hind tibiae pectinate with two or three widely separated short bristles. Abdomen flattened, somewhat conical in shape, clothed with short appressed bristly hairs, several weak macrochaetae on margin of the fourth segment, the genitalia large and bulbous, curving forward beneath the fourth segment. Wings to tip of the second longitudinal vein wholly smoky brown, the remainder hyaline, veins destitute of setulae, apical cell closed, the apex of third longitudinal vein obsolete. Anterior pair of calypteres sub-hyaline, the posterior pair smoky brown.

Described from a single female (Holotype) taken by the writer at West Springfield, Mass., August 13, 1915. Placed in the col-
lection of the Boston Society of Natural History. There is no evidence of the palpi being present in the specimen, and as these do not appear to be hidden in the oral cavity, nor the specimen to have been injured at this point, it is not improbable that more material will prove this species generically distinct.

Pelatachina pellucida Coq.¹

During May, 1912, the writer reared specimens of this species at the Gypsy Moth Parasite Laboratory. The tachinid maggots had emerged from the larvæ of Euvanessa antiopa Linn., during the month of August, 1911, hibernating in the puparia through the winter of 1911–12. From 344 of the lepidopterous larvæ taken in the Lynn Woods, Mass., 214 puparia of this tachinid were obtained. Superparasitism existed to a great extent in the host larvæ, thus, the figures do not indicate the exact percentage of parasitism. The maggots live within the host, located in typical integumental funnels. The anal stigmata of the puparia are highly raised with the dorsal surface reticulated. A series of the reared specimens compared with the type of the species in the United States National Museum, appear identical with the specimen described by Coquillett. To my knowledge, this is the first record of this genus having been reared in North America although Brauer and Bergenstamm² record the rearing of the genotype, Pelatachina tibialis Fall. from Vanessa urticae Linn. in Europe.

Compsilura concinnata Meig.

Since the introduction of this species from Europe and the establishing of it in the United States, by the United States Bureau of Entomology, as one of the foremost primary parasites of Por-theatria dispar Linn. and Euproctis chrysorrhoea Linn., it is known to have been reared from more than twenty species of native North American Lepidoptera. In the study of reared Tachinidae from various New England sources, it has been noted that this species is particularly prolific as a parasite of Euvanessa antiopa Linn. In certain instances of its parasitism upon this host in the New


England States, the percentage of parasitism has been well over 50 per cent. At times, as many as five maggots have matured within an individual host. I have before me a single female of this species, reared from Callosamia promethia Drury, May 2, 1914, by Mr. William Reiff at Forest Hills, Mass. These data appear to establish the fact that Compsilura concinnata hibernates through the winter in New England in the pupa of this host. The writer has also reared a male and female of this species, from a pupa of Diacrisia virginica Fabr., taken as a larva late in the fall of 1915 at West Springfield, Mass., the adult Compsilura issuing May 12–15, 1916. The tachinid maggots apparently hibernate in the host pupa until just before they are ready to pupate, whence, they leave the host pupa, probably in early April, and pupate within the cocoon of their host.

Exoristoides slossonæ Coq.¹

Three males of this species before me, taken at Bennington, Vt., June 18, 1915, by Mr. C. W. Johnson. One male with setulae present upon the first longitudinal vein agrees in detail with Coquillett’s description of slossonæ. The remaining two specimens without the presence of setulae upon the first longitudinal vein, agree with the description of Exorista spinipennis Coq.,² yet it is evident that all three specimens are conspecific. The character of setulae being present upon the first longitudinal vein, within the limits of E. slossonæ, is a variable one. With the exception of this character the descriptions of Exorista spinipennis and E. slossonæ are almost identical. I consider Exorista spinipennis Coq. a synonym of Exoristoides slossonæ Coq.

² Rev. N. Amer. Tach., p. 95.
THE SPECIFIC DIFFERENCES BETWEEN *APANTESIS NAIS* DRURY, *A. VITTATA* FABR. AND *A. PHALERATA* HARRIS.

By Werner Marchand,
Princeton, New Jersey.

W. J. Holland in the "Moth Book," p. 132, expressed doubts whether the three forms, including *A. vittata f. radians* Walker, are really distinct. The latter view is held by J. B. Smith (Insects of New Jersey, p. 441) who says, speaking of these three species: "With good bred material at hand the differences are obvious." Without being able to look up the literature on this subject at present, I wish to report on a few observations made which tend to show that at least two of these species are distinct. During my stay at the Bussey Institution in Forest Hills, Mass., during the summer of 1915, I was permitted, through the kindness of Prof. W. M. Wheeler, to obtain lepidopterous material from the moth-trap of the Institution. Eggs were obtained of *A. nais* and *A. phalerata*, that is of two species identical in appearance with specimens preserved under these names at the Boston Museum of Natural History. Of *A. nais* eight different broods were raised. All descendants gave typical *nais*: males and females with yellow hind wings (never red!), with black costal border of the fore wings, and in the males without any black spots on the white collar band, while of the females, about half the number had such spots present. Of *A. phalerata* one brood was raised. All the descendants were typical *phalerata*: males with pale, yellowish-pink hind wings, often less spotted as compared with *A. nais*; females with bright coral-red hind wings; both sexes with white costal border and with two black spots on the white collar band above the head; no yellow specimens. Numerous attempts were made to obtain hybrids of the two species but all in vain: the two species do not interbreed. No difficulty was encountered in obtaining offspring within the same species. A second generation was raised before fall of both *A. nais* and *A. phalerata*. No difference in the appearance of the second generation was seen as compared with the first generation. Hence I conclude that the two species are certainly distinct.

Of *Apantesis vittata* only males were found, hence this species
could not be bred. The fact that none of the broods of *nais* and *phalerata* gave any specimens of the type of *vittata*, seems to show, that *vittata* represents a third, entirely distinct, species. In *vittata* both yellow and red specimens are found in both sexes. The black spots on the hind wings as well as on the fore wings tend to fuse together. Extremes of such forms seem to correspond with *A. radians* Walker. The costal border is always white which serves to separate the yellow specimens from *A. nais*, and the white collar band is always without black spots which serves to separate the red specimens from *A. phalerata*. The size is slightly above that of *A. nais*, on the average.

On the suggestion of Dr. Henry Skinner I compared the male genital claspers of several individuals of the three species spoken of. It was found that in fact *A. nais* and *A. phalerata* differ widely in the structure of these claspers, and it is not unlikely that copulation would be mechanically impossible. The genitalia of *A. vittata* are however very similar to those of *A. nais*, and it would be of interest to attempt hybridization of these two species.

The fact that Holland's abundant material came mostly from one and the same locality "one little ravine in western Pennsylvania," does certainly not imply that it was all of the same species. No less than eight different species of *Apantesis*, including the above spoken of, were found in the immediate neighborhood of the Bussey Institution, attracted to light, and fairly abundant. Most of these are certainly less variable than often supposed to be the case in this genus.
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.

The undersigned will greatly appreciate receiving records of New Jersey species not listed in Smith's Insects of New Jersey.—Harry B. Weiss, 272 Hale St., New Brunswick, N. J.

Offered for cash, but exchange preferred. Fitch and early Illinois reports; Insect Life; Harris's Insect; many others.—J. F. Hallinen, Cooperton, Okla.


Hemiptera-Heteroptera. I desire specimens of this group from all regions, especially New England. I will give in exchange species of this and other orders (except Lepidoptera), and will identify New England material. Correspondence desired.—H. M. Parshley, Bussey Institution, Forest Hills, Mass.

Wanted: Psyche, Vol. IX, No. 300 (April, 1901). Address, giving price, Librarian, Stanford University, Cal.

Sarcophagidae from all parts of the world bought or exchanged according to arrangement. North American material determined.—R. R. Parker, Entomological Laboratory, Massachusetts Agricultural College, Amherst, Mass.

Wanted: Transactions American Entomological Soc., Vol. 4; Entomological News, Vol. 2, Nos. 6 and 10; Vol. 8, Nos. 1 and 6; Vol. 9, Nos. 1 and 2; Vol. 10, No. 10; Vol. 11, Nos. 1, 3 and 5. Will purchase at reasonable price.—Howard L. Clark, P. O. Box 1142, Providence, R. I.

Wanted: Insects of any order from ant nests, with specimens of the host ants, from any part of the world; also Cremastochilinae of the world. Will give cash or Coleoptera, Hymenoptera and Diptera from the United States.—Wm. M. Mann, Bussey Institution, Forest Hills, Boston, Mass.

Want to correspond with collectors of Noctuidae in Northern Massachusetts. Subject to supply will pay any reasonable price for good specimens Catocola Sappho.—Howard L. Clark, P. O. Box 1142, Providence, R. I.

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.


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## CONTENTS

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Habit of Leaf-Oviposition Among the Parasitic Hymenoptera.</td>
<td>63</td>
</tr>
<tr>
<td>Key to the Species of Leptoglossus Guér. Occurring North of Mexico</td>
<td>69</td>
</tr>
<tr>
<td>(Heteroptera: Coreidae). E. H. Gibson</td>
<td></td>
</tr>
<tr>
<td>The Life-History of Mesovelis mulsanti White. H. B. Hungerford</td>
<td>73</td>
</tr>
<tr>
<td>Notes on Aphids. G. O. Shinji</td>
<td>84</td>
</tr>
<tr>
<td>An Interesting Manuscript. L. O. Howard</td>
<td>87</td>
</tr>
<tr>
<td>The North American Species of Pachyneuron with Three New Species</td>
<td>88</td>
</tr>
<tr>
<td>(Chalcid-Flies). A. A. Girault</td>
<td></td>
</tr>
<tr>
<td>New Miscellaneous Chalcid-Flies from North America. A. A. Girault</td>
<td>91</td>
</tr>
<tr>
<td>A New Species of the Genus Mymar from the Woods of Maryland with an</td>
<td>99</td>
</tr>
<tr>
<td>Important Descriptive Note. A. A. Girault</td>
<td></td>
</tr>
<tr>
<td>A Metallic Species of Cirrospilopsis from Maryland (Hymenoptera:</td>
<td>100</td>
</tr>
<tr>
<td>Eulophidae). A. A. Girault</td>
<td></td>
</tr>
<tr>
<td>A New Species of Closteroceerus from California (Hymenoptera:</td>
<td>101</td>
</tr>
<tr>
<td>Eulophidae.) A. A. Girault</td>
<td></td>
</tr>
<tr>
<td>A New Genus or Subgenus of Pachyneurine Chalcid-Flies. A. A. Girault</td>
<td>102</td>
</tr>
<tr>
<td>Exchange Column</td>
<td>103</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Number of pages</th>
<th>50 copies without covers</th>
<th>100 copies without covers</th>
<th>50 copies with covers</th>
<th>100 copies with covers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>$1.50</td>
<td>$2.50</td>
<td>$3.50</td>
<td>$4.50</td>
</tr>
<tr>
<td>5-8</td>
<td>3.50</td>
<td>5.80</td>
<td>5.50</td>
<td>7.80</td>
</tr>
<tr>
<td>9-12</td>
<td>4.25</td>
<td>7.05</td>
<td>6.25</td>
<td>9.05</td>
</tr>
<tr>
<td>13-16</td>
<td>4.75</td>
<td>7.90</td>
<td>6.75</td>
<td>9.90</td>
</tr>
</tbody>
</table>

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THE HABIT OF LEAF-OVIPOSITION AMONG THE PARASITIC HYMENOPTERA.¹

By Harry Scott Smith.

Entomologists have for some time been more or less familiar with the strange habit of leaf-oviposition in the parasitic dipterous family Tachinidae. Twenty-nine years ago Dr. C. Sasaki of the Imperial University of Japan² made the interesting discovery that the so-called Ugi parasite of the silkworm (Crossosomia sericaria Corm.) deposits its eggs not within or upon its host, as was the habit of all other known parasites, but upon the leaves of the food plant of its host, i.e., the mulberry tree. These eggs were minute and very numerous and were taken into the alimentary canal of the silkworm along with the mulberry leaves upon which it fed. Later, in 1908, Mr. O. H. Swezey³ found the same curious habit to occur in the life-history of the Tachinid Chatogadia monticola Bigot, a parasite of various lepidopterous insects in the Hawaiian Islands. During the same year Mr. C. H. T. Townsend⁴ of the U. S. Bureau of Entomology recorded this curious habit in the Tachinid Blepharipa scutellata R. D., introduced into New England from Europe as an aid to the suppression of the Gypsy Moth, and in Pales pavida Meigen, introduced for the same purpose. Mr. Townsend also mentioned several other species which he suspected to have the leaf-oviposition habit. Another curious deviation from the regular methods of reproduction Mr. Townsend found to occur in Eupeleteria magnicorius Zetterstedt, and Zygobothria nidicola Townsend, these flies depositing living maggots on the leaves upon

¹ Occasional Contributions from the Cal. State Insectary, No. 5.
which the host feeds. The maggots attach themselves to the caterpillar host as it crawls over the food plant, and later bore their way into its interior. Recently Mr. J. L. King, of the Ohio Experiment Station, has given us an extremely interesting account of the same general habit, the subject of his studies being the Cyrtid *Pterodontia flavipes* Gray, a parasite of spiders.\(^1\) Up to the present time, however, no such startling deviation from the normal has been observed in the parasitic Hymenoptera.

In 1909 and 1910 the writer, while engaged in the study of the hymenopterous parasites of the Gypsy and Browntail Moths at the laboratory of the U. S. Bureau of Entomology, Melrose Highlands, Mass., carried on an investigation of the life-history and habits of *Perilampus hyalinus*, a hyperparasite of the Fall Webworm. In brief the life-history of this chalcidoid parasite was found to be as follows: Nothing in regard to the egg-laying habits could be ascertained. The first stage larva, however, a very curious being, heavily armored with chitinous plates and provided with numerous curved hooks and spines, was found crawling about on the outside of the caterpillar. Later these first stage larvae or planidia were found to bore their way into the body cavity of the caterpillar, there swimming about freely until the primary parasite larva, either hymenopterous or dipterous, was found, and into which they gained entrance. The *Perilampus* larva then remained quiescent until the primary parasite became full-fed and made its exit from the caterpillar to spin its cocoon or form its puparium. At the time of ecdysis the planidium found its way to the exterior of the host, after which it fed as an ectophagous parasite in the normal way. The egg-laying habit of this strange parasite has, however, remained a puzzle to entomologists, and at that time the writer made the following statement in regard to it:\(^2\)

“There have been made, so far as published records go, at any rate, no observations upon the oviposition of members of the genus *Perilampus*. It is known, however, that oviposition does not occur in the normal way, or in the manner we are accustomed to regard as the normal method of oviposition among the parasitic Hymen-

---

optera, and for this reason speculations on what may actually occur are rather interesting.

"In the first place it is obvious from the facts recorded in the preceding pages that Perilampus does not oviposit directly in or upon its host. In the second place, it does not oviposit within the caterpillar of which its host is a primary parasite, which is equally obvious from the observations already made. That it places its eggs *upon* the young caterpillar is improbable, the adult Perilampus being too slow and clumsy to be capable of accomplishing this act with any degree of certainty.

"There are two plausible methods which Perilampus might adopt for the deposition of its eggs, and the writer is strongly inclined to the view that one of these methods is in part at least correct. As in the case of some of the parasitic beetles, it may deposit its eggs upon flower heads or upon leaves of plants not in the immediate vicinity of the caterpillar colony, the planidia hatching from these eggs being conveyed to the caterpillars by means of some intermediate carrier. In the Coleoptera cited above the carrier is frequently a parasitic bee upon which, by means of their claws, the triungulins attach themselves and are conveyed to the nest of their host. With Perilampus, should this method prove to be the one which really takes place, the intermediate carrier might be any of the primary parasites which attack Hyphantria; that is, the hymenopterous parasites Limnerium or Apanetes, or the Tachinid Varichota. The planidium seems more or less fitted for this sort of a life and is apparently analogous to the triungulin of the coleopterous parasites. The chitinous plates with which it is armored are especially serviceable in preventing injury of various kinds, and the mandibles and hooks and spines would serve it very well as a means of clinging to its conveyer.

"The other method, which seems much more plausible, is that of oviposition upon the food plant *in the vicinity of a colony* of the caterpillars. This would do away with the necessity of an intermediate carrier, but would expose the delicate eggs to great danger unless they hatched immediately after deposition.

"While the eggs of Perilampus have not been observed after deposition, those contained in the ovarian tubes, in one case ap-
parenently mature, have been examined. They are of the usual elongate-oval shape, not stalked, and whitish in color."

For seven years the writer has been looking for a chance to corroborate or disprove the theories advanced in the above statement, but the opportunity did not present itself until about two weeks ago. During the previous summer specimens of Perilampus were occasionally bred from Chrysopa cocoons. Recently the writer was successful in capturing several adult female Perilampus of this species hovering about oleanders infested with Aphis nerii and fed upon by Chrysopa. The insects were then watched and were observed frequently to touch the tip of the abdomen to the leaf. On placing the leaf under the binocular microscope the minute transparent eggs of the Perilampus were seen, one end of the egg being slightly attached to the leaf. This observation proved the correctness of the original theory and established beyond doubt the habit of leaf-oviposition among the parasitic Hymenoptera. The eggs are numerous, one female depositing fifty-two in a single day. They are pearly white in color, about twenty-five one-hundredth millimeter in length, and are characteristically sculptured. The egg is very faintly attached to the

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1 Determined by J. C. Crawford as Perilampus chrysopa Crawford, new variety.
surface of the leaf at one end. Hatching takes place in seven to ten days and the first stage larva is of the planidium type described in the above mentioned paper. For several days previous to hatching the dark-colored planidium can be plainly discerned through the transparent egg-shell. The planidium is active immediately upon hatching, crawling rapidly about, but soon it attaches itself to the leaf by means of the caudal sucker and stands out at right angles to the surface. In this position it remains for days at a time, motionless, excepting when some insect comes within its reach, when it suddenly becomes frantically active, reaching and swaying back and forth in its attempt to attach itself to the prospective host. If the latter should unfortunately come too near, the planidium attaches itself with lightening-like quickness to a hair or bristle of the host. It then leisurely crawls down the hair to the host’s body and attaches itself by its mouth-hooks. Quite often the planidia are found attached to the egg-stalk of Chrysopa, assuming a position at right angles to the axis of the stalk. This shows an interesting instinct in the planidium, since it may and actually does, as the writer has observed, waylay the young Chrysopa larva as it leaves the egg and crawls down the stalk. The prescience of the mother Chrysopa in placing her eggs at the end of a long egg-stalk to overcome the cannibalistic propensities of her progeny is in this case their undoing, since the planidium attached to the Chrysopa egg-stalk is sure to reach its proper host, while those upon the surface of a leaf are quite as likely to attach themselves to an aphid or other insect.1

The planidia are remarkably long-lived for such delicate creatures. I have had them live for a period of seventeen days without food of any kind and without changing their position. Those which are fortunate enough to become attached to a Chrysopa larva immediately, as mentioned above, crawl down the hair or bristle and by means of their mouthparts attach themselves to the skin of their host. Many of these planidia undoubtedly lose their opportunity to develop through the moulting of the Chrysopa larva, although sometimes, as observed by the writer in the laboratory, they succeed in changing their position from the

1 In a note in the Journal of Economic Entomology, Vol. 9, p. 510, Mr. M. T. Smulyan mentions having found a Perdimus planidium on an aphid. Without doubt this is the young of a Chrysopa infesting species which attached itself to the wrong host. They will even grasp a camel’s hair brush if brought within their reach.
moult-skin to the newly moulted host. In cases where the Chrysopa larva died in the laboratory, the planidium invariably crawled out on the end of a hair, attached itself by the caudal sucker and awaited the approach of a new host. Apparently the planidium takes no nourishment until the Chrysopa larva spins its cocoon and pupates, after which it begins to feed and develops in much the same way as the writer has described for *P. hyalinus* (loc. cit.), excepting that it is never an internal parasite so far as has been observed.

It is difficult to understand just what is gained, from the standpoint of *Perilampus* infesting *Chrysopa*, by this extraordinary habit, since the Chrysopa larva is easily accessible to the normal method of oviposition and is in fact parasitized in the larval state by a number of parasites which oviposit directly into the host. In the case of *Perilampus hyalinus*, however, and other species having similar habits, the advantage is obvious, since by no other method could access be had to the larvae of the primary parasites. In the case, too, of those species of *Perilampus* infesting wood-boring Coleoptera and gall-making and stem-infesting Lepidoptera (the correctness of which records the writer is frank to confess he previously looked upon with doubt), the usefulness of this method of oviposition taken with the active planidium stage is readily seen, since in this way access is easily gained to the endophagous host through the wanderings of the planidium. Needless to say, this type of reproduction forms one of the most extraordinary adaptations to environment in the entire field of entomology.
KEY TO THE SPECIES OF LEPTOGLOSSUS GUÉR. OCCURRING NORTH OF MEXICO (HETEROPTERA; COREIDÆ).

By Edmund H. Gibson,
Bureau of Entomology, Washington, D. C.

The cosmopolitan genus Leptoglossus Guér. is represented in America, north of Mexico, by nine species all of which are listed in Van Duzee’s recent check list. Specimens bearing labels of two other species, namely balleatus Linn. and stigma var. minor Dall. are in the collection of the U. S. National Museum, but I believe them to have been wrongly determined.

This genus belongs to the tribe Anisoscelini A. & S. and may be separated from Chondrocerata Lap. and Narnia Stal, the other two genera of the tribe which are known to occur in North America, by the large dilations of the hind tibiae and simple antennae which have their basal joint long.

In working out the key to the species, color markings have been eliminated as far as possible. Specimens of each species have been examined and in practically each one access has been had to large series, which are in the collection of the U. S. National Museum.

Leptoglossus Guér.

Leptoglossus Guér., Voy. de la Coquille, Ins., p. 174, 1838.
Anisoscelis Spin., Ess. Hem., p. 200, 1837.

Leptoglossus Guér. may be characterized as follows: Head elongate, horizontal. Antennæ rather stout but not swollen or dilated, basal joint long, about equal to length of the head; rostrum passing the metasternum; bucculae short. Thorax longer than head, broad and rounding posteriorly. Elytra narrowing towards apex. Hind femora more or less swollen; hind tibiae with large dilations of foliations, the outer margins of which are usually more or less deeply scalloped. Spiracles at base and apex of abdomen about equally remote.

The haplotype of the genus is dilaticollis Guér.
Key to the species of Leptoglossus occurring north of Mexico.

1. Thorax coarsely punctate or rugose. Leptoglossus fulvicornis Westw.
   Thorax not rugose, only finely punctate. ......................... 2

2. Apex of head terminating in a stout spine. Leptoglossus clypealis Heid.
   Apex of head without a spine. ................................ 3

3. Fourth joint of the antennae equal to or shorter than the third joint. ......................... 4

4. Fourth joint of antennae longer than third joint. ........................................... 5

4. The outer expansion of the hind tibiae reaching almost to apex of tibiae, lanceolate. Leptoglossus corculus Say
   The outer expansion of the hind tibiae reaching but two thirds the length of tibiae, foliaceous. Leptoglossus occidentalis Heid.

5. Lateral-posterior margins of thorax more or less crenulate. .................. 6
   Lateral-posterior margins of thorax not crenulate, and with only a mere trace of a transverse color band or line on the elytra. Leptoglossus oppositus Say

6. Posterior angle of thorax terminating in a prominent spine Leptoglossus gonagra Fabr.
   Posterior angles of thorax not terminating in a prominent spine. ......................... 7

7. Thorax bordered with bright orange and foliation of hind tibiae short. Leptoglossus ashmeadi Heid
   Thorax not bordered with orange. Foliation of hind tibiae large and long. .................. 8

8. Scallops in the foliations of the hind tibiae deep and long. Leptoglossus zonatus Dall.
   Scallops in the foliation of hind tibiae shallow and usually short.
   Posterior femora swollen but not prominently incrassated Leptoglossus phyllopus Linn.

Leptoglossus fulvicornis Westw.

Leptoglossus fulvicornis Westw., Hope Cat., 11, p. 17, 1842.

This is a large species and can be distinguished from all others by having the thorax coarsely punctate or rugose. Antennae and first two pairs of legs light in color. No band or markings on elytra. Posterior angles of thorax broadly rounded and prominently raised.
It ranges from Maryland southward through Florida and Alabama.

**Leptoglossus clypealis Heid.**


The apex of the head terminating in a spine is the character which readily distinguishes this species from all others of the genus.

This is a western species occurring from Nebraska to Oregon, south through California, Arizona and New Mexico.

**Leptoglossus corculus Say.**


Together with the following species corculus has the fourth joint of the antennæ equal to or shorter than the third. This character may be used to separate these two species. *Corculus* differs markedly from occidentalis in having the dilation of the hind tibia lanceolate and reaching nearly to the apex of the tibiae, while the dilation in occidentalis is foliaceous and much shorter.

It is known to occur from New Jersey southward through Georgia, and west to Colorado.

**Leptoglossus occidentalis Heid.**


Following his description of the species Mr. Heidemann states: “This species has frequently been determined as *L. corculus* Say—but by close observation the differently shaped expansion of the hind tibiae will distinguish it at once.” The expansion is shorter and foliaceous.

The known distribution is from Colorado west to the coast and from California north to Vancouver.

**Leptoglossus oppositus Say.**


Anisoscelis tibialis H. S., Wanz. Ins., Vol. 7, p. 12, 1844.

The distinguishing characters for this species are the smooth lateral-posterior margins of the thorax and the unmarked elytra.
Only occasionally is there a faint transverse line on the elytra. The foliations of the hind tibiae are large with deep scallops. This is probably the most common species in the United States. It is primarily a southern species but is known to occur as far north as New Jersey.

**Leptoglossus gonagra** Fabr.

Anisoscelis antica H. S., Wanz. Ins., iii, p. 92, 1835.

This is a large species and easily recognizable by the broad thorax, the lateral-posterior angles of which terminate in a prominent spine, and also by the yellow transverse curved line on the anterior portion of the thorax. It is strictly a southern species.

**Leptoglossus ashmeadi** Heid.


Of the species occurring north of Mexico this is the most easily recognized one. The exceptionally short foliation of the hind tibiae and the bright orange coloration on the head and thorax make the identity unmistakable. Mr. Heidemann recorded it only from Florida.

**Leptoglossus zonatus** Dall.


Closely related to *phyllopus* Linn., but from which it can be separated by having the scallops of the foliations of the hind tibiae deeper and longer. A comparatively large species and recorded only from the south.

**Leptoglossus phyllopus** Linn.

Anisoscelis fraternus Westw., Hope Cat., ii, p. 16, 1842.

With *oppositus* Say this is one of the two most common species in the United States. It can be distinguished, however, from
oppositus by having the lateral-posterior margins of the thorax crenulated and by the prominent yellow band across the elytra. In general form it is nearest to zonatus Dall, but the latter has a much larger hind femora while the femora of phyllopus is only normally swollen. The scallops in the foliation of the hind tibiae are rather shallow and much shorter than in zonatus. Specimens have been examined from Virginia south to Florida and Texas.

THE LIFE-HISTORY OF MESOVELIA MULSANTI WHITE.

By H. B. Hungerford,
Cornell University, Ithaca, N. Y.

Among the most familiar inhabitants upon the surface of our ponds and quiet pools are the "skaters." These long-legged creatures that deport themselves with such ease and agility upon the surface of the waters have been noted by even the most casual observers. Their size and movements have forced at least a passing notice, but there are a number of small related species that escape all but those who look intently. Among these smaller forms is the little green Mesovelia mulsanti. It wears the brightest livery of them all, for the young and the apterous forms of the adults display varying degrees of green coloration, while the winged ones are even more conspicuous on the floating blankets of green alge because of the silvery whiteness of their wings.

These insects measure only from four to five millimeters in length but are so distinct from other bugs in structure that they have been regarded as a distinct family.

At various times in the past they have been found in our collections associated with the Hebridae, Gerridae, Hydrometridae and Veliidae but at last have been segregated as the family Mesoveliidae. The species here treated is the only one reported from the United States, but it is a widely distributed form.

It is at home in the haunts of the marsh-treader on the floating vegetation growing in the shallow waters of the pools, where the clumps of sedge spread their slender stems upon the water from the bordering bank, where young cat-tails spring up and green algae carpet the surface of the waters.
Since they were first made known to science in 1852 by Mulsant and Rey, through the description of *Mesovelia furcata*, there has been added one other species, described by F. B. White (9) from the Hemiptera collected in the Amazons by Prof. J. W. Trail and named *Mesovelia mulsanti*.

The information concerning the biology of these forms is meager and confined to a paper by Butler (2), 1893, on the “Habits of *Mesovelia furcata*,” collecting notes on *M. furcata* by J. Scott (6) in England, and on *M. mulsanti* by Uhler (8) and by Bueno (1) in this country. It seems, therefore, worth while to present some notes concerning the biology of *Mesovelia mulsanti* whose habits and life-history are certainly among the most interesting of all the bugs that walk upon the surface of the inland waters.

They may be separated from the other bugs of the surface film by the following synoptic table prepared by Mr. H. M. Parshley:

A. Head as long as entire thorax; body and appendages extremely slender

AA. Head shorter than thorax; form stout or moderately elongate.

B. Claws inserted at apex of last tarsal segment.

C. Antennae 5-segmented (except in Merragata); clavus membranous; membrane without veins

CC. Antennae 4-segmented.

D. Membrane without veins; hind coxae rotatory; color greenish; wingless form common

DD. Membrane with distinct veins forming elongate cells; hind coxae hinged; color not greenish; wings more or less developed

BB. Claws inserted before apex of last tarsal segment.

C. Hind femora not extending much beyond apex of abdomen; middle pair of legs about equidistant from front and hind pairs (except in Rhagovelia) size usually minute

CC. Hind femora extending much beyond apex of abdomen; middle and hind pairs of legs approximated, very distant from front pair; size moderate, rarely minute

---

1 See Bibliography.
Habitat and Food Habits.

It has been indicated above that these little bugs live upon the floating vegetation of ponds. Butler (2) found them on Potamogeton and Bueno (1) on duck weed, matted Hydrodictyon or other algae. The writer has found them about old logs projecting from the water—clumps of smartweed at the water's edge as well as on rafts of filamentous algae and leaves and stems of plants pro-cumbent upon the surface.

They were noted by Butler to be carnivorous in tastes. He fed them a variety of small insects and saw them feeding upon a springtail, (Smynthurus), a Cranibus, a Chalcid and a Hydrometra and supposed the usual food to be small Diptera and Hymenoptera. As to whether they caught their prey alive or availed themselves of the drowned and disabled specimens he was unable to say. That M. mulsanti can live upon such fare is certain for the writer has reared them on flies and plant lice cast upon the water.

They are cautious creatures but do on occasion fall upon fairly lively prey, as evidenced by the following instance: A fly thrown into the aquarium was seen to crawl up the side of the jar bearing an adult female Mesovelia with its beak attached near the caudal end of the fly which when disturbed flew to a nearby support bearing the tenacious little bug.

However, the writer has come to believe that, with Hydrometra, Microvelia and Rheumatobates, they are not dependent upon the chance and uncertain fare of terrestrial insects caught upon the surface film but find another, and indeed a more constant source in the organisms that dwell below but come up to the surface film. Among these, Ostracods and like forms are available as more or less staple food and Mesovelia have been observed exploring the sides of floating Typha and the tangled mats of algae for such Crustacea which they spear from the surface of the water.

The tiny nymphs feed upon more gentle organisms in the water, as there are few upon the surface that they are able to overcome. When offered springtails as suggested by Butler, disaster often followed and the writer lost many good rearings before he learned the inadvisability of offering such food. The hungry little creatures would attack them only to be turned topsy-turvy upon the water even by comparatively small springtails. Plant lice afforded
less risk of this kind and gave better results. They were used as the food supply in the isolation rearings where a study of molts was made. But in an aquarium twelve inches in diameter, the water of which contained algae and floating sedge stems amongst which dwelt an abundant population of entomostracans, the little bugs were reared through their complete cycle without other resource than that afforded by the waters and the weaker of their own kind.

Life-History.

Technique in Rearing.

Butler states that "pairing took place several times and the bodies of the females became, by the end of three weeks, greatly distended." The specimens died, however, without ovipositing and his conclusion in regard to the matter, in the light of our present knowledge, seems amusing. It is only fair, however, to state that the writer had the same experience until he discovered that the female possesses an ovipositor for inserting her eggs into the tissues of plants. The newly hatched young were isolated in small slender dishes upon a very shallow film of water with a small bit of sedge stem for a support. The water was kept fresh and clean for the health of the bug and to facilitate finding the molt skins.

Oviposition.

Since Mesovelia hides and protects its eggs by burying them in the tissues of certain plants that are associated with shores and shallow waters the female possesses an ovipositor adapted to this purpose. If the female be examined in lateral view the abdomen is seen to be laterally compressed at its caudal end in such a manner as to provide a sheath or groove for the ovipositor (Pl. I, Fig. 13). A dissecting needle inserted near the distal and caudal end of this fissure can be used to pry out and bring to view a shiny brown chitinized organ which may be turned down into a position approximately at right angles to the body, for its attachment is at the basal end of the sheath. In this position it is seen to be curved so that the tip is directed slightly forward. The general shape, viewed from the front, is roughly spear shaped and the parts
arranged in such a way that the front surface is concave forming a wide groove, reminding one, when in action, of the tip of an apple corer. Upon dissection it is seen to be made up of three parts, two lateral shafts that are strongly chitinized and toothed or serrated along the lower portion of their lateral margins and a broader central plate (see Pl. I, Figs. 14 and 15). The lateral shafts are attached to the flat plates of the abdominal wall. The central portion is in reality made up of paired parts attached to the median pair of sclerites that serve as the valves or shields for the ovipositor.

The manipulation of this instrument during oviposition may be observed any time during the spring, summer or autumn by confining a number of mating insects in a petrie dish containing only clear water and some food. After being thus deprived for a couple of days of materials in which to place their eggs they will gather about a small bit of sedge stem or cat tail leaf supplied them, and most eagerly set about the business of laying eggs. The writer has seen as many as eight thus employed about a portion of sedge stem one and one-half inches long and has had ample opportunity to watch the process under the binocular.

The female frequently explores the stem with the tips of her beak and antennae if indifferent in the matter, but if eager to oviposit, she mounts the stem without delay, raises the abdomen slightly, unsheaths the ovipositor and turns its tip down to the surface of the stem. At times the surface is tested out at several points—again if the first point of contact is favorable, the tip is caused to quiver back and forth till it gains a footing, and then rocking the body slightly from side to side the entire drill is caused to rotate or twist back and forth on its axis—rapidly at times, or again more slowly as may suit the necessity of the work, until a hole is effected and the ovipositor is buried to its base. During the deeper drillings the longitudinal alternate thrusts of the drill parts are apparent. The first part of the operation at least involves much the same sort of a motion as one employs in making a hole with a gimlet or awl.1

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1 In addition to the twisting motion and the alternate thrusts of the stylets there is yet another. It is the expanding or spreading of the drill parts during the enlarging or reaming out of the hole.
It takes but a moment in the spongy water-soaked stem of a sedge to drive the instrument up to its base. Then, after a moment of apparent quiet, the ovipositor is lifted slightly and the egg is forced by a series of abdominal contractions down the ovipositor and into the cavity reamed out to receive it.

The egg when forced into the ovipositor distends it considerably as it passes through its channel and thus can be seen to slip down into position with its distal end directed forward beneath the insect. The ovipositor being at last withdrawn from beneath, the egg slips out from behind the exposed circular end of it.

A number of eggs may be imbedded thus, in the stem before the ovipositor is sheathed—each one requiring a separate puncture. In the cylindrical stems of plants procumbent upon the water the eggs are likely to be inserted on the sides as they come in contact with the surface film, but this is by no means necessarily the case.

As frequently as not the male accompanies the female during the process. Having mounted her in mating he merely moves forward and remains perched upon her back as she busies herself with egg laying, mating being attempted and often consummated between her labors. 1

In starting the drill in a particularly stubborn or inconvenient place the female not infrequently uses one of her hind legs to steady and stiffen or support the drill. One female after making several attempts employed her right hind leg in such a manner that the tarsus was turned at an angle with the tibia and the angle thus formed used to direct and aid the ovipositor.

During the process of oviposition the female often defends herself from molestation by kicking vigorously with the hind legs when disturbed.

Description of Egg.

Size: Length .875 mm.; greatest diameter .187 mm. to .250 mm.; diameter of exposed circle .15 mm.

Shape: This shape is best shown in the drawing. The egg is elongate oval with a curved neck terminating in a flat surface which

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1 In mating the male mounts the female—clasps his fore legs around her mesothorax in front of her middle legs—rests his middle legs upon the water film or other supporting surface and holds the hind legs poised in the air. The copulatory organ of the male is long and curves around the side of the tip of the female’s body to come into contact with the genital opening. Contact lasts from a few seconds to one minute or longer. Upon withdrawal the copulatory organ is seen to be a slender white tube of astonishing length.
marks the exposed end of the egg as it lies in situ in the stem of some plant.

**Color:** When first laid, white; in the course of two or three days it has become watery transparent with portions of the embryo beginning to take form. These eggs buried singly as indicated above are shown in the drawings (Pl. I, Figs. 5 and 7). The exposed end of the egg shows up as a shiny membranous circular spot on the surface of the plant which bears it and is visible to the naked eye. This spot, though clear white when first laid presents at about the second day a very faint ring of pink which darkens to a deep pink after twenty-four hours. In the course of another day or two this gradually fades and two days before hatching the deep red eye spots may be seen through clear stems in the position shown in Fig. 7.

The egg stage lasts seven to nine days. At hatching the young nymphs, still enclosed in their embryonic membrane, work their way up through the little circular openings of the stem. This is a remarkable feat considering the size of the nymph and the size of the hole but is aided materially by the peculiar backward pointed pegs on the thin embryonic membrane. When well out of the stem this membrane is cast and the nymph takes its place upon the water.

**First Instar.**

**Size:** See the table presented below.

**Color:** When first hatched it is white with red eyes darkening to amber and green as it ages. To the unaided eye it is greenish brown. Thus it is much darker than the older nymphs, quite distinct in coloring. The tips of the appendages are dark while the limbs themselves are pale.

**Structural Peculiarities.**—The general form is stouter and more robust than that of the later stages. The body and limbs are clothed with hairs and bristles as shown in the Fig. 4. The head and thorax bear a few stout bristles and the antennae bear on the first segment several (usually 3 or 4) stout bristles directed mesally and the terminal segment is thickly covered with fine hairs. The limbs, besides bearing many hairs possess a number of black bristles arranged as follows: One stout bristle is prominent near the distal end on the anterior margin of the meso- and meta-thoracic
femura. The metathoracic tibia are beset with numerous irregularity arranged bristles. Terminating with one larger than the others.

The antennae are stout and as long as the body, four segmented, the terminal segment is somewhat broadened and as long as the other three. The head bears no indication of ocelli but does possess the black bristles indicated in the later instars.

The limbs are stout, the tarsi one-segmented and ending in two claws.

The abdomen bears a dorsal pore on the median line of the dorsum of the fourth abdominal segment.

Later Instars.

The second and later instars are bright green in color and more slender in form. They possess relatively fewer hairs on the body—but retain the black bristles in the positions indicated in the first instar. There appear in these later instars one black bristle on anterior margin of fore femur and two on the other femora. The structural characters remain constant until the adult stage is reached when the following changes become apparent.

The first antennal segment possesses but one black bristle instead of a number of them (usually).

The limbs are more slender and tarsi 3-segmented.

The connexivium is broad and the sexual characteristics appear.

In the winged female there appear two dark ocelli-like spots on the vertex.

The winged forms are often found with membrane missing. They have been observed to break away this portion of the wing with the hind tibia, exposing the tip of the abdomen as shown in Fig. 1.1

Following is given a table of measurements of the various instars and of the adults:

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1 Mr. J. R. de la Torre Bueno describes this habit in Halobatinae. Canadian Ent., Vol. IX, No. 1, p. 389 (1908)
Before attaining the adult stage, the nymph passes through five nymphal instars spending from two to three days in each stage. Mating occurs and oviposition begins about the third day. One female emerged August 1, began to lay August 3 and died August 12, having laid 44 eggs an average of nearly 5 eggs per day. Some of the females in isolation laid an average of less than this, while one female under observation laid 18 eggs in 24 hours, a surprisingly large number, when we consider the size of egg and adult. The table presented on p. 82 is the history of one of a number of series, of isolation rearings, and indicates the variations in the duration of the different stages. The record of the many that died after isolation is omitted. It represents at least 90 per cent. of the total for mortality is very heavy under laboratory conditions. However, rearing in isolation and in close confinement is the only way to arrive at the number of molts and duration of instars. When a number are rearred together the close resemblance of the instars and the variation in size within a given instar makes precise observation impossible. The writer has endeavored to determine diagnostic characters for the various instars. In the apterous forms he has found the spread from tip of femur to tip of femur the only fairly satisfactory determination (see table above). The developing winged forms beginning with the third instar are readily placed. (See Fig. 3 for the size of the wing pads in the 5th instar.)
## MESOVELIA MULSANTI—A HISTORY OF A FEW ISOLATED REARINGS.

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### Summary.

*Mesorelia mulsanti* is found about the margins of ponds and pools upon floating vegetation where it feeds upon small organisms coming to the surface film from below or that fall upon it. The species probably passes the winter as adults that begin ovipositing in the spring. They place their eggs in the stems of plants and even in the spongy wood of floating logs. There is a succession of generations throughout the season, each cycle requiring about twenty-four days. Winged and wingless forms occur together. Besides flying from pool to pool, they may be transferred in the egg stage. Mr. Beamer sent them from the southern part of the state to the writer at Lawrence, Kans., in the stems of sedge used as packing for some Nautocorids.

The general distribution of this species, and the ease with which it may be controlled and observed both as to oviposition and to hatching, make it a valuable object for studies on these phases of animal behavior.

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1. Since this paper was submitted for publication the writer has learned from Mr. J. R. de la Torre Bueno that he found the eggs of these bugs in plants some years ago. This gives him priority of observation on this point.
Hungerford—Life-History of Mesorelia mulsanti.
Explanations of Plate.

Fig. 1. Mesovelia mulvanti, winged male with membrane of wings broken off.

Fig. 2. Mesovelia mulvanti, winged female, wings entire.

Fig. 3. Fifth instar nymph; note the dorsal pore on fourth abdominal segment.

Fig. 4. First instar nymph.

Fig. 5. Eggs in stem of sedge, surface view of the two at left. The other two seen in situ in stem when portion of stem is removed.

Fig. 6. Fourth instar apterous form.

Fig. 7. Two eggs, showing their connection with surface of stem; eye spot shows in the one to the right.

Fig. 8. The embryonic membrane, cast by the hatching nymph; 2 "pegs" shown at the left enlarged.

Fig. 9. Apterus form.

Fig. 10. Apterus female.

Fig. 11. Male genitalia from above.

Fig. 12. Male genitalia from side, hooks in black.

Fig. 13. Ventral view of female ovipositor in its sheath.

Fig. 14. Ovipositor, lateral shafts shaded. They slide up and down on the central shaft.

Fig. 15. Cephalic view of ovipositor, turned into position for action.

Drawings 1, 2, 4, 9, and 10, by Miss Ellen Edmonson.

Bibliography.


(3) Champion, G. C. Mesovelia mulvanti in; Biologia Centrali-Americana, Hemiptera Heteroptera, II. 1898.


(8) Uhler, P. R. Notes on *Mesorelia bisignata* in; Kingsley’s Standard Natural History. II, p. 274. 1883.


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**NOTES ON APHIDS.**

By G. O. SHINJI,

Berkeley, California.

*Nectarosiphum rubicola* Oestl., with description of the male.

*Alate viviparous female.* General color, pale or green. Length of body, 3.8 mm. Width of abdomen, 1.6 mm. Wing expansion, 4.3 mm. Head, pale or green, broader than long, width between the eyes, .45 mm. Beak, reaching second coxa, near the tip dusky. Antenna situated on frontal tubercle, pale except dusky rings at the distal end of III, IV and V, VI including spur dusky, length of articles: III, 1.1 mm.; IV, .7 mm.; V, .55 mm.; VI, .3 mm.; spur, 8 mm. Sensoria about 14 on III, one each on IV and V. Prothorax wider than long, width, .6 mm., pale. Mesothorax slightly dusky, border with muscle lobes amber, width, 1 mm. Metathorax slightly dusky. Legs, distal one fifth the length of tibia and entire tarsi dusky, rest pale. Abdomen, pale, inflated. Cornicles mostly dusky, often basal half pale, length, 1 mm. Cauda, pale. Wings hyaline with smoky area near the tips of forewings, expansion: forewing, 4.9 mm., hind wing, 2.7 mm.

*Apterous viviparous female.* General color, pale or green. Length of body, 2.7 mm. Width of abdomen, 13 mm. Head, pale, broader than long. Beak reaches to third coxa, pale except apical half of third joint which is dusky. Length of antennal joint: III, .9 mm.; IV, .6 mm.; V, .55 mm.; VI, .2 mm.; spur, 1 mm. Prothorax, pale. Thorax and abdomen, pale. Tibia dusky. Rest of legs color of the body. Cornicle, dark, slightly swollen.
as in alate form, 1.2 mm. long. Cauda, pale, longer than wide at base.

*Host plant:* Thimbleberry.

*Locality:* University of California campus, Berkeley, Calif.

*Date of collection:* March 20, 1915.

*Male (alate):* Alate, wing venation as in the alate viviparous female. General color, rosy. Body small, length, 1.6 mm., width of abdomen, .5 mm. Head black or at least dusky, broader than long, length, .3 mm. between the eyes. Rostrum beyond the third coxa. Eyes black, large. Antenna black except lighter base of III. Length of joints, III, 1.1 mm.; IV, .8 mm.; V, .7 mm.; VI, .3 mm.; spur, 1.2 mm. Sensoria on antennal joints distributed as follows: III, 5; IV, 15; V, 15. Cornicles, black, .6 mm. long. Style dusky, small. Mesothorax black, length, .5 mm. Metathorax, black. Abdomen cylindrical, not much inflated, rosy or light red. Anteroventrally to the cauda there is a pair of somewhat horny cerci.

*Host plant:* Thimbleberry (*Rubus parviflorus* Nutt.).

*Locality:* University of California campus, Berkeley, Calif.

*Date of collection:* April 4, 1915.

*Notes.—* So far as my knowledge goes, *N. rubi* is one of the earliest male producers, the other being *Myzus ribis*. Although I have never studied the life history of this particular species, I had the opportunity of observing the emergence of stem-mothers from their eggs about the twentieth of February. The males were found only on the underside of already tinged leaves, while parthenogenetic forms were infesting terminal shoots and green, tender leaves. Not a single specimen of oviparous female or of egg could be found on the same or nearby plants at the time when males were abundant. Although the male of this species can be distinguished from its sisters by smaller size, darker coloration, numerous antennal sensoria, presence of paired cerci, etc., the only character common to the males of all Aphids, it must be mentioned, is the presence of cerci. To illustrate, the males of *Aphis pomi* are alate, and lighter than the alate viviparous form. The males of *Rhopalosiphum lactucae* are as large as the alate viviparous females. Again, the males of *Calaphis betulocoleans* have the same number of antennal sensoria as the alate sisters.
Chaitophorus coleoptis sp. nov.

Alate viviparous female. Body small, length including cauda, 1.4 mm. Width of abdomen, .7 mm. Wing expansion, 2.3 mm. Head broader than long, slightly narrower than prothorax, width including eyes, .45 mm., dusky. Beak reaching to second coxa, tip dusky. Antenna arising from side of head, six articed, third joint subequal to spur, apical half of fifth together with sixth including filament dusky, rest the color of the body. Length of articles: III, .4 mm.; IV, .23 mm.; V, .2 mm.; VI, .1 mm.; filament, .4 mm. Eyes dark red. Prothorax dusky, very short, width, .47 mm. Mesothorax dusky, width, .65 mm. Metathorax dusky. Front leg pale except tarsi which is dusky, middle and hind legs of the color of body with femora and tarsi dusky. Length of femora: front, .25 mm.; middle, .35 mm.; hind, .45 mm. Length of tibia: front, .35 mm.; middle, .50 mm.; hind, .75 mm. Abdomen, pale with a large middle dorsal patch of dusky or several transverse dusky bands, and also marginal dusky patch, somewhat hairy. Cornicles pale, constricted about the middle, slightly longer than wide at base. Style dusky, rounded at tip and constricted at base, provided with long spines. Anal plate pale, apex nearly straight, but a little curved in, never rounded nor much indented. Wings small, usually normal in venation, often one of the two varies in venation but cases in which both right and left wings are abnormal is rare.

Apterous viviparous female. Body with spines, pale, small, length, 1.45 mm. Width of abdomen, .9 mm. Head the color of body. Eyes dark red. Antenna arising from side of head; sixth including spur and apical half of fifth dusky, the rest color of head, length of articles: III, .4 mm.; IV, .23 mm.; V, .2 mm.; VI, .1 mm.; spur, .4 mm. Thorax and abdomen compressed, hairy, pale. Legs pale, except dusky tarsal joints. Cornicles pale, shape as in alate form, style, with spines, pale, anal plate as in alate.

Host plant: Abies balsami.
Locality: San Francisco.
Date of collection: April 10, 1915.
AN INTERESTING MANUSCRIPT.

By L. O. Howard.

At a meeting of the Biological Society of Washington, held March 10, 1917, Dr. Hugh M. Smith, chief of the United States Bureau of Fisheries, exhibited a packet of 283 loose sheets, each sixteen and five-tenths centimeters by ten centimeters, backed by pasteboard covers and labeled in manuscript, “Olivier's North American Coleoptera, 283 plates.” Below this legend is dimly written in pencil by a different hand, “Painted by Mrs. C. L. H.—, wife of Professor C. L. Hentz, bgt. November 2, 185—.” Dr. Smith, after exhibiting the packet, presented it to the writer, calling attention to a newspaper clipping which he had found under the cover from the Boston Transcript of November 21, 1856, giving a notice of the death of Prof. N. M. Hentz at the residence of his son, Dr. Charles A. Hentz, at Mariana, Fla., on the fifth instant (i. e., November, 1856), followed by a brief obituary notice. Dr. Smith further stated that this packet had been bought by his father at a book sale very many years ago.

On careful examination it seems obvious that this collection of loose leaves constitutes a selection of all the North American species of Coleoptera from the six volumes of A. G. Olivier’s “Entomologie, ou Histoire Naturelle des Insectes Coleopteres.” Obtaining access to a copy of Olivier’s great work, Prof. Nicholas Marcellus Hentz had evidently asked his talented wife, Caroline Lee Hentz, to copy the colored illustrations and descriptions of all of the species described from North America. Or possibly he did the drawing and she copied the descriptions.

Hentz, before his marriage, had lived at Boston and Philadelphia, moving south shortly after marriage in 1824. Olivier’s work may have been loaned to him from Philadelphia or from Boston, as he was frequently in correspondence with T. W. Harris.

In the correspondence, as published in “The Entomological Correspondence of Thaddeus William Harris, M. D.,” printed by the Boston Society of Natural History, in 1896, there is no reference to the loan of Olivier, but the last letter published was Harris to Hentz, November 6, 1839, and the manuscript copy was probably made later than that date.
On comparison of these loose leaves with the copy of Oliver in the Library of the Bureau of Entomology the Hentz illustrations prove to be very faithful copies, a little lighter in color as a rule, but with the added effort in some cases of indicating high lights on dark species, which improved their general appearance as compared with the copy of the printed work in Washington. In a few cases the colors are not completely worked in.

In the copies of the descriptions useless words are omitted. For example, should the original read, "Les antennes sont noires," Mrs. Hentz would simply write "Antennes noires." But no useful descriptive word is omitted. The enormous amount of copying that Harris, Fitch and other early entomologists had to do in the absence of funds for the purchase of rare works is a matter of frequent record. It is doubtful, however, if there exists a more perfect and useful manuscript than the one just described. It will be extremely useful, even today, since it brings together in compact form only the North American species described and figured by Olivier. It will be deposited either in the Library of the United States National Museum or in that of the Bureau of Entomology, where it may be consulted.

THE NORTH AMERICAN SPECIES OF PACHYNEUR ON WITH THREE NEW SPECIES (CHALCID-FLIES).

By A. A. Girault,
Bureau of Entomology, Washington, D. C.

Based on the types (except albutius). Females.

I. Legs yellow except the coxae (compare anthomyiae).

Scape blackish. (Is a Dibrachys.)

*nigrocyaneum* Norton

Scape yellow. As in *anthomyiae* (of which it is a probable variant). Median carina of propodeum sometimes single (the abdominal petiole not strongly striate). (=*syrphi* Ashmead) (=*syrphicola* Ashmead.)

*albutius* Walker

II. Legs with at least the coxae and femora concolorous or the latter darkened. Spiracular sulcus narrow, distinct, no
lateral carina. Mandibles 4 = dentate. Clypeal pro-
jection with a tooth on each side of its base.
Abdominal petiole over twice longer than wide, scaly.
Neck of propodeum conspicuous; clypeus with its
projection with a concave distal margin. Coxae
and femora submetallic. Scape yellow. Median
carina of propodeum obsolete . . . altiscuta Howard
Abdominal petiole only a little longer than wide.
Clypeal projection truncate or subtruncate.
Coxae metallic, femora washed with metallic.
Scape pale.
Propodeum with a more or less complete (paired
and diverging) median carina which is somewhat
like a ruga and rather delicate, variable. Funicle
joints all short, somewhat variable. Abdominal
petiole scaly. (= allograpta Ashm.)

anthomyia Howard
The same. Propodeum with single median and
lateral carinae, the latter more or less obscure and
paired at base; petiole with strong longitudinal
striae. Scutellum with a distinct cross-suture
before apex. Segment 2 of abdomen caudad at
meson faintly emarginate . . . hammari Crawford
The same but scutellum without a distinct cross-
suture before apex (only a faint obscure ridge in its
place as in other species), segment 2 of abdomen is
sharply minutely incised caudad at meson (as in
the other species), the spiracular sulcus is twice
broader while the median and lateral carinae of the
propodeum are more delicate

virginicum sp. nov.
Scape with the distal half metallic.
The same as hammari but the cross-suture of the
scutellum is indicated by coarser punctures, distad
of its site, the caudal margin of segment 2 of the
abdomen is convex, entire, the median carina of
the propodeum is represented by several interlac-
ing, delicate rugae broadly across the meson while
the tibiae are dark except at each end or reddish brown......................texanum sp. nov. Scape wholly metallic except at the extreme base of its body; the bulla metallic. Propodeum as in Propachyneuronia siphonophora Ashmead (plane with a neck and spiracular suture). Scutellum with no indication of a cross-suture; segment 2 of abdomen slightly emarginate at meson caudad, convex there. Petiole sub-quadrate, finely scaly. Funicle 1 somewhat the smallest.....................californicum sp. nov.

**Pachyneuron virginicum** Girault.

*Female:* Like hammeri Crawford except as pointed out above. The male is the same except that the funicle joints are considerably longer, 1 twice longer than wide.

From a pair reared from wingless, viviparous females of *Aphis sorbi* Kaltenbach on apple. Blacksburg, Virginia, August, 1915 (M. T. Smulyan).

*Types:* Catalogue No. 20368, U. S. N. M., the pair on tags, the male head and caudal tibia on a slide.

**Pachyneuron texanum** Girault.

The types are three females reared at College Station, Texas, in February, 1891, from wheat (F. M. Webster). Catalogue No. 20369, U. S. N. M., the examples on tags, a head and a caudal tibia on a slide.

**Pachyneuron californicum** Girault.

The males have the legs white except the coxae and the proximal half of the caudal femur; the scape is nearly wholly whitish, the funicle more hairy, with joints 1–2 subequal and over twice longer than wide. The types and cotypes are three pairs on tags with a slide bearing a female head and caudal leg. Mt. Antonio, Calif., 6,000 feet, July 20, 1911, and Carpenteria, Calif., August 17, 1911 (P. H. Timberlake). Catalogue No. 20370, U. S. N. M., two pairs on tags (Mt. Antonio) and the slide.
NEW MISCELLANEOUS CHALCID-FLIES FROM NORTH AMERICA.

By A. A. Girault.
Bureau of Entomology, Washington, D. C.

Pseudiglyphomyia marilandica sp. nov.

Female: Length, 1.00 mm. Very similar to nigrivariegata Girault but somewhat smaller and differing also in the following particulars: The general color is orange; the face of prothorax has a black stripe across it; cephalic margin of scutum rather broadly black; the parapsidal furrows and the suture between scutum and scutellum are more noticeably black; also black thus—there is a moderately large round spot in the center of the scutellum; the spot on the axillae is more distinct; the cephalic margin of the propodeum narrowly out a little laterad of the spiracle and an oblique stripe from base between meson and spiracle, extending well toward apex; and seven narrow cross-stripes on dorsal abdomen from base to apex, the first broadly interrupted at the meson. Prothorax lemon yellow. Teguile dusky, also the antennae, the scape paler except on dorsal edge and toward the apex. Mandibles 6-dentate. Funicle joints subequal, each twice longer than wide and longer than the pedicel; club 1 nearly as long as funicle 1, longest, 3 with a distinct terminal spicule. The propodeum is as in nigrivariegata but there is no very narrow lateral carina directly from the minute round spiracle which is not very close to the cephalic margin. Types compared.

One female, open woods, Glenndale, Md. (September 28, 1916).

Type: Catalogue No. 20622, U. S. National Museum, the female on a tag, the head and the hind tibiae on a slide.

Euplectrus platypenæ Howard.

Reared from a larva on grass, Barbados, B. W. I., January, 1915 (F. Watts).

Gonatocerus illinoiensis sp. nov.

Female: Similar to the description of jwator Perkins but the legs are yellow except all tibiae and tarsi besides the prothorax, lateral and caudal margins of scutum and the parapsides except apex
(cephalad). Fore wings subhyaline. Middle and hind coxae black. A most beautiful species when alive.

One female, window of a laundry, Coulterville, Ill., June 10, 1911.

Type: Catalogue No. 20631, U. S. National Museum, the female on a slide.

**Neomphaloides cincinnatus** sp. nov.

Female: Length, 1.20 mm. Slender, the stylus a little shorter than the ovipositor and a third of the abdomen’s length.

Dark metallic blue, the wings hyaline, the venation and scape pale, the tarsi, knees, cephalic and middle tibae and the caudal legs except the coxae golden yellow. Abdomen above and below with a large peltate spot of golden yellow at base (base and lateral margin narrowly concolorous, the yellow reaching to apex of basal third) and with over the basal half of the stylate part golden yellow. Pedicel but somewhat longer than wide, about half the length of funicle 1, the latter slightly longest, thrice or more longer than wide, the club joints twice longer than wide, the third with a distinct but not elongate terminal spine. Mandible tridentate, the third tooth obliquely truncate. Stylus hairy. Punctures along lateral margin of scutum very delicate, obscure. Sculpture usual but the propodeum rather coarsely scaly, with a narrow median carina and a similar, straight lateral one, the spiracle minute, round, halfway between middle and cephalic margin.


Type: Catalogue No. 20472, U. S. National Museum, the female on a tag, the head on a slide.

A second female, same place, some days later.

**Dibrachys clisiocampae** (Fitch).

Four females reared from the larvae of *Phthorimaea operculella*, Pasadena, Calif. (J. E. Graf).

**Polynema bifasciatipenne** (Girault) varium var. nov.

Female: Differing from the typical form in being light yellowish brown, including the legs; distal stripe of fore wing nearly as long (or even longer) as the middle one and subrectangular, its apical margin flatly convexed, its basal nearly straight. Ovipositor black except at base, more extruded (for a length equal to a third
of that of the abdomen's body or nearly as long as the slenderer petiole). And the hind wings are wholly hyaline.

The male has a fuscons band across the abdomen a little before apex.


**Types:** Catalogue No. 20599, U. S. National Museum, one male, three females on tags.

**Anaphoidea conotracheli** (Girault).

From eggs of *Crapionius inaequalis*, West Virginia (F. E. Brooks).

**Eutelus betulae** sp. nov.

**Female:** Length, 1.00 mm. Dark metallic green, the wings hyaline, the scape, most of the pedicel, venation, cephalic tibiae, tips of other tibiae and the tarsi, yellowish brown. Body finely scaly punctate, the propodeum and abdomen scaly, the former tricarinate but the median carina weak, subobsolete. Parapsidal furrows incomplete. Propodeal spiracle minute, rounded, its own diameter from the cephalic margin. No spiracular sulcus. Abdomen conic-ovate, a little longer than the rest of the body, depressed or sunken above, its second segment occupying a fourth of the surface. Lateral ocelli far distant from the eyes. Clypeus small, not advanced, sharply incised at the meson, thus bidentate, its teeth obtuse. Mandibles 3- and 4-dentate. Antennæ inserted near the clypeus, a little below the ventral ends of the eyes, 13-jointed with three ring-joints, the third of the latter largest; funicle joints subquadrate, subequal, somewhat shorter than the pedicel. Stigmal vein a half shorter than the marginal, somewhat shorter than the postmarginal.

The male is similar but the abdomen is much shorter, depressed and obtuse at apex.

From two pairs reared from "*Cecidomyiia betula*, Albany, N. Y., June 10, 1887 (J. A. Lintner)."

**Types:** Catalogue No. 20789, U. S. National Museum, two pairs on tags, appendages on a slide.
Eutelus salicis sp. nov.

Female: Length, 2.15 mm. Like the preceding but much larger, the pedicel is entirely reddish yellow and larger (also the first two ring-joints; funicle 1 is about twice longer than wide), the femora reddish yellow; the clypeus is not incised but broadly sinuate or concaved; the abdomen is longer and stylate, not sunken, the antennae inserted barely below the ventral ends of the eyes; the propodeum is about as in Habrocytus onerati and the marginal vein is somewhat larger. Differs from H. onerati (Fitch) mostly in that the flagellum is black, the antennae with three ring-joints and somewhat lower on the face.

From three females reared from a conical Cecidomyid gall on Salix longifolia, Melrose, Mass., January 20, 1882 (U. S. Department Agriculture).

Types: Catalogue No. 20788, U. S. National Museum, the three females, minutien-mounted and a slide bearing caudal tibiae and a head.

Achrysocharella pulchrella sp. nov.

Female: Length, 1.00 mm. Bright orange yellow, the abdomen somewhat paler, the wings hyaline, the body marked with dark metallic blue as follows: Pronotum, cephalic half of scutum, a dot on each side, center of occiput, a tolerably broad stripe across the base of the abdomen, followed immediately by a narrow cross-stripe and then at intervals equal to the basal stripe (except in the first instance) by four sometimes thicker cross-stripes, the last one of which is at base of distal third. Legs, scape and pedicel, white, the funicle and club dusky. Tip of ovipositor valves black. Head and thorax very finely punctate, the propodeum and abdomen scaly. Propodeum plane, with a median carina and a oblique carina just laterad of the rounded spiracle. Scutellum with a seta on each side of the middle, somewhat flattened. Post-marginal vein shorter than the stigmal. Terminal spine of the club as long as its joint; pedicel, funicles 1–2 and club 1 subequal, twice longer than wide; club 2 somewhat shorter, 3 still shorter. Club narrowing distad. Mandibles with two acute outer teeth and a third inner which is rather broadly truncate at apex and there with minute teeth. Parapsidal furrows barely indicated cephalad. Habitus of the Australia grandis.
From one female in the U. S. National Museum Collection from the District of Columbia.

*Type:* Catalogue No. 20438, U. S. National Museum, the female on a card, the head on a slide.

**Atoposomoidea ogimæ** Howard. *Genotype.*

Same as *Diaulinopsis* but postmarginal abbreviated. Head normal.

**Grotiusomyia flavicornis** sp. nov.

*Female:* Length, 1.20 mm. Aeneus black, the wings hyaline, the legs (except the coxae and femora) and the antennæ, straw yellow. Pedicel dusky. Head and thorax finely scaly punctate, the abdomen scaly except segment 2 which is glabrous (except at apex). Postscutellum and propodeum subglabrous, the latter with a strong median carina and a curved smooth sulcus in the site of the lateral carina, the mesal margin of which is an obtuse carina; spiracle elliptical, of moderate size, cephalad. Parapsidal furrows complete, fine like lines. Pronotum transverse-quadrate, over half the length of the scutum. Segment 2 of abdomen much the largest, occupying a third of the surface, its caudal margin straight. Axilke considerably advanced. Marginal vein as long as the submarginal, over twice the length of the long stigmal, the latter distinctly shorter than the postmarginal. Mandibles 6 = and 7 = dentate. Club 2 = jointed, nippleless, the joints about equal in length, 1 a little wider than long. Pedicel somewhat longer than wide, the funicle joints shortening and widening, 1 slightly shorter than the pedicel, the others wider than long. Antennæ clavate. Femora usually yellow except the caudal ones.

From six females reared from an oak pyralid, Washington, D. C.

*Types:* Catalogue No. 20695, U. S. National Museum, the females on tags (1 minutien), a head and four caudal legs on a slide.

**Aphidencyrtus aspidioti** Girault.

A pair from *Lepidosaphes ulmi*, Monmouth, Me., July 22, 1914 (E. H. Siegler). The male bears two ring-like funicle joints and a very long, solid club, the antennæ 5 = jointed.
Lamprostatus canadensis sp. nov.

Female: Length, 2.45 mm. Stout. Dark metallic green, the wings hyaline, the venation dusky yellow, the tibiae and tarsi reddish brown. Head and thorax densely scaly, the scutellum with a deep, foveate cross-suture before its apex and at base with a short median sulcus and row of small punctures along its lateral margin; propodeum with a median carina (and no others) from which run more or less distinct oblique rugae; also a lateral carina distal, the spiracle moderately large, ovate. Petiole wider than long, the second abdominal segment occupying not quite half of the surface, its caudal margin straight but with a short slit at the meson. Antennae inserted a little below the middle of the face, above the ventral ends of the eyes; clypeus not advanced but at each end with a stout tooth and another in the middle (of its ventral margin); an obtuse ridge from the clypeus to the antennae along the meson. Parapsidal furrows deep, distinct. Suture between pronotum and scutum distinct. Antennae 13\(=\)jointed with two ring-joints, the club wider than the funicle but not half its length; funicle 1 a third longer than wide, 6 quadrate, longer than the pedicel. Scape not long. Postmarginal vein longer than the marginal, the stigmal long, a little shorter than the marginal. Abdomen flat above, much keeled beneath, smaller than the thorax. Mandibles 3\(=\)and 4\(=\)dentate.

Described from one female in the U. S. National Museum from Banff Springs, Alberta, Can. (E. A. Schwarz).

Type: Catalogue No. 20429, U. S. National Museum, the specimen on a tag, the head, caudal legs and a fore wing on a slide.

Miscogaster flora sp. nov.

Female: Length, 2.10 mm. Like abnormicolor but only the caudal tibiae are purple and the blotch on the fore wing does not form a crescent but is a large, oblique marking from the apex of the stigmal vein, its sharp end caudo-proximad; the clypeus is somewhat more produced. Funicle 5\(=\)jointed.

From two females, Jacksonville, Fla. (Ashmead).

Types: Catalogue No. 20790 U. S. National Museum, the specimens on tags, a head, fore wing and caudal tibia on a slide.
Miscogaster biguttata sp. nov.

**Female:** Length, 2.25 mm. Similar to *flora* but the legs all white, the fore wings bear two small, rounded spots, one at the apex of the stigmal vein, the other, larger and somewhat quadrate, at the base of the marginal vein. In some males, the proximal spot is absent and there is a narrow, yellow cross-stripe at about apex of proximal fourth. Antennae nearly all yellow.

From five males, one female with *flora*.

*Types:* Catalogue No. 20791, U. S. National Museum, the specimens on tags.

Megorismus poloni sp. nov.

**Female:** A third smaller than *lasioptera* Ashmead and differing from that species notably in having the antennae wholly concolorous except the bulla; also, as follows: the antennae are inserted somewhat farther ventrad, on a level with the ventral ends of the eyes; the clypeus is stoutly bidentate at the apical meson instead of unidentate, as in the other species; the propodeum is subglabrous and though tricarinate there is not a cross-carina consisting of three rugae which converge at the meson from each side. Segment 2 of abdomen occupying nearly a half of the surface; its caudal margin at meson with a short slit. Lateral carina of propodeum failing just before the cephalic margin. Postmarginal vein more or less subequal to the marginal, longer than the slender stigmal. Prothorax distinct. Parapsidal furrows complete, shallow. Scutellum with a shallow cross-suture before the apex. Petiole of abdomen quadrate, reticulate, the abdomen conic-ovate, pointed ventrad, about as long as the thorax. Antennae 13-jointed with two ring-joints; funicle 1 a little longer than wide, much shorter than the subelongate pedicel; funicles 2–4 subequal to 1.6 quadrate. Scape long and slender. Tibiae at each end yellowish brown. Mandibles 4-dentate.

Described from four females from Placer County, California, August (U. S. National Museum).

*Types:* Catalogue No. 20792, U. S. National Museum, the specimens, minutien-mounted and a slide bearing a head and caudal tibiae.

In the species *lasioptera*, segment 2 of the abdomen is shorter than in *poloni* and its caudal margin is entire.
Trydymus æneicornis sp. nov.

*Female:* Half the size of *robiniaecola* Ashmead and differing farther in having the antennæ wholly metallic green and also the legs except knees, tips of tibiae and tarsi; otherwise the same but the spiracle of the propodeum is smaller and about its own diameter from the cephalic margin. The clypeus at apex is distinctly convexly projected. Valves of ovipositor distinctly shortly extruded. First ring-joint extremely short. Pedicel longer than the subquadrate funicle 1. Otherwise as in the named species.

Described from one female taken from a plum tree in New York State, May 25, 1888.

*Type:* Catalogue No. 20425, U. S. National Museum, the female on a tag and a slide.

Trydymus gargantua sp. nov.

*Female:* Length, 2.30 mm. Like *æneicornis* but very much larger, a third or more larger than *americensis* or *robiniaecola* and differing farther as follows: the scape is yellow at extreme base, the pedicel at apex and beneath, the funicle and club all so except above; the legs are golden yellow except the coxae and the proximal two thirds (less on cephalic femur) of the femur which are metallic; the ovipositor is not at all extruded and the propodeal spiracle is large, oval and at cephalic margin. Pedicel subequal to funicle 1. The same otherwise.

The male is similar but the funicle is 6-jointed, the club 2-jointed, funicle 1 shorter.

Described from a pair from Ithaca, N. Y. (Cornell University).

*Types:* Catalogue No. 20426, U. S. National Museum, the pair on tags, male and female antenna and caudal legs on a slide.

The clypeal projection is somewhat more prominent in this species.

Trydymus poloni sp. nov.

*Female:* Like *gargantua* but the ovipositor is a little extruded, the legs are golden yellow except most of the middle and all of the caudal coxae, the antennæ so except the scape above at distal two thirds, the pedicel above and the funicle joints too, more or less; the projection of the clypeus is not convex but subtruncate; the foveæ along the cephalic margin of the propodeum are minute and
the spiracle is oval and a short distance off the cephalic margin. The same otherwise. Mandibles 4-dentate.

Described from one female on a tag in the U. S. National Museum from Franconia, N. H.

Type: Catalogue No. 20427, U. S. National Museum, the female on a tag, a caudal leg and the head on a slide.

A NEW SPECIES OF THE GENUS MYMAR FROM THE WOODS OF MARYLAND WITH AN IMPORTANT DESCRIPTIVE NOTE.

By A. A. Girault,
Bureau of Entomology, Washington, D. C.

Mymar cincinnati sp. nov.

Male: Similar to venustum (female type) but the antennae are entirely black, the base of the blade of the fore wing is rather broadly infuscated, there are on the fore wing 43 primary marginal cilia (instead of 34), the midlongitudinal line of discal cilia runs from apex nearly to the base of the blade (instead of into the costal margin, farther from base); and most of the discal cilia of the fore wing are caudad of the midlongitudinal line instead of cephalad as in the other species. Scape long, curved; flagellar joints elongate, subequal, 2 eight times (or more) longer than wide.

One male captured by sweeping grass in an open wooded bog, Glenndale, Md., August.

Type: Catalogue No. 20468, U. S. National Museum, the specimen on a slide.

Mymar venustum has the caudal wing shaped like a long thick bristle with the hooklets at its apex. In the above new species it is similar but prolonged beyond the hooklets in the form of a hair as long as the part from base to the hooklets and after that length widening into a very linear blade of more than half the length of the hairlike pedicel and which bears a few long marginal cilia caudad. In Mymar, then, the hind wing has a short, very linear blade on a long pedicel while the petiole of the wing (from base to hooklets) is much longer than in the other genera. This blade part of the wing must break off easily and this accounts for
its absence in *renustum*. In the Australian *M. tyndalli*, the blade-like portion of the caudal wing was absent. *Neomymar* has normal hind wings except that the petiole is long as in *Mymar*.

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A METALLIC SPECIES OF *CIRROSPILOPSIS* FROM MARYLAND (HYMENOPTERA EULOPHIDÆ).

By A. A. Girault,

Bureau of Entomology, Washington, D. C.

The following species resembles a *Diaulinopsis* but there are no grooves on the scutellum, the caudal tibial spur is single and the club without a distinct apical nipple.

*Cirrospilopsis metallicus* sp. nov.

*Female:* Length, 1.10 mm. Brassy metallic green, the wings hyaline, the legs (except the coxae; apex of first coxae yellow), venation and the antennae (except the scape and pedicel except both at apex), golden yellow. Body densely scaly, the parapsidal furrows distinct, the propodeum moderately short, noncarinate (a median carina subobsolete), the spiracles small, rounded, cephalad. Bristles on thorax minute, sparse. Postscutellum rather large. Mandibles 4-dentate, the last two teeth much smaller than the others. Pedicel subequal to funicle 1 which is nearly twice longer than wide, 2 somewhat shorter, the club somewhat longer than the funicle; ring-joints distinct. Middle tibial spur long, slender. Stigmal vein not quite half the length of the marginal, the postmarginal two-thirds the length of the marginal.

From two females captured by sweeping in the woods, Glenndale, Md., May 4, 1916.

*Types:* Catalogue No. 20291, U. S. National Museum, the specimens on a tag, a head and two caudal tibiae on a slide.
A NEW SPECIES OF CLOSTEROCERUS FROM CALIFORNIA (HYMENOPTERA EULOPHIDÆ).

By A. A. Girault,
Bureau of Entomology, Washington, D. C.

This new species is characterized by bearing narrow fore wings with rather long apical fringes and a T on the fore wing formed by a long longitudinal stripe from proximad and the first cross-stripe; the letter is on its side, to the right from the upright.

Closterocerus tau sp. nov.

Female: Length, 0.85 mm. Black metallic blue, the scutum and scutellum lighter blue except marginally, the tarsi white except the distal joint: pronotum conical, light blue discally. Body densely scaled, the propodeum with a median carina only, sub-glabrous. Venation sooty, the very long marginal vein silvery white. Fore wing broadening distad, about thrice longer than wide at its truncate apex, its apical marginal cilia somewhat less than half the greatest width, the discal ciliation absent except on the infuscations; the thick longitudinal stripe originates at caudal margin opposite the base of the marginal vein and runs straight into the middle of the first cross-stripe which is across from the apex of the marginal and all of the post marginal veins (with the stigmal in its middle); first cross-stripe somewhat narrower than the second which is at apex, the hyaline space between them equal to the second cross-stripe. Stigmal and postmarginal veins subequal, not very short, the first at right angles to the marginal. Funicle joints equal, twice wider than long; pedicel very large, longer than the funicle. Mandibles tridentate. Otherwise usual. Wings with two cross-stripes.

From one female on a tag in the U. S. National Museum from Inyo County, California.

Type: Catalogue No. 20290 U. S. National Museum, the specimen above, the head and a fore wing on a slide.
A NEW GENUS OR SUBGENUS OF PACHYNEURINE CHALCID-FLIES.

By A. A. Girault,
Bureau of Entomology, Washington, D. C.

Propachyneuronia gen. nov.

Based on Eneyrhis siphonophora (Ashmead) of which Pachyneuron micans Howard, P. aphidivorum Ashmead and Pachyneuron maidiaphidis Ashmead are synonyms (types examined). The same as Pachyneuron but the antennae bear three ring-joints. The genotype has the clypeus radiate striate but not strongly, acutely produced (a smaller tooth on each side of the clypeus); the propodeum bears a neck and is plane (except for a few foveae along the cephalic margin) with the spiracle small, its own diameter from the cephalic margin. Mandibles acutely 4-dentate. Scape metallic, the funicle joints all short. Abdominal petiole transverse, with a tooth from each side. Segment 2 of the abdomen entire as to its caudal margin, occupying about a third of the surface. Stigmal vein longer than the marginal.
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CONTENTS.


Notes on Some New Species of the Genus Dioctria (Asilidae). Nathan Banks .......................... 117

New Social Bees. T. D. A. Cockerell ........................................... 120

Synoptic Keys to the Lygaidae (Hemiptera) of the United States. H. G. Barber ......................... 128
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</tr>
</thead>
<tbody>
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<td>$1.50</td>
<td>$2.50</td>
<td>$3.50</td>
<td>$4.50</td>
</tr>
<tr>
<td>5-8</td>
<td>3.50</td>
<td>5.80</td>
<td>5.50</td>
<td>7.80</td>
</tr>
<tr>
<td>9-12</td>
<td>4.25</td>
<td>7.05</td>
<td>6.25</td>
<td>9.05</td>
</tr>
<tr>
<td>13-16</td>
<td>4.75</td>
<td>7.90</td>
<td>6.75</td>
<td>9.90</td>
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EIGHT NEW MALLOPHAGA OF THE GENUS LIPEURUS FROM NORTH AMERICAN BIRDS.

By E. A. McGregor,

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Lipeurus brevicephalus sp. nov.

Two females, two males, and two immature individuals (McGregor No. 101, Washburn No. 166) from sand-hill crane (Grus mexicana), western Minnesota, April 15, 1894.

This species is nearest L. hebræus N. (from Grus cinera and G. pavonina) from which it is very distinct. It also superficially resembles L. toxoceros N. which is from an entirely different host.

Description of Male. Total length, 4.76 mm.; length of head, 1.045 mm.; length of prothorax, .357 mm.; length of metathorax, .797 mm.; length of abdomen, 2.585 mm.; width of head across temples, .907 mm.; width of prothorax, .660 mm.; width of metathorax, .962 mm.; width of abdomen, .990.

Head slightly longer than wide, rather abruptly narrowed anteriorly, with a truncate frontal margin, antennal sinuses very shallow, temples some what rounding, eyes strongly projecting, hindhead widest half way between the eyes and the posterior angles, occipital margin strongly concave, four long marginal hairs and two short ones before the antennal angle, a prickle arises from the eye, one longish hair and five prickles on the temporal margin, and a pair of prickles arise dorsally from the forehead; head pale, antennal bands arise just before the antennæ and are lost in the colored areas which extend laterally from the mandibles, but reappear as narrow borders behind the eyes. What appear to be faint occipital bands extend toward the bases of the mandibles. Antennæ with segment 1 greatly swollen and equal to all the other segments; segment 3 with a dorsal, distal appendage and with a dorsal, proximal, annulated gland.
Thorax one-fifth longer than wide. Prothorax trapezoidal, with posterior margin nearly straight. A weak spine at the posterior lateral angle. Metathorax at first converges slightly and then widens to the abdomen: posterior margin twice weakly concave forming a weak median angle: a series of five long hairs in the posterior angles, and on each side between the latter and the middle a series of four similar hairs; central and hind portion of prothorax and central portion of metathorax yellow-amber colored. Legs ample, yellowish, pale margined.

Abdomen slender, elongate, slightly widening to segment 5, then tapering gradually to segment 9; segment 1 conspicuously shorter than the others; segments 2 to 8 with transparent lateral plates immediately within which occur longitudinal bands of darker color; general color pale amber. Segment 2 with a short spine at the posterior angles; segment 3 with three similar spines at the posterior angles; segment 4 with a spine and a longer hair at the posterior angles; segment 5 with one long and two shorter hairs at angles; segment 6 with three shortish hairs at angles; segment 7 with three longish hairs at angles; segment 8 with two longish hairs at the posterior lateral angles, one just within the lateral plate, and four along the posterior border; segment 9 very deeply notched, forming a pair of terminal claw-like appendages at the inner borders of which near the base are a pair of shortish hairs, while a series of six short hairs occur laterally thereon.

Type: Catalogue No. 21369, U. S. Nat. Museum.

*Lipeurus crotaphagæ* sp. nov.

One female (Bishop p. No. 916) from groove-billed ani (*Crotophaga sulcirostris*), Victoria, Mexico, December 10, 1909, collector F. C. Bishopp.

Not much resembling *L. macgregori* Kell. from same host, but probably nearest *L. variegatus* Neumann and *L. picturatus* Kell. The present species is very distinct from all of these.

*Description of Female.* Total length, 1.44 mm.; length of head, .455 mm.; length of prothorax, .104 mm.; length of metathorax, .182 mm.; length of abdomen, .332 mm.; width of head, .429 mm.; width of prothorax, .260 mm.; width of metathorax, .364 mm.; width of abdomen, .598 mm.

Head roughly pentagonal, a trifle longer than wide, converging

abruptly to a narrow frontal margin bordered on each side by two shortish hairs. Between the trabeculae, which are quite prominent, and the frontal border five prickle arises. Antennal sinuses hardly noticeable. Ocular projections barely discernible; ocular fleck conspicuous. Temple margins diverge slightly posteriorly to the squarish angles which bear a strong spine; a prickle arises from the eye, and two from the temples. Occipital margin almost straight, but with a weak median convexity. Antennal bands clearest just before the antennae, paling anteriorly and separated at front by the large, median, dark-bordered clear area which extends back to the mandibles. Temples narrowly margined by blackish borders. Faint bands running backward from the trabeculae and the mandibles unite posteriorly to form a W-shaped figure. A diamond-shaped occipital signature. Antennae conventional.

Thorax one-fourth wider than long, prothorax rectangular with very slightly convex posterior margin. A short spine at each posterior lateral angle. Smoky-amber color with a median clear area, and with narrow, dark, underlying bands. Metathorax pentagonal, sides diverging strongly to the angulated posterior margin. A strong postulated spine at the lateral posterior angle, and four long, postulated hairs along each lateral third of the hind border. Color smoky-brown, with a median, vase-shaped, clear area. Legs smoky banded.

Abdomen widely elliptical, widest on the fourth segment. General color hyaline with a dorsal series of paired, sub-quadrate, brownish plates, and with lateral plates of slightly darker color on segments 2 to 7 inclusive; the dorsal plates on segment 1 larger and darker than others. Marginal hairs at posterior lateral angles as follows: Two weak hairs on segment 3, two longer ones on segment 4, two long hairs on each of segments 5, 6, 7 and 9, one long hair on segment 8. A median pair of long spines on segments 1 to 8 inclusive. A pair of weak terminal hairs. Segmental sutures mostly invisible.

Type: Catalogue No. 21363, U. S. Nat. Mus.

Lipeurus mississippiensis sp. nov.

One female (Bishop No. 4053) from flicker, Hamburg, Miss., December 24, 1914, coll. W. E. Dove.
This conspicuously marked species is nearest *L. snodgrassi* Kell. (of humming-bird) and *L. stramineus* Denny (of woodpecker), but from both of these our species is very distinct.

*Description of Female.* Total length, 1.62 mm.; length of head, .477 mm.; length of prothorax,.108 mm.; length of metathorax,.162 mm.; length of abdomen,.882 mm.; width of head across temples,.342 mm.; width of prothorax,.270 mm.; width of metathorax,.360 mm.; width of abdomen,.432 mm.

Head fully a third longer than wide, rhombic-rectangular in outline, forehead slightly narrowed to the wide, rounded front, temples converging rotundately to the very slightly concave occiput. Antennal sinuses rather shallow. Trabeculae quite prominent. Ocular projections not very noticeable. Antennal bands extremely conspicuous as wide, dark areas bordering the forehead, but paling anteriorly and interrupted across the frontal margin by the large, quadrilateral, clear area before the mandibles; continuing paler around the antennal bases to the temporal marginal bands which are as dark as the antennal bands but somewhat narrower; both of these bands are bordered inwardly by conspicuous pustulations. Occipital border without color. Backward pointing bars resembling occipital bands extend from the antennal bands part way to the occiput. An obelisk-shaped occipital signature plainly visible. A strong hair at each angle of the frontal border, two shorter hairs before each trabecula, a prickle on the eye, two long hairs on the hind portion of temples, a pair of prickles dorsally on the forehead, and a similar pair dorsally between the eyes. Excepting the antennal, temporal and occipital bands, the mandibles, the oesophageal sclerite and the occipital signature, and the smoky temples, the head color is transparent. Antennæ normal, segments 1, 3, 4 and 5 smoky banded.

Thorax one-third again as wide as long. Prothorax rectangular with front and hind margins almost straight. A strong hair at each posterior lateral angle. Wide, dark, submarginal bands extending nearly to occipital signature, within which are underlying smoky areas, separated by a median clear area. Metathorax quite strongly diverging to the twice weakly emarginated posterior border. A strong and a weak spine at each angle, and a transverse series of twelve long hairs along the hind margin. Inward curving, black, submarginal bands, further bordered by
McGregor—Mallophaga of the Genus Lipeurus.
dark-brown which involves the entire segment excepting a central, clear, urn-shaped area. Legs conventional, pitchy bordered.

Abdomen clavate, widest on the fifth segment. Segments 1 to 7 each with black, lateral plates which reach well into the segment ahead, and with wide, brown, blotches within the plates with deeply indented inner margins. Segments 4 and 5 each with a faint central blotch, and a T-shaped blotch involving segments 6 to 9 inclusive. The posterior lateral angles of segments 3 to 7 supplied with hairs as follows: Segment 3, a weak prickle; segment 4, a prickle and a long hair; segment 5, two long hairs; segment 6, two long hairs; segment 7, a short and a long hair. Segment 8 with a long hair at middle of lateral margin; segment 9 with a terminal fringe of 14 long hairs; segments 2, 3, 4, 5, 6 and 8 with a long hair arising just within the head of the lateral plate; segments 1 to 7 inclusive with dorsal transverse spines as follows: Segment 1, four; segment 2, two; segment 3, two; segment 4, four; segment 5, five; segment 6, three; segment 7, four.

Type: Catalogue No. 21368, U. S. Nat. Mus.

Lipeurus texanus n. sp.

One female (Bishop No. 3244) from meadow lark, Gainesville, Texas, November 26, 1915, coll. F. C. Bishop, and one immature individual (Bishop No. 4015) from turtle dove, Uvalde, Texas, November 20, 1914, coll. Parman & Bishop.

This species is nearest L. baculus N., from which it is very distinct as follows: Occipital margin of head, general shape and

Drawings by the author. Made through use of camera lucida with little attempt to restore symmetry.

EXPLANATION OF PLATE.
Plate V.

Fig. 1. Female of Lipeurus mississippiensis sp. nov.
2. Male of Lipeurus brevicephalus sp. nov.
3. Left leg III of male of Lipeurus brevicephalus sp. nov. (viewed ventrally).
4. Female of Lipeurus crotaphaga sp. nov.
5. Right leg III of female of Lipeurus mississippiensis sp. nov. (viewed ventrally).
posterior margin of metathorax, outline of abdomen, and peculiar abdominal lateral plates.

Description of Female. Total length, 1.55 mm.; length of head, .466 mm.; length of prothorax, .095 mm.; length of metathorax, .206 mm.; length of abdomen, .784 mm.; width of head across temples, .286 mm.; width of prothorax, .191 mm.; width of metathorax, .244 mm.; width of abdomen, .339 mm.

Head flat-iron shaped, five-eighths again as long as wide, forehead rather quickly narrowed to the narrowly truncate front which bears at each side a clavate appendage and a hair of equal length. Temporal borders sub-parallel; occipital margin nearly straight. Antennal sinuses rather shallow. Trabeculae quite prominent. Ocular projections missing. Antennal bands extend from the clavate appendages to the ocular flecks, interrupted by the conspicuous clypeal sutures and again by the inward-pointing hyaline bars arising at the trabecule. Temples narrowly margined with brownish. Occiput with a thickened, clear border. Clypeus clearly demarked by the forward-angulated suture, and split by a median suture. Temples pale amber. A large, pale, irregular shaped occipital signature. General color very pale. A hair at the clypeal suture, two before the trabecule, one at hind angle of antennal sinuses, one on hind third of temples. Antennae reaching behind occipital border faintly margined and banded.

Thorax about one-quarter as long as broad. Prothorax lenticular with weakly convex anterior and posterior borders, bisected faintly by a median clear bar which also bisects the metathorax. Bordered laterally by a pale margin. A weak spine at the posterior lateral angles. Metathorax pentagonal, the posterior margin strongly angulated on the first abdominal segment. Three long, pustulated hairs at the lateral angles. Like the prothorax, the general color is pale amber with colorless lateral borders. Legs rather small, pale.

Abdomen clavate, widest on the fourth segment. Posterior lateral angles of segments 2 to 8 with hairs as follows: Segment 2, a prickle; segment 3, a short spine; segment 4, a strong spine; segment 5, a long hair; segment 6, two long hairs; segment 7, two long hairs; segment 8, a short hair. Segment 9 has four short hairs and two prickles. Segments 1 to 8 inclusive are provided
laterally with large rectangular sclerites, and segments 1 to 7 have in addition a narrow, brownish, lateral plate.

*Type:* Catalogue No. 21366.  U. S. Nat. Mus.

**Lipeurus bishoppi** sp. nov.

Four males and one female (Bishopp No. 4995) from domestic geese, Hamburg, Miss., December 3, 1915, coll. W. E. Dove.

This species is probably nearest *L. temporalis* N., of the merganser, and it also bears some resemblance to *L. squalidus* N., of ducks, and to *L. constrictus* Kell., of scoters.

**Description of Male.** Total length, 3.05 mm.; length of head, .664 mm.; length of prothorax, .186 mm.; length of metathorax, .431 mm.; length of abdomen, 1.771 mm.; width of head between eyes, .442 mm.; width of prothorax, .326 mm.; width of meta-thorax, .431 mm.; width of abdomen, .524 mm.

Head just half again as long as wide, forehead converging to the sharply rounding front, antennal sinuses shallow, trabecule rather prominent, ocular flecks lacking, temples converging from the eyes to the concave occiput.  Six heavy spines along the lateral half of the front and anterior half of forehead, the third of which is heaviest; a short hair before trabecular, a hair on the eye, four prickles along the temples and a long hair on the hind third of same. Antennal bands occur as thin, hyaline borders which before the trabecule give off a short, swollen, posterior-directed bar, and at the hind border of the antennal sinuses sends off a similar, inward-pointing bar, general color pale, smoky amber. Antennæ strong, reaching to the middle of the prothorax, segment 3 with a strongly developed hooked process.

Thorax three-sevenths again as long as wide.  Prothorax rectangular, front margin quite strongly convex, hind margin weakly convex.  Narrow, brownish, submarginal bands curve backward and inward, nearly meeting on the median line; coxal markings showing faintly through; general color pale amber.  A prickle and a short hair at the posterior lateral angles. Metathorax quadrilateral, slightly constricted near the middle, posterior margin weakly concave.  General color same as prothorax, with a brown-bordered, black spot at each lateral constriction. Six long stiff hairs on each lateral third of the hind margin.  Legs strong, brownish-yellow.
Abdomen linear-clavate, widest on the fourth and fifth segments, segment 1 short and lenticular. Posterior lateral angle supplied with hairs as follows: Segment 2, one prickly; segment 3, two weak hairs; segment 4, a short and a long hair; segment 5, one short and two long hairs; segment 6, two long hairs; segment 7, two longish hairs; segment 8, two long hairs. The terminal segment is shallowly notched on each side of which is a prickly and a short hair; a smoky blotch involves most of the segment. At the anterior angles of each of segments 2, 3, 4 and 5 is a black, triangular blotch; general color transparent.

Type: Catalogue No. 21365. U. S. Nat. Mus.

Lipeurus aberrans sp. nov.

Three females and four males (Bishopp No. 7228) from the Texas bob-white (Colinus virginianus texanus), Columbus, O., January 25, 1917, coll. F. C. Bishopp. These birds had been introduced for experimental purposes from a point in Mexico opposite Eagle Pass, Texas.

This aberrant species is nearest L. docophoroides Piag., of the California partridge (Callipepla californica) from which it differs radically in the shape of head, prothorax and metathorax.

Description of Male. Total length, 2.18 mm.; length of head, .619 mm.; length of prothorax, .210 mm.; length of metathorax, .240 mm.; length of abdomen, 1.112 mm.; width of head, .532 mm.; width of prothorax, .370 mm.; width of metathorax, .608 mm.; width of abdomen, .741 mm.

Head a trifle longer than wide, the fore margin forming a nearly even curve between the trabeculae which are very strongly developed. Antennal sinuses deep. Ocular projections very conspicuous.

Explanations of Plate.

Plate VI.

Fig. 1. Female of Lipeurus texanus sp. nov.
2. Male of Lipeurus bishoppi sp. nov.
3. Right leg III of female of Lipeurus texanus sp. nov. (viewed ventrally).
4. Left leg III of male of Lipeurus bishoppi sp. nov. (viewed ventrally).
McGregor—Mallophaga of the Genus Lipurus.
ous. Temples at first parallel and then rounding convergingly to meet, without angles, the nearly straight occiput. Antennal bands black, conspicuous, paling just before ocular blotches which extend inward and forward as a narrowing bar; ocular bands replaced by pale underlying sickle shaped bars; temples margined by a black, crenate band which extends paler along the occipital margin; excepting the smoky colored, spindle shaped occipital signature, the brown oesophageal sclerite and mandibles, the general color is pale. Six prickles and two short hairs along the frontal border, a prickle and two short hairs before the trabecae, a long hair from over the eye, two long hairs and four prickles from the temples. Antennae very stout, basal segment about equalling all others, third segment brownish and with strong, hooked appendage, second segment with weak but well defined appendage.

Thorax one-third again as wide as long. Prothorax somewhat trapezoidal, the posterior margin rather strongly convex. Lateral margins bordered with heavy, black bands from the anterior ends of which narrow, fainter underlying bars extend backward and inward; a pale blotch occurs at each posterior lateral angle, and a small, triangular blotch lies directly behind the occiput. A long hair arises at each posterior angle. Metathorax pentagonal the hind margin sharply angulated on first abdominal segment; lateral sides diverging very abruptly. A dark interrupted, submarginal band extends from the prothorax to the black, pustulated blotch at the posterior lateral angle, and a triangular blotch involves each temple; excepting these markings and an anterior median pair of faint blotches, the general color is pale. A spine and a short hair at the lateral angles, and five long, pustulated hairs on each lateral third of posterior margin. Legs normal, brown bordered and banded.

Abdomen clavate-ovate, widest on fourth segment, contracted abrupt at the seventh segment. Segments 1 to 7 inclusive with narrow, brownish, lateral plates over-reaching hind end of plate next ahead. Segments 1 to 7 each with a chestnut-brown transverse blotch which are parted on the median line; those of segments 1 to 6 with a large hyaline spot at the sides, and in addition those of segments 2 to 7 with a small, clear, circular spot at their centers. Segments 3 to 8 with hairs at the posterior lateral angles as follows: Segment 3, a short hair; segment 4, two long hairs;
segment 5, three long hairs; segment 6, three long hairs; segment 7, a short and a long hair; segment 8, three long hairs. Segments 1 to 7 with series of transverse short hairs as follows: Segment 1, 24; segment 2, 21; segment 3, 29; segment 4, 29; segment 5, 26; segment 6, 18; segment 7, 12. Along each side of terminal segment a fringe of ten successively shorter hairs. An irregular-shaped genital blotch involves segments 8 and 9.


**Lipeurus lineatus** sp. nov.

One male (Bishop No. 4063*) from quail, Hamburg, Miss., January 5, 1915, coll. W. E. Dove. The specimen is somewhat shrunken so that excepting, probably, the head, a proper restoration would show the body parts rather ampler than indicated in the camera lucida drawing accompanying.

This species is nearest *L. variabilis* N. of the domestic fowl, but differs from it in the head markings, shape of metathorax, shape and markings of abdomen, and in the nature and distribution of hairs.

**Description of Male.** Total length, 2.05 mm.; length of head, .480 mm.; length of prothorax, .133 mm.; length of metathorax, .231 mm.; length of abdomen, 1.193 mm.; width of head, .302 mm.; width of prothorax, .196 mm.; width of metathorax, .290 mm.; width of abdomen, .267 mm.

Head subrectangular, three-fifths again as long as wide. Widest just before antennae. Forehead bullet-shaped, with a dusky border darkest midway along the margin; antennal sinuses deep; trabeculae fair sized; temple margins gradually diverging and meeting the rather deeply emarginate occiput without angles. Eyes not protruding beyond margin; ocular flecks conspicuous; antennal bands most distinct just before antennae, interrupted across antennal bases and reappearing to form ocular blotches; temples bordered with pale brown bands; very faint occipital bands. With exception of foregoing markings and the chestnut brown mandibles, the general color is transparent. Two longish hairs on front, two longish and one long hair at beginning of forehead, three short hairs before antennae, two shortish hairs on temple, two prickles dorsally before occipital emargination, and two strong spines dorsally near center of forehead. Antennae very
strong, reaching behind hind margin of prothorax; basal segment with strong spur posteriorly, third segment with a spur-like projection.

Thorax one-quarter again as long as wide. Prothorax rectangular, posterior margin nearly straight, bordered laterally by chestnut brown bands from which faint, narrow, underlying bands extend inward to near the median line. A weak hair on each side of posterior margin midway to center. Metathorax roughly quadrature, posterior margin slightly rounded. Submarginal, brownish bands ending posteriorly at the smoky-ringed pustulations on the posterior lateral angles which give rise to five longish to long hairs. Anterior and posterior angles each with smoky blotches, and median sternal blotches showing through; general color pale. A weak hair on the hind margin just within the pustulations. Legs very long, smoky bordered.

Abdomen (in the contracted specimen) linear, noticeably constricted on the third and fourth segments, widest on the first segment. Segments 1 to 8 inclusive with wide, chestnut brown lateral bands. Segments 2 to 8 with hairs at the posterior lateral angles as follows: Segment 2, a long hair; segment 3, a long hair; segment 4, a prickle; segment 5, a short spine; segment 6, a short spine; segment 7, a longish hair; segment 8, two extremely long, slender hairs. Segment 8 gives rise at the middle of lateral plate to a prickle and a very long hair, and at the posterior margin two pustulations give rise each to two short hairs. Segment 9 bears a pair of terminal prickles. Segments each 1 to 8 inclusive bear centrally a pair of dorsal spines. Faint lateral blotches, which become slightly darker posteriorly, almost totally involve each of the segments. A faint genital blotch involves segments 7, 8 and 9.

Type: Catalogue No. 21362. U. S. Nat. Mus.

Lipeurus clavatus sp. nov.

One female (Bishop No. 4063b) from quail, Hamburg, Miss., January 5, 1915, coll. W. E. Dove.

This species is closest to L. snodgrassi Kell., of the hummingbird, and L. introductus Kell., of the pheasant, but not at all resembling the known Lipeurí of the partridge or the Bob-white.

Description of Female. Total length, 2.03 mm.; length of head,
Psyche [August

.477 mm.; length of prothorax, .126 mm.; length of metathorax, .243 mm.; length of abdomen, 1.170 mm.; width of head across temples, .288 mm.; width of prothorax, .225 mm., width of metathorax, .360 mm.; width of abdomen, .477 mm.

Head two-thirds again as long as wide, projectile-shaped. Antennal sinuses extremely shallow. Ocular projections slightly noticeable. Forehead and front margined with a pale, narrow band which turns inward before the antennæ to form a pair of pitchy spots; commencing at the eyes the temples are margined with a chestnut colored band which gradually pales posteriorly; a pair of pitchy spots occur at the occipital border; with these exceptions, and the smoky temples, the general color is pale. Six prickles on forehead between center of front and trabecule; four prickles and a long hair on the temples. Antennæ normal.

Thorax about as wide as long. Prothorax roughly trapezoidal, pale straw-color, with narrow, brown, submarginal bands; posterior margin nearly straight; a weak spine before posterior lateral angles. Metathorax trapezoidal, posterior border straight, general color same as prothorax, sides mostly pale-bordered with sub-marginal brownish bands; four very long hairs at each posterior lateral angle. Legs unusually small, pale.

Abdomen clavate-elliptic, widest on the fourth segment. Segments 2 to 7 each with blackish-brown lateral bands which widen slightly at their anterior and posterior ends into brownish, inward-pointing blotches; segments 2 to 7 inclusive with extremely faint transverse blotches, those of segments 3 to 7 each bisected medially; segment 8 with a slightly darker transverse blotch. Hairs at the

Explanation of Plate.
Plate VII.

Fig. 1. Male of Lipurus aberrans sp. nov.
2. Male of Lipurus lineatus sp. nov.
3. Female of Lipurus clavatus sp. nov.
4. Left leg II of male of Lipurus aberrans sp. nov. (viewed ventrally).
5. Right leg III of male of Lipurus lineatus sp. nov. (viewed ventrally).
6. Right leg III of female of Lipurus clavatus sp. nov. (viewed ventrally).
McGregor—Mallophaga of the Genus Lipeurus.
posterior lateral angles as follows: Segment 2, a short hair; segment 3, a long hair; segment 4, a long hair; segment 5, two long hairs; segment 6, two long hairs; segment 7, a long hair; segments 3 to 7 each with a long hair arising just medially of the lateral angles; segment 8 with two long hairs laterally; a pair of long, subterminal hairs before the deeply emarginate posterior tip.

Type: Catalogue No. 21367. U. S. Nat. Mus.

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NOTES ON SOME NEW SPECIES OF THE GENUS DIOCTRIA (ASILID.E).

By Nathan Banks,

Our Eastern specimens of the genus Dioctria have all been placed in the species *albius* Walker. In examining our specimens I note, however, two types of male genitalia. In one, the northern form, the superior plate has two broad lobes, sometimes standing out flat, sometimes rolled down over the other parts; in the other more southern specimens the superior plate is divided into two long tapering parts ending in a knob-like enlargement, with a tooth on the inner surface and a pencil of yellow hair on the outer edge. The northern form is the true *albius* Walker; it has the third antennal joint short, and with a very short style; the mystax is black; the body is rather longer than in the southern forms. The southern forms I divide into two species, one with the antennae like *D. albius*; the other with the third joint and style much longer; both are new.

*Dioctria brevis* sp. nov.

Black, bronzy as in *D. albius*, and in general similar to that species; the third antennal joint barely if any longer than in *D. albius*. It differs at once, in the shape of the superior plate of the male genitalia, having two long tapering divisions, rather swollen at their tips, with a sharp, slender tooth on the inner side shortly before tip, and on the outer side a pencil of yellow hair.

Specimens are 8 to 10 mm. long, and come from Sea Cliff, N. Y.; Medina, Ohio; Englewood, N. J.; and north fork Swannanoa River, Black Mountains, N. C.

Type: M. C. Z. 10032.
Dioctria longicornis sp. nov.

This in appearance is similar to *D. brevis*; in some the mystax is mostly white, and the pleural piece in front of wing-base is not often pollinose. The male genitalia are closely similar to those of *D. brevis*, but the branches of the lateral appendages are not just the same. It differs, however, at once from *D. brevis* and also *D. albius* in the very much longer antennae; the third joint being much longer than the first and second together, and the style longer and about as thick as the third joint.

Specimens are 7 (♂) to 9 (♀) mm. long, and all I have are from the vicinity of Washington; Chain Bridge, Glencarlyn, and Dead Run, Virginia.

*Type:* M. C. Z. 10033.

Dioctria longicornis var. tibialis var. nov.

Two males differ from the type in having all the tibiae reddish on basal half. They are from Chain Bridge, Va.

*Type:* M. C. Z. 10034.

Dioctria media sp. nov.

Black, face golden, mystax black, thorax and abdomen more hairy than in *D. albius*, thorax reddish pollinose much as in *D. albius*; the third antennal joint and the style about as in *D. albius*; the body shorter than in *D. albius*; the male genitalia have the superior plate a slender, finger-like projection, about four times as long as broad, with parallel sides and undivided; the lateral arms of the genitalia are very much shorter and heavier than in either *D. albius* or *D. brevis*. Length 7 to 8 mm.

Five specimens from Sonoma County, Calif., 4 July (Osten Sacken), San Raphael, Calif. (Osten Sacken) and California (H. Edwards). These were doubtfully referred to *D. albius* by Osten Sacken, but the male genitalia show them to be very distinct.

*Type:* M. C. Z. 10037.

Dioctria pleuralis sp. nov.

Black, face golden to white, mystax pale; third joint of the antennæ very long, the style about one-fourth of the third joint; vertex shining, the thorax with mostly yellowish hairs. On the pleura.
from base of wings to front coxae is a yellowish pollinose stripe. Legs all pale yellowish, the hind basitarsus very large, as long as the next three joints together; the mesothorax has the hind lateral pieces yellowish, and the metathorax is golden pollinose; abdomen dull rufous, with indistinct black on each segment, mostly near the middle, first segment wholly black. Wings moderately fumose. Length, 8 mm.

One female from Los Angeles, Calif. (Clark coll.).

Differs from D. rubidus in the pale coxae, and shape of style, from D. pusio in color of the abdomen and thorax, and the shape of the style.

_Type:_ M. C. Z. 10035.

**Dioctria flavipes** sp. nov.

Runs to no. 6 in Back's table. The legs wholly pale yellow (including coxae); the mystax pale; the abdomen black, largely reddish below; the second segment has a reddish spot on the sides in front, hardly seen from above, the third segment has a basal reddish band, the fourth segment with both basal and apical bands of reddish, the fifth and sixth segments with reddish at tip. The hind basitarsus is large, and as long as the next three joints together; the body has few, short hairs. Length 6 mm.

One ♀ from Yakima, Washington, 2 July 1882 (Samuel Henshaw coll.).

_Type:_ M. C. Z. 10036.

**Dioctria sackeni** Will.

The specimen from the White Mountains referred to by Williston in the Osten Sacken coll. is a male and has the genitalia similar to those of _albicus_, but the parts are close together and may differ in details not clearly visible in this specimen.
NEW SOCIAL BEES.

By T. D. A. Cockerell,
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A close study of the Neotropical social bees of the genera Melipona and Trigona brings out the fact that there are numerous local races or subspecies, such as may be found among the ants. Most of the new forms coming to light are so closely related to others previously described, that it becomes a matter of convenience or opinion whether to regard them as distinct but closely related species, or races of aggregate species. Two or more of these closely related forms may occupy the same general region, and on the other hand, any one of them may extend over an enormous territory. They do not seem to be closely related to any special environmental factors, but they do follow the lines of general variation in the group, showing greater or less intensity of color or extension of color-pattern. They are practically constant in any one lot, and we do not find much miscellaneous individual variation. All this so closely parallels the condition among the ants, that we naturally look for a common cause or factor, which can only be the social mode of life, with continual inbreeding. In both groups, it is probably rare for individuals to mate with others than members of their own colony. Following up this idea, we note a similarity between the relationship of the different forms and that to be observed between these occupying a series of small islands; e.g., the birds of the Lesser Antilles, or the rats of the small islands of the Malay Archipelago. Continual inbreeding within a limited group or area will lead to homozygosity, and small differences in the original constituents may appreciably affect the end result. An occasional cross between stable races thus established will break up the combinations and furnish material for a series of new types.

It must be said, however, that in Bombus we do not observe the same state of affairs. The species of Bombus are notoriously variable in color, and the varieties are largely local, but they are also largely individual. InBombus, if I rightly understand the facts, the odoriferous males assemble from various nests, and do not necessarily or perhaps more than frequently mate with members of their own colony. If this is true, we can see why there is
more miscellaneous variation in *Bombus*, and less tendency to produce a series of slightly different yet constant races.

Although we cannot discern any obvious connection, at least of an adaptive nature, between the color-variations of all these genera and the environment, it does not follow that no relation of any sort exists. In *Bombus*, at least, there are some very remarkable cases of parallel variation in particular regions. This subject has been dealt with at length by Friese and Wagner, and O. Vogt, and Sladen gives a summary of some of the more important facts in his work "The Humble-Bee," p. 148. A most striking case is described below; the beautiful black, white and red colors of *Bombus terrestris simlaënsis* are duplicated by those of *B. niveatus callophenax* from the same region, though structurally the bees are quite distinct. It is beyond belief that all these cases of parallel color variation are accidental, depending on no common cause. There may be Müllerian mimicry involved, but the whole subject appears to need further investigation. It is not impossible that in some cases the coloration really indicates relationship, and that the structural characters have varied. We always tend to assume that structure is far more permanent than color or marking, but fossil insects show the enormous antiquity of color-patterns. In the quite numerous cases in which bees resemble in color and pattern species of quite other genera, or even wasps, it is manifest that the colorational similarity is secondary, and not due to common descent from insects so colored.

**Bombus terrestris simlaënsis** Friese

*Female:* Kashmir, 9,000 ft., June 1911 (R. L. Woglum). This has the relatively short malar space of *B. terrestris*, as also has a worker of *B. terrestris fulrocinetus* Friese, from Simla, which was labelled *B. tunicatus* Smith in F. Smith's collection. Meade-Waldo has recently referred *B. tunicatus* Smith as a variety to *B. lapidarius*; but the specimen before me, from Smith's collection, has rather the structure of *terrestris*. The type locality of *tunicatus* is Chusan, China. According to Meade-Waldo, *B. gilgitensis* Cockerell is also a variety of *B. lapidarius*, but the form of the malar space seems to ally it rather with *B. terrestris*. *Bombus incertus* Morawitz, which I have from A. Skorikov, is said by Meade-Waldo to be the same as *tunicatus*; it has the structure of *lapidarius*, not
that of *terrestris*. The indications are that Smith mixed two species under *tunicatus*, which explains the discrepancy referred to above.

**Bombus niveatus callophenax** subsp. nov.

*Female:* Length about 19 mm.; exactly like *B. terrestris similäensis* in color and appearance, except that it is considerably less robust, but easily separated by the third antennal joint, which is about three times as long as fourth, longer than fourth and fifth, but not quite equal to 4–6; also by the much longer malar space, which is fully 1.5 times its apical width. From typical *B. niveatus* (which I have from A. Skorikov) it is known by the white and black hair on the second abdominal segment being arranged as in *similäensis*, the lower edge of the white strongly curved, not reaching hind margin of segment. The surface of the clypeus is more polished and less punctured than in *niveatus*. It differs from *B. gilgitensis* at once in the malar space, the distinctly though delicately punctate apical segment of abdomen, the white hair of scutellum not mixed with black, and venter of abdomen without fulvoferruginous hair. The apical abdominal segment has scanty black hair (it is red in *niveatus*), and the wings are dark reddish, much darker than in *niveatus*. From *B. incertus* it is easily known by the antennae. Kashmir (*R. L. Woglum*). U. S. Nat. Museum. Perhaps a distinct species, to be called *Bombus callophenax*.

**Trigona mirandula** sp. nov.

*Worker:* Length about 5 mm., rather robust, shining; head large, broader than thorax, but facial quadrangle considerably longer than broad; mandibles without teeth, basal half yellow, apical red; labrum yellowish; cheeks pale yellow suffused with red; malar space obsolete; clypeus ferruginous, the lower margin pale yellow; supraclypeal area and lower half of middle of front pale reddish, but sides of face almost to summit of eyes with extremely broad pale yellow bands; upper half of front black, with a median yellow line; vertex black; scape light ferruginous, darkened at apex; flagellum dark above, reddish beneath; mesothorax black, with narrow lateral margins, which extend to axillae; rest of thorax clear red; legs red, hind tibiae longitudinally divided red and black, the black extending right across apically; hind basitarsi largely dark; hind tibiae broad, but not extremely so, the fringing hairs pale red;
hind basitarsi ordinary; tegulae pale reddish; wings grey, stigma and nervures dusky reddish, not dark; abdomen red, each segment with a rather broad black band, the whole coloration rather dark and obscure, but shining.


**Trigona beccarii jombenensis** subsp. nov.

*Worker:* Like *T. beccarii* Gribodo, except that there is more light color on scape, and the clypeus is yellow, with a narrow black band along anterior margin, and a pair of oblique reddish marks above.


**Trigona curriei** sp. nov.

*Worker:* Length about 3 mm., robust, black; head large and quadrate; mandibles and base of scape red; clypeus with a median groove; whole body polished and shining; cheeks very broad; tegulae fuscous; wings dilute brownish, stigma pale with a dusky margin; legs obscurely reddish; abdomen short and broad, the first segment very obscurely more or less reddish. Related to *T. magrettii* Friese, but easily separated by the brownish wings. The head also is quite broad.


**Trigona musarum** sp. nov.

*Worker:* Length about 6 mm., robust, clear reddish-fulvous, with little hair; head large, but facial quadrangle longer than broad; clypeus and sides of face suffusedly yellowish; mandibles dusky at apex, of the simple type, with a small tooth at inner corner; malar space well developed; face and front shining; vertex with fuscous hair; scape long and slender, yellow, with a dark mark posteriorly above; flagellum piecous above, ferruginous beneath; thorax above polished and shining, with thin brown hair; meso-thorax rather obscurely spotted with fuscous, the lateral margins and axillae obscurely yellow; tegulae large, light fulvous; wings dilute grey, stigma slender; legs entirely fulvous, anterior and mid-
dle ones with concolorous hair; hind tibiae extremely broad, hind margin with dark hairs; hind basitarsi broad, the outer apical angle produced as a broadly rounded lobe; abdomen broad, shining, the apical part suffusedly dusky.

Type: From "Philadelphia Banana R.," Costa Rica (F. Knab). U. S. Nat. Museum. Also from Boqueron River, Panama, May, 1907 (Aug. Busck). The name given is from Musa, the banana. Differs from T. mellea Smith and T. pallida Latr. by the broad hind tibia and quite differently shaped basitarsus. From T. mellicolor Packard (which M. A. Carriker has taken at Pozo Azul, Costa Rica), it differs at once by the shape of the head. T. mellicolor is a member of "coccofago" group, and has an extremely broad head; while the metathorax is black, with a transverse testaceous patch.

Trigona salvatoris sp. nov. (tataira subsp.?)

Worker: Length 5–5\(\frac{1}{2}\) mm.; closely allied to T. mediorufa (Cockerell), with the same black and red pattern of mesothorax, but differing thus: head black (faintly reddish), the clypeus dull yellow with two dark marks, a pale spot behind lower end of eye (in immature specimens the whole head dusky reddish); scape dark reddish; posterior half of abdomen suffusedly dusky.


These bees of the "coccofago" group, with their very broad heads and remarkable habits, may be regarded as a distinct subgenus (Oxytrigona subg. n.), with mediorufa as the type. T. mediorufa was described as a subspecies of T. flaveola Friese, but the latter name cannot stand, as there is an earlier T. flaveola Spinola. It is assumed that T. coccofago or cagafogo (the name is variously spelled) is identical with T. tataira Smith; in fact "tataira" is the popular name of the bee. When making comparisons in Psyche, 1913, p. 13, I neglected to note that my cotype tataira was a male, and that the name was founded by Smith on males alone. It seems probable that we shall have to recognize a species T. tataira, with various races, as follows:

Trigona tataira Smith.
Trigona tataira friesiella n. n. (flaveola Friese).
Trigona tataira mediolora (Ckll.).
Trigona tataira salvatoris (Ckll.).

T. mellicolor Pack. should apparently be kept distinct. The question whether to regard all these bees as species, or group them as races of an aggregate species, must be decided largely on grounds of convenience. The case is parallel to those frequently observed among ants.

**Trigona perangulata** sp. nov. (*claripes* subsp.?)

**Worker:** Length about 7 mm., slender; very close to *T. clavipes* Fabr., differing thus: lateral face-marks coming up to level of top of clypeus; legs clear red, with trochanters yellow on outer side, anterior and middle femora yellowish above apically, middle basitarsi with most of posterior half black, hind tibiae broadly black posteriorly on apical half (this black area anteriorly with a large round lobe), hind basitarsi largely blackened; abdomen with four black bands, the first divided in middle by a cuneate paler area, the others angularly pointed in middle cephalad, and correspondingly notched caudad.

**Type:** From Alhajuelo, Panama (Canal Zone), May 27, 1912 (A. Busck). U. S. Nat. Museum. Also from Pozo Azul, Costa Rica, June 15, 1902 (M. A. Carriker).

**Trigona pachysoma** sp. nov. (*postica* subsp.?)

**Worker:** Length about 6 mm., very broad and robust, with short abdomen. Very close to *T. postica* Lat. (Prov. Sara, Dep. Sta. Cruz de la Sierra, Bolivia, 500 m., J. Steinbach), but with an obscure red spot on each side of face, wings strongly suffused with orange, nervures and stigma clear ferruginous, fifth abdominal segment without evident pale hair-patches. Compared with *T. bipunctata* Lep. (from F. Smith's collection) it is more robust, with more highly colored wings; the facial spots in *bipunctata* are dull white.

**Type:** From Porto Bello, Panama, April 20, 1912 (A. Busck). Also from Culebra, Canal Zone, 1910 (H. H. Rousseau). These insects have strong grooves on the mesothorax, which are lacking in the superficially similar *T. branneri* Ckll. In *T. branneri* the abdomen is dorsally polished and shining all over; in *T. pachysoma* dull, the bases of the segments shining. My *T. postica* is from the
Berlin Museum, and was determined by Strand. Specimens from S. Paulo, determined as *postica* by Friese, are another species, having the tubercles tipped with yellow, and the abdomen beyond second segment covered with fulvous hair.

**Trigona nitidula** sp. nov. (*frontalis* subsp.?)

*Male:* Length about 4 mm.; closely resembling *T. frontalis* Friese, but the wings are quite clear (not greyish), and the nervures and stigma are dull testaceous; the abdomen is entirely dark. Eyes red; orbits converging below; clypeus, labrum, supraclypeal area and lateral face-marks yellow; mandibles yellow; scape yellow in front. Thorax shining black, with narrow lateral margins of mesothorax, axilae and hind margin of scutellum cream-color.

Tucuman, Argentine, December 26, 1912 (*A. H. Rosenfeld and T. C. Barber*). U. S. Nat. Museum. The types of *T. frontalis* came from Honduras, whence are also specimens in the U. S. National Museum, received from Friese. A related but larger species is *T. remota* Holmg., which I have from S. Paulo, Brazil. Also of this group is *T. molesta* Puls, of which I have seen specimens from S. Paulo and Blumenau, determined by Friese.

**Trigona opaca** sp. nov. (*lineata* subsp.?)

*Male:* Length about 5 mm.; black, the front, long mesothorax and large scutellum dull; band on prothorax (interrupted in middle), lateral margins of mesothorax, continuing on axilae and round margin of scutellum, as well as a large mark on tubercles, from which a line proceeds anteriorly, all clear yellow; clypeus (except two light brownish bars on disc), mandibles, supraclypeal mark (separated by a line from clypeus) and narrow bands along inner orbits to not far from top, all pale yellow; labrum dark brown, with a pale dot at each side; malar space small; eyes red; scape yellow in front; flagellum black, obscure red beneath; anterior and middle tibiae light yellow on outer side, hind tibiae with a broad light yellow band behind; tarsi rufofuscous; tegulae rufofuscous, with a minute pale dot; wings greyish, with a pale yellow spot at base, just behind tegulae, stigma and stronger nervures piceous; abdomen dullish, without markings, whole insect almost hairless, looking like a *Prosopis*.

Tabernilla, Canal Zone, Panama, July, 1907 (*A. Busck*). Very
near to *T. lineata* Lep., but with yellow markings, and apparently distinct. Unfortunately, I do not know the male of *lineata*; and even R. du Buysson, who had a nest full of *lineata*, found no males. There is a good deal of confusion as to what *T. lineata* really is. The species I accept as such (from Brazil) is that called *lineata* by Friese. Baker and Ashmead formerly identified as *lineata* Mexican specimens of *T. frontalis flavocincta* Ckll., an insect easily separated by the shining mesothorax. Ducke stated in 1910 that *T. bilineata* Say was the same as *lineata*; but what I have regarded as *bilineata* (e.g. from Mexico, D. F., J. R. Inda) is extremely close to *T. bipunctata* Lep., agreeing in the light patches at sides of face. The clypeus of *bilineata*, as thus interpreted, is highly polished; that of *bipunctata* dullish.

**Trigona atomaria** sp. nov.

*Worker:* Length about 3 mm.; yellow, including antennæ; face and front without markings, but vertex with a transverse dark band enclosing ocelli; metathorax dorsally pure black; legs yellow, hind tibiae (which are not unusually broad) with hind and apical margins on outer side broadly brown, hind basitarsi, brown on outer side; tegulae pale testaceous; wings clear hyaline, nervures and stigma pallid; stigma large, with a dusky margin; abdomen with black bands on hind margins of segments. Head ordinary, abdomen broad.

Pozo Azul, Costa Rica, June 15, 1902 (M. A. Carriker). A singular little species, not close to any other. It may perhaps be compared with *T. goeldiana* Friese, from Pará, but the markings are wholly different.

**Trigona ferricauda** sp. nov.

*Worker:* Length about 5.5 mm., with long and ample wings; head large but of ordinary shape, black, with clypeus, supraclypeal area and lower corners of face (the last obscurely) ferruginous; sides of face and cheeks with a dense pale (olivaceous on cheeks) pruinose pubescence; front and vertex smooth and shining; mandibles ferruginous, strongly quadridentate, with also a minute tooth between third and fourth, the teeth black; malar space short; scape light rufotestaceous, black above at apex; flagellum black above, rufotestaceous beneath, last joint bright red above
and below; thorax rufotulus, with pale hair; mesothorax shining, black with narrow red lateral and hind margins; mesopleura with a large black spot below; middle of mesothorax shining, distinctly darkened, sides densely ochreous-pruinose; tegulae pale rufotestaceous; wings greyish; stigma slender, dull pale yellowish; legs entirely clear ferruginous, hind tibiae relatively narrow, the fringe on hind margin long and red; hind basitarsi nearly parallel-sided; abdomen rather narrow, entirely shining ferruginous.

Porto Bello, Panama, April 18, 1912 \( (A. \text{Busck}) \). Related to \( T. \text{braueri} \) Friese, from Brazil, but readily separated by the black mesothorax. There is a strong superficial resemblance to \( T. \text{dorsalis} \) Smith, which occurs at Alhajuelo, Panama \( (\text{Busck}) \), Guapiles, Costa Rica \( (\text{Crawford}) \) and Secanquin, Guatemala \( (\text{G. P. Goll}) \).

SYNOPTIC KEYS TO THE LYGEIDE.I.E (HEMIPTERA) OF THE UNITED STATES.

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PART I.

Several months ago I was requested by Dr. W. E. Britton of the Connecticut Agricultural Experiment Station to prepare a list of the Lygeidae occurring in Connecticut, with suitable keys, for the proposed list of Hemiptera of the state. As a basis for this work I found it necessary to construct synoptic keys of all of the subfamilies, tribes and genera for the entire United States. As so much time and study has been spent in their preparation, and as no such keys covering this family, restricted to our fauna, has ever been published, it seems advisable to publish these in the hope that they may be of service in solving some of the difficulties experienced by systematists in this troublesome group. Professor Gregory, superintendent of the Connecticut Geological and Natural History Survey, and Dr. Britton have kindly given their consent to this publication in advance of the appearance of such parts as apply only to New England Lygeidae.

I have used as a basis for these keys Stal’s “Genera Lygeidarum
Europeæ," Off. Vet.-Akad. Förh., 1872, and Enumeratio Hemipterorum, Part 4, 1874. As Van Duzee's excellent "Check List of the Hemiptera of the United States," recently published, will be used for reference I have adopted his system of nomenclature and order of arrangement. However, I have found it necessary to transfer the genus Orsillacis Barb. to the Tribe Lygeini. Part II will include the Subfamily Rhyparochrominae or Aphaninae.

I desire to express my appreciation to Dr. W. E. Britton, who makes the publication of these keys possible and to Mr. H. M. Parshley of Bussey Institution, who has suggested some important changes in my keys.

Key to the Subfamilies of Lygaeidae.

A. All sutures between the ventral segments of the abdomen straight and reaching the lateral margins on each side. Head commonly without setæ near the eyes.

B. All of the abdominal spiracles situated dorsally. Entire posterior margin of the pronotum, or at least the margin before the scutellum, turned down convexly. Fore femora, compared to the succeeding pairs, not much swollen and rarely armed beneath with teeth or spines.

C. Posterior margin of the pronotum between scutellum and lateral angles more or less distinctly depressed or impressed. Hemielytra, also usually the head, pronotum and scutellum impunctate. The two interior veins of the membrane commonly joined together near base by a transverse vein. Lygaeinae Stal.

CC. Posterior margin of the pronotum between the scutellum and lateral angles not distinctly depressed or impressed. Hemielytra, head, pronotum and scutellum distinctly punctate. The two interior veins of the membrane not joined together near base by a cross vein. Cyminae Stal.

BB. All of the abdominal spiracles not situated dorsally, at least those of the sixth placed on the venter. Posterior margin of the pronotum, at least before the scutellum, commonly not turned down convexly. Fore femora, as compared with the succeeding pairs, more or less shortened and swollen, armed or unarmed.
D. All of the abdominal spiracles not situated ventrally, at most only the three apical ones so placed. The anterior femora moderately incrassate and commonly unarmed (except some species of Ischnodemus).

E. Head always narrower than the posterior margin of the pronotum; tyulus not sulcate. Hemielytra not convex and almost if not quite impunctate; clavus not narrowing posteriorly; commissure distinct, at least half as long as scutellum. Fore femora sometimes much swollen (Ischnodemus)

Blissinae Stal.

EE. Head, across eyes, very broad, as wide as or wider than the posterior margin of the pronotum. Tyulus usually sulcate. Hemielytra convex and plainly punctate; clavus commonly narrowing posteriorly; commissure usually absent or very short. Fore femora moderately incrassate and unarmed

Geocorinae Stal.

DD. All of the abdominal spiracles situated ventrally. Anterior femora more or less swollen and armed with one or more spines.

F. The anterior femora much swollen and armed beneath with one or more teeth. Exterior vein of corium not parallel with margin. Corium not wider than abdomen. Buccule short, confined to front of head. Posterior coxae not widely separated.

G. Membrane with the two interior veins connected anteriorly by transverse veins. Posterior margin of pronotum very concave before scutellum. Fore femora not armed with numerous teeth

Heterogastrinae Stal.
GG. Membrane with the two interior veins not connected anteriorly by a transverse vein; all veins running from the base, sometimes posteriorly reticulate. Posterior margin of the pronotum straight before the scutellum. Fore femora much swollen and armed with numerous teeth

*Pachygronthinae* Stal.

FF. The anterior femora not so incrassate as in the preceding and armed with a single tooth. Corium expanded, wider than abdomen; exterior vein sub-parallel with margin of corium. Buculae extended through the head. Antennae inserted close to bucculae. Posterior coxae widely separated. . . . *Oxycaerinesis* Stal.

AA. The suture between the third and fourth ventral segments of the abdomen most commonly curved anteriorly and not reaching the lateral margins. Head commonly provided with two setae near eyes. Fore femora swollen and armed with teeth

*Rhyparochrominae* Stal.

Key to the Tribes and Genera of the Subfamily Lygaeinae.

A. Apical margin of the corium straight, not sinuate inwardly. Exterior apical angles of antenniferous tubercles obtuse or sub-obtuse. Last dorsal segment of the male truncate. Genital segment of the males not foveate. . . . Tribe *Lygaeini* Stal.

B. Basal segment of antennae just surpassing the apex of the tylus. Rostrum not extending beyond the first segment of the abdomen. Head short and broad.

C. Posterior margin of pronotum before scutellum sinuate; carinate anteriorly in the middle. Scutellum more or less tumid and carinate apically

*Oncopeltus* Stal.

CC. Posterior margin of pronotum truncate; without a median keel or with keel not reaching the anterior margin. Scutellum not tumid, with a longitudinal keel, commonly joined to a transverse keel at base.

*Lygaeus* Fab.
BB. Basal segment of the antennæ not reaching apex of tylus. Rostrum extending to the middle of the venter. Head longer than broad. 

AA. Apical margin of corium inwardly sinuate. Scutellum near base with a more or less distinct transverse ridge; base before this depressed; longitudinally carinate behind ridge. Apical angle of the antenniferous tubercles prominent, acute or subacute. Sixth dorsal segment of the male rounded. Genital segment of male foveate. Tribe Orsillini Stal.

D. Basal segment of antennæ surpassing apex of tylus. Head moderately elongate. Rostrum short, its apex scarcely reaching upon the abdomen.

E. Costal margins of hemielytra straight throughout, parallel or converging posteriorly. Eyes prominent, the exposed area back of eyes greater than half of the width of the eyes. Bucculae less than half the length of gular area. Apex of orifices exteriorly, prominently auriculate Tribe Ortholomus Stal.

EE. Costal margin of the corium straight only at the base, if at all. Eyes not so prominent. Bucculae variable. Apex of orifices suddenly abbreviated, rarely subauriculate Tribe Nysius Dall.

DD. Basal segment of antennæ not reaching apex of tylus. Head much elongated. Rostrum long, reaching to or beyond the middle of the venter Tribe Belonochilus Uhl.

Key to the Tribes and Genera of the Subfamily Cymicina.

A. Head without a curved longitudinal sulcus before each ocellus; apical angle of antenniferous tubercles not prominent. Basal segment of antennæ surpassing apex of tylus; fourth segment of antennæ longer than third. Scutellum equilateral with the claval commissure shorter than scutellum. Hemiylera hyaline, provided with few punctures. Orifices exteriorly extended and produced into a tooth at apex. Tribe Ischnorrhynchini Stal.

B. Head porrect, not abruptly deflexed in front. Eyes nearly
in contact with front margin of pronotum. Width of head across eyes not much more than half the width of posterior margin of pronotum. Sides of clavus parallel. Costal margin of corium convexly arcuated. *Ischnorrhyncus* Fieb.

**BB.** Head deflexed in front, almost vertical. Eyes distant from the anterior margin of pronotum; tumid back of eyes. Width of head across eyes subequal to width of posterior margin of pronotum. Clavus posteriorly widened. Costal margin of corium concave towards base. *Ninus* Stal.

**AA.** Head with a curved longitudinal sulcus before each ocellus. Apical angles of the antenniferous tubercles prominent, acute. Basal segment of the antennae not surpassing the apex of the tylus; fourth segment shorter than third. Scutellum broader than long. Clavus widened posteriorly. Commissure much longer than scutellum. Hemielytra not hyaline, strongly and densely punctate. *Tribe Cymini* Stal.

**C.** Tylus considerably produced before the buccula. Rostrum shorter, scarcely reaching middle of mesosternum; second segment extending a little behind anterior margin of prosternum. Mesosternum distinctly grooved. *Arphnus* Stal.

**CC.** Tylus not at all or very slightly extended beyond the buccula. Rostrum longer, extending to or behind the intermediate coxae; second segment usually reaching anterior coxae. Mesosternum not distinctly grooved. *Cyamus* Hahn.

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**Key to the Genera of the Subfamily Blissinae.**

**A.** Body elongate; abdomen over twice as long as head and thorax together. Apical margin of corium straight. Anterior coxal cavities closed behind, along the posterior margin of the prosternum. Antennae longer than head, thorax and scutellum together. Rostrum relatively shorter, its apex not reaching past the middle coxae. Scutellum subequilateral. *Ischnodcins* Fieb.

**AA.** Body shorter; abdomen less than twice as long as head and thorax together. Apical margin of corium not straight but sinuate before apex of clavus. Coxal cavities open along the posterior margin of the prosternum. Width of head across
eyes about one half the diameter of the posterior margin of the prothorax. Antennæ about as long as head, thorax and scutellum together. Rostrum longer, reaching past the middle coxae. Scutellum broader than long. ................ Blissus Burm.

Key to the Genera of the Subfamily Geocorinæ.

A. Head extended laterally, eyes obviously stalked; inner margins of the eyes strongly converging throughout; the eyes not in contact with the anterior lateral margins of the pronotum. The first segment of the rostrum shorter than the second or subequal to it. Ocelli commonly placed midway between the inner margin of the eye and the middle of the vertex. Head smooth, impunctate. .................. Isthmocoris McAtee.

AA. Eyes not obviously pedunculate or stalked and commonly contiguous to the anterior lateral margins of the pronotum; inner margins, at least anteriorly, more commonly subparallel. Head, commonly, more or less punctate. Ocelli in most cases placed closer to the inner margin of the eyes than to middle point of the vertex (except in punctipes Stal and flavilineis Stal). The first segment of the rostrum longer than the second

Geocoris Fallen.

Subfamily Heterogastrinæ.

Body oblong. Lateral margins of pronotum lightly marginate; posterior margin strongly concave. Anterior femora armed toward apex with a tooth or spine. .................. Heterogaster Schill.

Key to the Genera of the Subfamily Pachygronthinæ.

A. Antennæ short; first segment shortest of all, not attaining apex of head and not clavate at apex; second segment more than twice as long as basal segment. Head strongly deflexed from base; exterior margins of the jugæ not elevated to form a ridge. Scutellum subequilateral, not at all calloused near basal angles. Apical margin of corium toward apex of clavus more or less sinuate, and at outer apical angle obviously rounded. First tarsal segment of the hind legs short, about as long as the second and third taken together. ................. Phlegyas Stal.

AA. Antennæ longer; first joint longest of all, far surpassing apex of head and clavate or swollen at apex. Head not strongly deflexed; exterior margins of lateral lobes (jugæ) of the head
ridged. Scutellum usually longer than wide and with a smooth calloused area near basal angles. Apical margin of corium straight and outer apical angle subacute. First tarsal segment of hind legs longer than second and third together.

B. Scutellum without a median longitudinal, pale, smooth line

BB. Scutellum with a median, longitudinal, pale, smooth line

\[ \text{Eduncala A. and S.} \]

\[ \text{Pachygrontha Germ.} \]

Key to the Genera of the Subfamily Oxycareninae.

A. Veins of corium and membrane evident. The corium coarsely but sparingly punctate. Head, pronotum and hemicelytra without fine erect hairs. Head, pronotum, scutellum and body beneath not polished. \[ \text{Crophius Stal.} \]

AA. Veins of corium and membrane not evident. The general surface of the corium impunctate. Head, pronotum and hemicelytra with fine erect hairs. Head, pronotum, scutellum and body beneath polished. \[ \text{Dyecoderus Uhl.} \]
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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: Psyche, Vol. IX, No. 300 (April, 1901). Address, giving price, Librarian, Stanford University, Cal.

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Wanted: Transactions American Entomological Soc., Vol. 4; Entomological News, Vol. 2, Nos. 6 and 10; Vol. 8, Nos. 1 and 6; Vol. 9, Nos. 1 and 2; Vol. 10, No. 10; Vol. 11, Nos. 1, 3 and 5. Will purchase at reasonable price.—Howard L. Clark, P. O. Box 1142, Providence, R. I.

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Would appreciate receiving date, stage and mode of hibernation of insects of all orders. J. P. Baumberger, Bussey Institution, Forest Hills, Boston, Mass.


Wanted: Insects of the family Embiidæ (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.
CONTENTS.


Notes on the Habits of the Snow-Fly (Chionea).  *Werner Marchand*  . 142


Notes on Tingidæ.  *Herbert Osborn and Carl J. Drake*  . 155

Book Review.  *E. P. Felt*  . 161

Note of Correction (Hemiptera).  *H. M. Parshley*  . 164

Exchange Column.  . 165
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<td>3.50</td>
<td>5.80</td>
<td>5.50</td>
<td>7.80</td>
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<td>9-12</td>
<td>4.25</td>
<td>7.05</td>
<td>6.25</td>
<td>9.05</td>
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<tr>
<td>13-16</td>
<td>4.75</td>
<td>7.90</td>
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FIVE NEW SPECIES OF NORTH AMERICAN TACHINIDÆ.

By Harrison E. Smith,


Following are the descriptions of five new species of Tachinidæ from North America. The writer wishes to acknowledge his indebtedness to Dr. C. H. T. Townsend, who has very kindly compared the following described species with material in the collection of the U. S. National Museum, and assisted the writer in many other ways with this difficult family of insects.

Pilatea unicolor sp. nov.

Length 6–8 mm. Black, brassy gray pollinose.

Front in male about three-fifths, in female about one and one-fourth to one and one-half times as wide as either eye. Frontal vitta opaque black, not as wide as either side of front. Diameter of head at vibrissæ less than at base of antennæ. Vibrissæ on the oral margin, facial ridges bristly on the lowest fourth to one-third. Proboscis short and fleshy, palpi normal, yellow. Ocellar bristles strong, proelinate; two pairs of orbital bristles present in the female, absent in male. Frontals arranged in a single row, descending to base of third antennal joint, outside of these a few bristly hairs. Parafacials and sides of front uniformly brassy gray pollinose. Antennæ black, nearly as long as face, the third joint in male three to three and one-half times as long as, in female about three times as long as the second. Arista thickened on the basal third, the penultimate joint as broad as long. Sides of face about one-sixth as wide as the facial depression, cheek width approximately one-seventh the eye height.

Thorax as viewed from the rear, marked with five black vittæ. Dorso-centrals three, sternopleurals three. Scutellum bearing a
discal pair, three pairs of long marginals and a weak pair of cruciate apical macrochaetae. Legs black, front pulvilli in male about as long as the last tarsal joint. Middle tibiae each bearing a single strong bristle on the outer front side near the middle, hind tibiae pectinate with a row of bristles of unequal length.

Abdomen bearing discal and marginal macrochaetae. Apical cell open, ending in costa a little before the extreme wing tip. Hind cross-vein nearer to bend of the fourth longitudinal than to the small cross-vein, the third longitudinal vein bearing two or three bristly hairs at its base. Wings except lower margins, usually wholly smoky tinged, or sub-hyaline. Tegulae usually yellowish white, with a blending smoky tinge in males.

Described from three males and seven females. One taken by the author at Melrose, Mass., the remainder taken by Mr. C. W. Johnson at Glen House, N. H., Orr’s Island, Me., Chester and Auburndale, Mass., and Middletown, Conn.

Holotype (male) and allotype (female) in collection of the Boston Society of Natural History.

Pilatea ruficornis sp. nov.

Differs from the preceding species, as follows: Length 12 mm. Black, gray pollinose species.

Parafroitals and sides of face rich golden yellow pollinose. Frontal vitta opaque velvety brown, at middle wider than either side of front. Antennæ except apical portion of the third joint yellow, arista thickened on the basal third. Facial ridges bristly on the lowest fifth. Dorso-central four, sternopleurals three. Middle tibiae each bearing two strong macrochaetae on the outer front side near the middle. Wings sub-hyaline, veins brown, the third longitudinal vein bearing two bristles at its base. Tegulae milky white, bordered with yellow around the edges.

Described from a female specimen taken by Mr. S. A. Shaw, at Hampton, N. H., July 25, 1903. Holotype placed in the collection of the Boston Society of Natural History.

The two species above described are evidently congeneric with Coquillett’s Masicera celer recently designated the genotype of Pilatea Towns.2

1Rev. N. Amer. Tach., 1897, p. 114.
Spathimeigenia nigriventris sp. nov.

Length 7 mm. Black, grayish pollinose species.

**Female:** Front as wide as either eye, frontal vitta opaque dark velvety brown, parafrontals and sides of face gray pollinose. Frontal bristles in a single row, descending to base of third antennal joint, outside of these two pairs of orbital bristles. Eyes bare, ocellar bristles strong proclinate, weak bristly hairs on parafacials not regularly disposed. Antennæ black, the third joint three times as long as the second, arista thickened on the basal two-fifths, the penultimate joint as broad as long. Vibrissæ on an approximate level with the front edge of the oral margin, the facial ridges bristly on about the lower half. Cheeks about one-seventh the eye height, proboscis short and fleshy, palpi normal, yellow.

Thorax, pleurae and coxae black, grayish pollinose. As viewed from behind, the outer thoracic vittæ, anterior to the transverse suture, are approximately five times as wide as the two inner vittæ. Dorso-centrals three, sternopleurals three, the lowest of which is considerably weaker. Abdomen shining black, segments two to four gray pollinose on about the basal three-fifths, bearing marginal macrochaetae only. Venter distinctly carinate and bearing rather long bristly spines, a piercing ovipositor present. Scute lum bearing a short discal pair, three pairs of long marginals and a short weak pair of apical macrochaetae. Legs black, the middle tibiae, each having a single stout macrochaeta on the outer front side near the middle. Hind tibiae pectinate with a row of bristles of irregular length.

Wings sub-hyaline, apical cell open, ending a little before the extreme wing tip. Third longitudinal vein bearing two bristles at its base, and a single bristle at inter-section of the small cross-vein. Tegulae whitish, faintly bordered with yellow.


Homœonychia rapæ sp. nov.

Length 7 mm. Head slightly wider than thorax, diameter of head at vibrissæ approximately as great as at base of antennæ. Eyes hairy, front one and one-third times as wide as either eye. Frontal vitta opaque velvety brown, slightly wider than either side of front. Ocellar bristles stout, proclinate; orbital bristles absent in male. Frontal bristles arranged in a single row, descend-
ing at least half-way down the sides of face, outside the frontal row to eye margin many scattered bristly hairs. Antennae black, five-sixths as long as face, the second joint very short, the third joint broad, oval, nearly two times as wide as long. Arista thickened on the basal three-fifths, the penultimate joint as broad as long. Vibrissae placed on about a level with the front edge of the oral margin, facial ridges bristly on the lowest two-fifths to one-half. Facial plate enlarged, three times as wide at its greatest width, as at base of antennae. Probiscis short and fleshy, palpi normal, black. Cheeks about two-fifths the eye height.

Thorax black, gray pollinose, marked with four narrow vittæ. Scutellum bearing a discal pair, three pairs of long marginals and a cruciate apical pair of macrochaetae. Middle tibiae bearing two stout macrochaetae on the outer front side near the middle. Hind tibiae sub-ciliate. Abdomen gray pollinose with a median black vitta, bearing discal and marginal macrochaetae. Sides of first three segments faintly reddish black, abdominal hairs sub-erect.

Wings hyaline, veins brown, apical cell open, ending in costa a little before wing tip. Posterior cross-vein sinuate, nearer to bend of fourth longitudinal vein than to the small cross-vein. Third longitudinal vein bearing two bristles at its base. Tegulae opaque milky white.

Described from a male specimen reared by Mr. R. T. Webber at the Gypsy Moth Parasite Laboratory, bred from *Pontia rapae* Linn., August 17, 1915.

Holotype, Cat. No. 21024. U. S. N. M.

*Aphrocorera montana* sp. nov.

Length 10–12 mm. Front in male about one and two-thirds, in female about two and one-fifth times as wide as either eye. Viewed from the side, the head projects in front of the eye about the horizontal diameter of the eye, frontal vitta opaque black. Frontal bristles disposed in a single row, descending a little below the arista, from the base of antennæ running obliquely to the eye margin. Sides of front bearing many bristly hairs, densely silvery gray pollinose, concolorous with parafacials. Ocellar bristles proclinate, two pairs of orbitalis present in the female, absent in male. Antennæ black, the third joint in male about three and one-half times as long as in female about two and one-half times
as long as the second. Arista thickened on approximately the basal half, the penultimate joint as broad as long. Eyes bare, cheeks nearly one-third as wide as the eye height. Facial ridges bristly on the lowest three to four-fifths, vibrissae strong, cruciate, on a level with the front edge of the oral margin. Proboscis short and fleshy, palpi black.

Thorax thinly gray pollinose, rather indistinctly vittate. Dorsocentrales three, sternopleurals three. Legs black, front pulvilli in male as long as the last tarsal joint. Middle tibiae bearing a row of four or five bristles on the outer front side. Hind tibiae pectinate with a row of bristles of unequal length. Scutellum black, sometimes a reddish tinge at the tip, bearing a weak discal pair, three pairs of long marginals and a shorter cruciate apical pair of macrochaetae.

Abdominal segments grayish pollinose on the basal margins, the first and second segments, each bearing a pair of marginal macrochaetae, the third segment a discal pair and a marginal row, the fourth segment bearing numerous macrochaetae and bristly hairs on the apical three-fifths. Hairs of abdomen numerous, long and erect.

Wings hyaline, apical cell open, ending well before the wing tip. Posterior cross-vein nearer to bend of fourth longitudinal vein than to small cross-vein, the third longitudinal vein bearing four or five bristles at its base. Tegulae milky white, narrowly bordered with yellow.

Described from one male and three females taken by Dr. R. R. Parker at Powderville, Montana, April 18–24, 1916. One female, Gallatin Co., Montana, April 26, 1902, taken by Mr. R. Benton.

Holotype (male) in collection of Montana State College.

Females of this species deposit an elongate oval, flattened white egg. Hence, if the species is referred to the proper genus, as I believe, Allophorocera Hendel is certainly not congeneric with Lydella Desv. Lydella nigripes Fall. the genotype of Lydella has a distinct ventral carina, piercing ovipositor and larviposits living larvae within the host, thus it appears that Allophorocera is a valid genus and not synonymous with Lydella, as stated by Mr. Coquillett.

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2 Essai Myod., 112, 1830.
NOTES ON THE HABITS OF THE SNOW-FLY (CHIONEA).

By Werner Marchand,
Department of Animal Pathology, The Rockefeller Institute for Medical Research, Princeton, New Jersey.

The interesting wingless Tipulid genus Chionea has often attracted the attention of entomologists because of its being one of the few insects which are found regularly at winter-time, being apparently quite at home on snow and at low temperatures. Also this genus is not without interest for the student of Parasitology, in so far as so many wingless species are found among the parasitic insects, the habits of which may be elucidated by a fuller knowledge of forms with similar characteristics.

The genus Chionea was described first by Dalman (1816), with the type-species C. araneoides, from Sweden. Later, the snow-flies have been reported from places in Scandinavia, Germany and Austria, Russia, Alsace, Switzerland and Italy; the early stages have been described by Brauer (1854), and have been found repeatedly since, being terrestrial in habit and occurring under decaying leaves in wooded regions. At first, these captures were all recorded under the heading of Chionea araneoides Dalm., but it appears that the true C. araneoides, together with a dark and thick-legged form, C. crassipes Boheman, occurs only in Scandinavia, Lapland and Finland, while the Chionea of Germany, Austria and part of Russia (with araneoides), belong to C. lutescens Lundstr., and those of the Swiss and Italian Alps to C. alpina Bezzi. The two last-mentioned species are nearly related to one another, more yellow in color, and differ from the Scandinavian forms chiefly by the antennae which are composed of a smaller number of joints, and bear longer hairs than in the northern species. Also considerable differences have been found in the arrangement and formation of the hairs on the legs.

In America, the species C. valga Harris, discovered in 1835 and described in 1841, has been found repeatedly since in New England (Emerton), Minnesota (Lugger), and Canada (Gosse). Interesting notes on its habits, especially on its copulation, we owe to Lugger (1896), who observed the species in Minnesota. According to Johnson (Psyche, 1907, p. 41–44), it is doubtful whether there is
more than one species of Chionea in North America, though several have been described, but Bezzi (1913) thinks that *C. scita* Walker must be regarded as a good species.

During a sojourn in Davos, Ct. Grisons, Switzerland, at an altitude of ca. 1560 m. (4,680 feet) above sea-level, I found occasion to observe these insects, which were entirely new to me. As I find that the peculiar hibernal habits of this and some other winter-insects are not yet clearly understood, the publication of my results, however fragmentary, may be of some interest.

The first specimen, a male, was found on November 21, 1913, at Luginsland, Davos-Dorf, on a warm, sunny day, when the snow on which a crust had already formed, was softened and partly melted at the surface; and large numbers of flies of the families Tipulidae (Trichocera), Simuliidae, Chironomidae (Diamesa, etc.), Mycetophilidae, Borboridae, Muscidae, etc., were found alive or half-frozen on the snow, having evidently escaped from their hibernation quarters, and fallen on the snow after a brief flight in the warm afternoon sunshine. A few Trichoptera (belonging to *Psilopteryx zimmeri*, a late fall species) and spiders were also collected. It was only when I had returned home and assorted the captures, that among the spiders the Chionea was discovered and its systematic position among the Tipulids readily ascertained with the aid of Huegenuin’s remarks on it. The specimen had, however, been killed together with the other material.

On November 24 at noon a new snow-fall set in, and a second specimen, a female, was found about 4 p.m. running over the fresh snow. This time, no other insects were seen on the snow. The locality of these captures was a comparatively dry, sunny slope of southeast exposure which in summer is covered with alpine meadows. There were no trees except a few groups of Larch-wood (larix), and low pines.

After it had been collected, this Chionea was carried about for several hours in a small glass bottle in my pocket. On my returning home, it was placed on a plate on which it started running about eagerly, attempting to climb up the margin. It was, however, invariably driven back when approached by the hand, which gave me the impression that it was the heat of the hand which caused it to change its course. A small piece of snow being placed on the plate, the Chionea at once climbed on it, pressing its pro-
boscis against it for a short while as if to drink, then running over it and going again on the plate. Attempting to escape, it was repeatedly driven back by the approaching hand. I noticed that my hands were rather warm. In fact, it did not stop when approached by my wife's hand which was cooler, and on which the insect would continue to run.

The specimen was kept alive and a cage constructed which permitted its observation. The cage consisted of a glass tray,

![Diagram of observation cage](image)

Fig. 1. Observation cage used in experiments with Chionea: a, general view of cage; b, same seen from above; #, habitual resting place of Chionea.

about one and one-half feet long, covered entirely with two glass covers, which could be replaced, wholly or in part, by wire-netting. After some experimenting, it was preferred to cover the whole with wire-netting, and in addition to this, to cover the short sides of the tray with the two pieces of glass, leaving an open space in the middle, covered only by wire-netting, as seen in the figures. The tray was, at first, half filled with sifted earth and half with snow in order to ascertain whether the insect would show a preference for one of these. It seemed equally at home on both and observations tended to show that Chionea is a true snow-insect, not a mere accidental one, as has been supposed by Emerton (see Johnson, *Psyche*, 1912, p. 102), and as all the other insects quoted above undoubtedly are.

The Chionea was placed on the border-line between snow and
earth. It went on the snow but soon passed over to the sifted earth without apparently showing any preference for either, the temperature being low; running for awhile over the earth on which, on account of its brownish color, it was hardly visible, it passed again on the snow and ran there approximately as long as it had on the earth. It then started, with some effort, to climb the glass walls of the cage, demonstrating the negative geotropism of most insects, and arrived on the wire-netting of the cover. In the arrangement described, it was found that the Chionea preferred the uncovered part of the wire-netting where the open air had access. Apparently it was seeking out the coldest spot available.

It was observed that each time when, in the course of running about on the wire-cover, it approached the part which was covered by a glass plate it stopped its straightforward course, running alongside the covered part and soon returned into the open region. Several times it went under the glass cover as if for trial, but never remained very long; while in the open region it would run about freely in various directions.

It was not ascertained with exactness how long the insect stayed in the covered nor how long in the open part, but the observations clearly show that the Chionea preferred the open region, which seemed to indicate that it found here its apparently very low optimum of temperature. The cage was exposed to the open air at not much above freezing temperature, in a glass veranda, the door of which was kept open.

It was found that this behavior of the Chionea was somewhat modified by the influence of light. On that side of cage which was in greater distance from the light, it went more often under the covering glass than on the side nearer to the light. It seemed therefore that the negative thermotropism was stronger and more pronounced in the light than in the shade.

At the same time the Chionea showed itself distinctly positive phototropic. The conflict between the two instincts must be strongest on the side nearer the light, as here one should expect the insect, on account of its phototropism, to go under the glass cover. However, it is in the light, that it most consistently avoids going under the shelter. As a result, its favorite place remained that part of the open region which was nearest the light and just bordering the glass cover, and it was here that the fly usually came to rest.
The cage was now turned 180°, all other conditions remaining unchanged. The Chionea at once demonstrated its positive phototropism by running in a straight line towards the light. Arrived at the glass-covered part, however, it turned aside without going under it. After a little while, it was seen to go under this glass cover for a short time, but soon came back and returned across the whole uncovered field, coming to rest at the edge of the other glass cover, which was now on the darker side of the cage. Left to itself, the Chionea would sometimes tumble down from the wire-netting of the cover, and run about for awhile on the snow or earth. However, it always soon climbed the glass wall again, and took to its former place in the open part of the cover, which, exposed to the draft, was probably colder than the snow.

To test out whether Chionea really preferred the open region because of its being colder, I warmed my hand by means of a hot electric light bulb, and could, by coming near it with the heated surface of the hand, drive the insect from the open field of the cover into the space under the glass cover. I concluded that the Chionea, as a rule, seeks out the coldest place it can possibly find. The experiment was then closed.

On November 25, in the morning, the Chionea was found sitting at the under surface of the glass cover which was covered with hoar-frost. The snow in the cage was partly melted, and the resulting humidity had formed an ice-crust on the glass cover. The Chionea seemed perfectly at ease while resting on this icy surface.

Towards noon I brought the insect out into the open air to the edge of the balcony, on which fresh snow had fallen. It was watched but otherwise left entirely to itself, and was seen running over the snow alongside the whole railing of the balcony, the direction being against the wind (positive anemotrop?). It kept itself somewhat on the inner side of the railing on the side of the house, but pursued its course in a nearly straight line. Only once it turned to the outer side and had to be driven back to prevent its falling from the balcony. Three times it went to the left (the side of the house-wall), going below the edge and to the underside of the snow-layer covering the railing, remaining quiet for a short time, but each time returned soon to the surface of the snow and continued its walk. Though on these three occasions it came near to
the place where the snow-covering bordered on the wood of the railing, the insect was never seen going on the wood, showing a well-marked preference for the snow. Arrived at the end of the balcony, the Chionea had to be stopped in order to prevent it from falling; this was done by approaching it with the finger, avoiding actual contact. This was found sufficient to cause it to change its course. If carefully touched with the tip of the finger, it contracted all the legs towards the body and remained quiet. After making two attempts to go in the previous direction, it finally turned to the side, and continued to run in a straight line alongside the transverse railing of the balcony in the same way as described before.

The fly was then placed in its cage, where it at once started climbing the glass walls. Shortly afterwards, at 1 p. m., it was again found sitting on the underside of the cover, this time under the glass plate. At 2.30 p. m., however, it was found to have resumed its favorite resting-place, under the wire-cover in its open part, at the edge of the anterior glass cover, that is, at the coldest spot.

On November 26, a very sunny day, observation was omitted in the morning. At 2.30 p. m. it was found that the snow in the cage was melted and the Chionea was lying motionless in the melting water, apparently dead. However, as I knew from my experience that drowned caterpillars may often be revived, an attempt was made to bring the Chionea back to life and was successful. The insect gradually began to move its legs and antennæ, until, at 4.30 p. m., it had regained its normal condition. It was then placed back in the cage.

During the efforts to revive the insect, it was kept in the heated room at least part of the time, in order to facilitate the evaporation of the water. A piece of blotting-paper was used first to absorb the excessive moisture. Blowing seemed to aid it in resuming its movements. When these had been started, however feebly, a piece of snow was brought to touch the claws of the feet, and it was noticed that each time the leg responded with a considerable reaction. In fact, snow touching the feet proved to be the strongest stimulus to cause them to move, and I conclude therefore that normally the contact of the tarsal claws with the surface of the snow is the necessary stimulus for Chionea to keep moving continually, as to remain on one place might cause it to freeze.
In the evening the temperature had sunk to \(-8^\circ C\). and the Chionea, kept in the veranda at a temperature considerably below freezing, was sitting on the earth. On November 26, it was still alive sitting on the earth on that side of the cage directed towards the outer, colder side of the veranda. For several days, as the writer was ill, no observations were made. The Chionea was kept alive in the hope that some day a male specimen could be found which would make it possible eventually to obtain copulation and eggs. The weather was moderately cold and the cage remained in the glass veranda.

On November 29, after it had been raining all night, a very warm but cloudy day followed. The snow everywhere was sinking together. The Chionea remained quiet for the whole day hiding in a corner. In the evening, when the temperature had sunk again below freezing \((-2\frac{1}{2}^\circ C\).), the door of the veranda was kept open and the Chionea was seen creeping slowly about on the earth of the cage.

On December 2 (melting weather), snow was placed in the cage, the Chionea being active most of the time. At 1 p. m., the temperature had arisen to \(6^\circ C\), and the Chionea was very lively, running about in its cage. On December 4, a violent "Foehn"—storm set in, and, unfortunately, no trace of the Chionea could be found, the strong wind having blown the cover partly from the cage, which permitted the insect to escape. It had lived ten days in captivity, apparently without taking any food other than snow-water.

My disappointment over the loss of my interesting object of observation was great, and it was with mixed feelings when on December 7, after an abundant snow-fall, I found two male Chionea, at about 11 a. m., on the snow, somewhat below the spot where the two previous specimens had been found. These males were both larger than the first one found on November 22, and very lively. In spite of a careful search, no females were found and the hope of bringing about a copulation had to be abandoned. The two males perished within the next few days and no further specimens could be obtained.

On December 8, the first of the males died in consequence of exposure to sunlight. As the fresh snow-fall was followed by bright, sunny weather, the temperature in the glass veranda and in the
Marchand—Notes on the Habits of the Snow-Fly (Chionea)

1917

Notes on the Habits of the Snow-Fly (Chionea)

149

The glass cage had apparently become too high; however this may be, the insect was found dead in the cage in the direct sunlight. The other specimen had remained in the shade. In the evening, the temperature fell to 

\[-11^\circ \text{C.}\]

and being curious to know whether the Chionea would withstand such low temperatures, I left the glass door of the veranda open over night. On the morning of December 9, the second Chionea was dead, apparently killed by frost, after the fashion of the famous tamed herring which had learned to walk about and breathe air but one day fell into a pond and was drowned. The adaptation to cold has evidently its limits even in Chionea, and this insect, although it has its most active stage at low temperatures, seems to withstand freezing less than many other insects which at low temperatures become entirely passive.

The possibility that the males have normally a shorter life than the females should, however, be taken into consideration, and may partly account for their rapid death. The factor of humidity may also be of importance, and death in the bright sunlight may be due to increased evaporation as well as to the temperature.

Conclusions.

Chionea is not an accidental guest on the snow but perfectly adapted to life on the snow by its habits. This is evident from the fact that it can move about on snow for a practically indefinite time without being frozen, while most other insects which may be collected on the snow have been carried there by air currents or attracted by the strong light, but do not run about on the snow and usually perish within a few hours on the spot where they have fallen. Furthermore, the Chionea regularly drinks water from the snow by pressing its proboscis against it as was repeatedly observed.

Chionea is attracted to the snow:

(1) By the bright light and white color of the snow (+phototropism);

(2) By a thermotropic reaction which is, in itself, stronger than the phototropic reaction and which increases in the light (−thermotropism);

(3) By the peculiar contact of the snow and a direct stimulus resulting from the action of cold on the claws (special temperature-sensibility?).
I have made an attempt, on the basis of these meagre data, to gain an idea of the ecology of Chionea in Nature. What is the biological significance of its living on the snow? Food is apparently not taken, hence the quest of food cannot be the purpose. The larval stage can naturally not live on the snow. Consequently, I assume that the ecological significance of the nivicole adaptation is that it affords to these wingless insects an opportunity for the sexes to meet, the considerable distances which may be covered on the snow supplanting in a measure the function of the wings, especially if the insects are aided by the eyes in finding each other. As long as the insects are hidden in the half-frozen ground under the snow, the chances of the sexes to find one another are very remote. However, as soon as fresh snow falls, and the temperature rises (usually for one or two days) to somewhat above freezing, Chionea becomes strongly positive phototropic and negative geotropic. The insects seek the light, climbing up, probably not through the snow, but around tree-trunks, bushes or other places relatively free from snow, and run about, covering considerable distances. After copulation has taken place, the males die, and the females return under the snow where they are protected from extreme cold, depositing the eggs from which larvae may develop in the spring. Possibly, the change to low temperature, as it usually occurs soon after each fresh snow-fall, will be in itself a sufficient cause for the insects, males and females, to return under the snow until the next favorable opportunity. On all of these points new observations are necessary. I wish, however, to call attention to the fact that Lugger in Minnesota (1895) has indeed observed that Chionea copulates on the snow, in spite of several degrees below freezing in the cases observed by him, and I found my own hypothesis confirmed by his findings. Lugger also observed that the female crawls down through a crevice in the snow and deposits her eggs which are described as elongated and yellowish, but which did not hatch.

It is to be noted in this connection that, according to T. W. Cockle (1914), also Boreus, the other well-known snow-insect, is found to copulate in mid-winter on the snow, as he observed in many instances giving a detailed account of the process; and it would be of considerable interest to know whether in Boreus there
is any special adaptation by tropism to the life on the snow, as apparently the case in Chionea.

The species treated here was probably Bezzi's *Chionea alpina* described by him in 1908, a few years before these observations were made. I conclude this from a comparison of my specimens with Bezzi's description, finding the characters to agree pretty closely. Characteristic for *Chionea alpina* are: the color, being yellowish but darker than in lutescens, the thickened femora, the stiff bristle-like hairs on the legs, showing a distinctly serial arrangement, the seven-jointed antennae (eight in valga, nine to ten in araneoides) and the hairs on these which are, in lutescens, much longer than in the northern species. Moreover, the type-locality of Bezzi's species, Chiareggio, Valtellina December 8, 1899), is not very far from my locality, and separated from it only by the Engadine valley. On the other hand, Bezzi records another specimen of *Chionea alpina*, which he received from the Silvretta-glacier, likewise in the Rhaetic Alps and not far from the Davos-valley. The size of my specimens ranges from 2-4 (♀ 5?) mm. in length.

As far as I know, *C. alpina* has not yet been figured, and the accompanying imperfect drawings may facilitate comparison with other species. Bezzi states that in the female of *Chionea alpina* the ovipositor is always curved upwards, a feature which, however, was absent in the specimen from Silvretta-glacier. My specimen did not show anything of this sort. Possibly, the ovipositor assumes this position after copulation has taken place or after oviposition. Another characteristic which presents some difficulty is the number of antennal joints. I believed my specimens to be six-jointed, but Bezzi gives seven joints as the number in his species, the last two joints being discernible, as Lundstroem has pointed out, by the position of the bristles. I have made some drawings of the antennae, as accurately as possible, on which it is seen that they may be called seven-jointed, the last two joints being however fused into one.

*Note.—* One of the two male specimens still in my possession was found to have lost all its legs during transportation, showing also in this peculiarity its relationship to the Tipulids. I notice that all the legs have broken off at the trochanter, the latter remaining attached to the coxa. It seems, therefore, that there is a predisposed
place of rupture, by autotomy, at the border-line between femur and trochanter.

Literature.¹


¹Only the more important papers are listed here. Many publications contain data on *Chionea*, its local occurrence, etc.
Marchand—Habits of the Snow-fly.
MARCHAND—Habits of the Snow-fly.
Speiser, 1899. Über Reduction der Flügel bei ectoparasitischen Insekten, Insekten-Börse, XVI, 1899, pp. 117 and 122.

EXPLANATION OF FIGURES.
Plate VIII.
Fig. 1. Chionea alpina Bezzi, male, dorsal view.
Fig. 2. Ventral side of another individual, male.
Fig. 3. Head of male, lateral view.
Fig. 4. Ovipositor of female, dorsal view.
Plate IX.
Fig. 1. Chionea alpina, male, habitus. (Freshly killed individual.)
Fig. 2. Antenna of male.
Fig. 3. Terminal portion of same antenna, slightly turned aside.
Fig. 4. Antenna of another individual.

A NEW SPECIES OF CRIORHINA FROM NEW ENGLAND.

BY CHARLES W. JOHNSON,
Boston, Massachusetts.

Criorhina intermedia sp. nov.
♂. Face covered with white tomentum; facial tubercle, a line above the oral margin (narrowly separated from the tubercle) and the cheeks, shining black, frontal triangle with yellowish tomentum, antennal process, the narrow front and vertex black, occiput grayish pruinose, pile yellowish, antennæ black, base of the third joint brownish, arista black. Thorax black, in front of the transverse suture grayish pruinose, behind shining black, the long pile in front of the suture, on the pleura, post-alar callosities and scutellum, yellow, the remaining pile black, forming a broad band between the wings. Abdomen: the first and second segment grayish pruinose, with long yellowish pile, the remaining segments
shining black, with black pile. Legs black, tips of the tibiae and all of the tarsi reddish brown, the upper side of the hind metatarsi black, front and middle femora fringed below with long yellow hairs, posterior tibia strongly curved, under side of the hind tarsi with yellow tomentum. Halteres light brown. Wings hyaline, all the veins margined with brown, most prominent on the cross-vein, stigma yellow, squamae brown, fringed with brownish hairs. Length, 16 mm.

The female has the front about one-fifth the width of the head, dusted with brown and with brownish hairs, face yellowish pollinose with a wide facial stripe.

One male and six females collected by the writer at Jaffrey, N. H., June 15 and 18, 1917, on the flowers of the choke cherry. One female, Dartmouth, Mass., April 25, 1916 (N. S. Easton). Holotype, allotype and four paratypes in the collection of the Boston Society of Natural History. One paratype in the Museum of Comparative Zoology and one in the author's collection. In one of the specimens from Jaffrey and the one from Dartmouth, Mass., the band of black hairs on the thorax is absent, while in some of the others it is less prominent than in the holotype. The series vary in size from 12–16 mm.

The species is readily separated from C. verbosa Walker, in having the tibiae black and in the absence of yellow pile on the abdomen beyond the second segment. The Jaffrey specimens would indicate that it appears later in the season than C. verbosa. My records for the appearance of the latter range from March 13 to April 20. It seems to be more closely related to C. nigriventris Walton, from which it is separated by the yellow pile on the abdomen.
NOTES ON TINGIDÆ.

By Herbert Osborn and Carl J. Drake.

In recent numbers of Psyche,¹ Mr. H. M. Parshley has presented articles on Tingidæ in which he has called attention to what he considers errors in articles written by the writers and offered numerous criticisms that it seems necessary to note. In so far as these criticisms and corrections are warranted they are of course to be welcomed, but there are many instances in which a careful reexamination of material studied and a study of material coming to hand since our papers were published fail to establish the validity of Mr. Parshley's criticisms. Some of these are considered in the following notes and others are discussed in a paper in the Ohio Journal of Science. (Vol. XVII, pp. 295–307.)

Fenestrella ovata Osborn & Drake (Plate VIII, Fig. d).

The criticism by Parshley of the drawing of this species in his second paper is quite inaccurate as a comparison of the photograph (Fig. d) of the type with the drawing will indicate. The statement, “the base of the third antennal segment is slightly capitate,” is entirely absurd as there is no such structure present, and, furthermore, capitate refers to a structure at the distal end of a segment. We have recently received a second specimen of this unique little form from Ohio.

Key to the Nearctic Species of Physatocheila.

1—Rostrum short, reaching between the intermediate coxae

P. brevirostris Osb. & Drk.

Rostrum considerably longer and of various lengths........... 2

2—Rather large insects (length 4.6 mm.), second antennal segment small at the base and much enlarged at the apex.

P. major n. sp.

Smaller insects (length 4 mm. or less), second antennal segment not as the above........ 3

3—Rostrum not extending beyond the apex of the rostral sulcus; outer costate nervure that bounds discoidal area nearly straight; color dull, uniform yellowish-brown.

P. parshleyi n. n. (= plexa Parsh.)

¹December, 1916; February, 1917.
Rostrum reaching more or less beyond the rostral sulcus; outer costate nervure that bounds discoidal area sinuate; color either brownish, or brownish more or less tinged with yellow, or brown or grayish-brown variegated with pale cinereous and black, or cinereous.

P. plexa Say (= P. variegata Parsh.)

Physatocheila parshleyi nom. nov. (= P. plexa Parsh.).

This species was described by Parshley in his first paper as the true form of P. plexa Say. Although the species meets the requirement of the writer's contracted form of Say's description and his assumed characters of a true plexa it is distinctly at variance with the original description if taken in its entirety. Compare as follows: (Say) "Body brownish, more or less tinged with yellow" surely cannot be the same as (Parshley) "Uniform dull yellowish brown"; (Say) "two series of which on the lateral margins are a little larger," in reference to the reticulations of the elytra is hardly identical with (Parshley) "Costal area of the hemielytra with two almost regular series of areoles"; the rostrum is not mentioned in the original description of plexa and the length of the rostrum is entirely an assumed character by Parshley. It might be well to note that the length of the rostrum is not given by Say in any Tingid description, also that this species has never been taken in the regions where Say did his entomological work. In as far as we know this species has only been taken in the New England States and eastern Canada; plexa is a common species in the states where Say worked and our collections include numerous specimens of this species from Portland, Oregon, to the Atlantic Ocean. The structures mentioned in the key will readily separate this species from allied forms and the other characters can be noted in Parshley's first paper under plexa Say.

Physatocheila plexa Say, Uhler, Heidemann, Osborn & Drake (= variegata Parshley, but not plexa).

The conclusions drawn by Parshley in his first paper are based on a special interpretation of Say's description and a few assumed characters as indicated below.
Parshley.

"... brownish, more or less tinged with yellow," and "... two series [of reticulations] ... on the lateral margins ... [of the hemielytra] ... ."

Say.

"Body brownish, more or less tinged with yellow, with dilated approximate punctures; head with three elevated lines: thorax not dilated on the sides; with three elevated lines: scutel also with three elevated lines: hemielytra with small, symmetrical, orbicular reticulations of nervures; two series of which on the lateral margins are a little larger; those near the inner margin of the membrane also a little larger."

The color description of *plexa* is rather indefinite as only the color of the body is mentioned by Say and this is not of a constant and uniform color as distinctly indicated by the words, "more or less tinged with yellow." By omitting "of which" Parshley gives a different meaning to the portion of the description which describes the lateral margins of the elytra, and, furthermore, in the form that the author calls *variegata* (= *plexa* Say) the costal area is not always either triseriate or averaging three rows of areolae as stated in the description. Evidently, the writer failed to study all his paratypes as Fig. 1, *b* will indicate; this is a photo-

![Fig. 1. a, b, and c, Physatocheila plexa Say (= variegata Parsh.): d, P. major. n. s. p. (Photographs by Carl J. Drake.)](image-url)
graph of the paratype from Wellesley, Mass., which was sent to the junior author by Parshley as a typical form of variegata. As stated under parshleyi, Say never mentioned the length of the rostrum in any Tingid, and the length there given is only an assumed character.

Our collections include specimens from Oregon (Portland), Idaho, Nebraska, Kansas, Iowa, Wisconsin, Illinois, Michigan, Virginia, New York, and Massachusetts. Stål also records the species from "Illinois." This series of specimens indicate the species to be quite variable, especially in color, length of rostrum, and in number of rows of areole in costal area, but there seems to be no distinct variety. The many variations in color may be noted in the key. Our Illinois specimens are almost of a uniform brownish color and the costal area is quite uniformly biseriate. The costal area of the elytra is either uniformly biseriate, or triseriate, or more or less irregularly triseriate, or with various intermediate forms between bi- and triseriate. The length of the rostrum is quite variable, always extending beyond the end of the rostral sulcus, but never reaching beyond the posterior margin of the second abdominal segment. In taking the length of the rostrum one should always note the position of the head and prothorax. In the senior author's collections are specimens determined by Uhler and Heidemann. The specimen determined by Heidemann is listed by Parshley as a paratype under variegata from Berkeley Springs, Va.

**Physatocheila major** sp. nov.

Head armed with five spines, the spines arranged as in plexa Say. Antenniferous tubercules large, curved inwardly. Antennae clothed with fine short hairs; basal segment swollen, a little longer than the second; second segment short, small at the base and strongly swollen at the tip; third segment longest, slenderest, about two and a half times the length of the fourth; fourth segment fusiform. Pronotum tricarinate, the carinae low and uniseriate; lateral margins as in related species; hood a little larger than in other Nearctic species. Rostral sulcus broad, the rostrum almost reaching posterior margin of second abdominal segment. Elytra a little longer than the abdomen, broadly rounded at the apex; costal area rather broad, irregularly areolate, with two or three confused rows of areole; discoidal area a little broader and the
outer boundary slightly more sinuate than in *plexa*. Wings slightly longer than abdomen. Abdomen quite broad in both male and female. Length, 4.6 mm.; width, 1.8 mm.

*Color.*—General color brownish, slightly marked with yellowish and black. Antennae brownish, the distal half of apical segment blackish.

Two specimens, a male and female from Urbana, Illinois. The photograph illustrates the type specimen; all specimens of *Physatocheila* are equally enlarged. This species is readily separated from allied forms by its larger size and the second segment of the antennae.

**Melanorhopola duryi** Osborn & Drake (Plate VIII, Fig. e).

The form of this species is not very broad when compared with females of other species in the genus. The third antennal segment is slightly enlarged towards the apex and the distal segment is decidedly conical rather than fusiform as stated by Parshley in his second paper. The photograph of the type will illustrate the structures mentioned. All photographs of the species in this genus are of the same magnification and the antennae have been placed in a horizontal position with the body so that the proportions between the same or different species are quite accurate.

**Melanorhopola clavata** Stål (Plate VIII, Figs. a, b and c).

This is a common and well-known species in the
eastern part of United States. Our most western records are Iowa and Nebraska. The photographs show the difference between the short winged and long winged forms, also the extreme variations in the lengths of the antennae.

**Melanorhopola uniformis** Stål (Plate VIII, Fig. f).

This species, as we determined it, is quite closely allied to *lurida*. The photograph represents the South Dakota specimen listed in our Ohio bulletin.

**Melanorhophola lurida** Stål (Plate VIII, Figs. h and g).

Parshley has erroneously stated the length of the antennae of this species in his second paper. The antennae either slightly exceed, equal, or fall considerably short of the tip of the abdomen; the third segment is also more or less swollen near the apex. The lateral margins of the pronotum are either vertical or reflexed more or less against the surface of the pronotum. The form of *lurida* and *uniformis* is also very much confused and not based on specimens of the same sex. The male of *lurida* is narrow, but the female is as broad or broader than the female of *uniformis*. The male of *uniformis* is unknown to us. The Figures f (*uniformis*) and g (*lurida*) illustrate the short winged females of the two species; Figure h is the macropterous male of *lurida*. The two specimens of *lurida* show almost the extreme variations in the length of the

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**Explanation of Plate.**

*Photographs by Carl J. Drake.*

Figs. a, b, and c. **Melanorophola clavata** Stål (a, macropterous female; b and c, brachypterous females, the latter with short antennae).

Fig. d. **Fenestrella orata** Osborn and Drake (type greatly enlarged).

Fig. e. **Melanorophola duryi** Osborn and Drake (type).

Fig. f. **Melanorophola uniformis** Stål (brachypterous female).

Figs. g and h. **Melanorophola lurida** Stål (g, brachypterous female with short antennae; h. macropterous male with long antennae).
Osborn and Drake—Tingidae.
antennae in this species. The size of lurida in our series of twenty-four specimens varies in length from 4.35 mm. to 5.8 mm. It is impossible to separate the smaller specimens of lurida from obscura Parsh., by the inadequate and obscure description nor by the characters used in the key to the genus in his second paper. In both of these papers a great deal of emphasis is placed on size, narrow form, and antennal structures that apply equally well to the smaller specimens of lurida. Possibly an examination of the types may enable one to separate them.

BOOK REVIEWS.

The Mosquitoes of North and Central America and the West Indies. By L. O. Howard, H. G. Dyar and Frederick Knab.


A notable chapter in that branch of Dipterology known as Culicology has been completed by the appearance of Volume 4 of this magnificent contribution to the knowledge of American mosquitoes—a work which reflects high credit not only upon the authors and the institution which made publication possible, but also upon the recognition entomology has won and which really has made possible the completion of such a comprehensive and exhaustive study. It is a response to the recognition of the vital relation certain species of mosquitoes sustain to the welfare of the human race, and a demonstration of the fact that the knowledge of pathogenic forms is incomplete without a study of associated and allied species.

The older entomologists easily recall the earlier days when only a few supposedly uninteresting and assumedly similar or very similar species of mosquitoes were known to occur in America, and can compare the conditions then and those obtaining now with practically 400 recognized species referable to 25 genera, and presenting undreamed of biological and morphological diversities,—
and this after excluding the Corethrineae. It is not in mere numbers of species that this work displays its merits. It is most emphatically a compend of our knowledge—taxonomical, synonymical, morphological, biological—of a large and important group presenting many difficult problems to the solution of which the several authors have contributed largely, and at the same time most carefully made due acknowledgment of the part played by their colleagues.

This series of volumes leaves little to be desired along historical, biological and economic lines, and since the first two volumes appeared in 1912, and were duly reviewed, there is no necessity of extended comment in this connection.

The first part of the taxonomic portion (Volume 3) appeared in 1915, and is continued in the just issued Volume 4. Obviously one could hardly be discussed intelligently without the other. The authors have recognized only those genera which could be defined by characters found in both sexes, and consequently submerged some because they were based upon peculiarities exhibited by one sex, giving as a reason therefor that not all specimens submitted for determination are bred, nor are both sexes always represented. This is very frequently the case with other insects. It is doubtless more convenient from certain standpoints, and yet it is admitted by the authors that genera erected upon characters found only in one sex are valid, and the disregard of such genera may not be generally accepted. A striking application of this method is seen in the inclusion of such different forms as Aëdes fuseus O. S., now considered a synonym of the European A. cinereus Meign., and the large series represented by the salt marsh mosquito (sollicitans), and a number of our common woodland mosquitoes in the same genus. There are marked differences in these insects not only in the male palpi, but in the genitalia, and the mere fact that there has been reduction in palpal structures in several independent series by no means invalidates the use of such modifications for generic separation. This is simply a tendency in specialization which is closely paralleled in the gall midges where we consistently find the same phenomenon, though in both sexes, in each of several large tribes and within certain limits the palpal reduction indicates the degree of specialization, and in the group.
mentioned is usually accompanied by other modifications—not infrequently biological as well as structural.

The stability of modern nomenclature is rather rudely shaken by the footnote, on page 824, to the effect that those who had unlearned Stegomyia fasciata must now proceed to dissociate their mental processes from Aëdes calopus and think in terms of Aëdes argenteus, a discovery made too late for incorporation throughout a work which has been in progress for approximately ten years, and if later workers insist upon a strict application of the rules of nomenclature, it is probable that there will be another change in the name of the genus to which this world-famous mosquito is referred. The announcement that Aëdes fuscaus O. S. is a synonym of the European Aëdes cinereus Meign. is also made in a footnote, and like the preceding was received too late for incorporation in the body of the work.

It is not expected that a dissertation of this character would be entirely acceptable to all. It deals with a large group. The classification has been worked out in recent years from several very diverse standpoints. The authors have endeavored to harmonize the evidence presented by adult and immature stages and it is more than probable that no two or three men would arrive at the same conclusion in regard to a number of debatable points. We have in these volumes tabulations for the separation of families, tribes, genera and species in both imago and larval stages and also a remarkably comprehensive and detailed study of the larvæ. A knowledge of these latter, their habits and characteristics, is of great importance in mosquito control work. This series of four volumes constitutes by far the most complete account we have of any similar group and marks distinct progress toward that comprehensiveness and thoroughness investigators so generally recognize as ideal. It is unfortunate that two of the authors who undertook the preparation of the systematic part of this work did not have an opportunity of personally studying the types in European collections.

There doubtless will be some changes in generic groupings and possibly some in tribal definition, though the latter appears to the reviewer as very satisfactory. We have at least a magnificent basis for future work, and he who desires to improve upon the system proposed may well estimate in advance the amount of
labor involved in the attempt to rearrange this vast complex with its varying, and in some instances apparently antagonistic lines of development in the adult and immature stages. The faunal region covered is broader than that which falls to most investigators and moreover there have been exceptional opportunities for special collecting in a number of representative areas.

E. P. Felt.

NOTE OF CORRECTION (HEMIPTERA).

Psyche, 1914, Vol. 21, List Hem.-Het. of Maine:

In this article are a number of errors of determination, etc., which are corrected in my New England list recently published in the Occasional Papers of the Boston Society of Natural History.

Psyche, 1915, Vol. 22, Synop. Families:

P. 90, line 3 from bottom: “rostrum 3-segmented” should read rostrum 4-segmented.

Ib., Synop. Pentatomidae:

P. 172, line 20 from bottom: “17” should read 16; line 8 from bottom: “14” should read 15.

P. 173, line 20 from bottom: “16” should read 1.
1. Peribalus. Delete the next three lines and substitute:
Juga not much longer than tylus......................17


P. 212, “embolim” should read embolium.

Psyche, 1917, Vol. 24, Notes on N. Am. Tingidae:

P. 24, The holotype of Hesperotingis fuscata Parsh. is in de la Torre Bueno’s collection, not in Barber’s.

For other corrections see Psyche, 1915, Vol. 22, p. 220.

H. M. Parsley.
EXCHANGE COLUMN.

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Offered for cash, but exchange preferred. Fitch and early Illinois reports; Insect Life; Harris’s Insect; many others.—J. E. Hallinen, Cooperton, Okla.


Hemiptera-Heteroptera. I desire specimens of this group from all regions, especially New England. I will give in exchange species of this and other orders (except Lepidoptera), and will identify New England material. Correspondence desired.—H. M. Parshley, Smith College, Northampton, Mass.

Wanted: Psyche, Vol. IX, No. 300 (April, 1901). Address, giving price, Librarian, Stanford University, Cal.

Sarcophagidae 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 Cremastochilinae of the world. Will give cash or Coleoptera, Hymenoptera and Diptera from the United States.—Wm. M. Mann, Bussey Institution, Forest Hills, Boston, Mass.

Wanted to correspond with collectors of Noctinidae in Northern Massachusetts. Subject to supply will pay any reasonable price for good specimens Catocala Sappho.—Howard L. Clark, P. O. Box 1142, Providence, R. I.


Wanted: Insects of the family Embiidae (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.

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

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CONTENTS.

The Temporary Social Parasitism of *Lasius subumbatus* Viereck. W. M. Wheeler 167
Notes on the Marriage Flights of Some Sonoran Ants. W. M. Wheeler 177
The Pleomotorosis of *Myrmecocystus*. W. M. Wheeler 180
The Distribution of the Nose Fly and Other Species of *Gastrophilus* in the United States. F. C. Bishopp 182
Preliminary Experiments with Sodium Fluoride and Other Insecticides Against Biting and Sucking Lice. F. C. Bishopp and H. P. Wood 187
Geometrid Notes. L. W. Swett 190
Note on the Ichneumonid Genera *Cyanocryptus* and *Lamprocryptus*. C. T. Brues 191
Note on the Adult Habits of Some Hymenopterous Parasites of Orthoptera and Mantodea. C. T. Brues 195
Exchange Column 197
Index to Volume XXIV 199
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THE TEMPORARY SOCIAL PARASITISM OF LASIUS SUBUMBRATUS VIERECK.¹

BY WILLIAM MORTON WHEELER.

During the past summer, while studying the ants of the Sacramento Mountains, at Cloudcroft, N. M. (alt. 9,000 ft.), I had an opportunity to observe the method of colony formation employed by *Lasius (Formicina) umbratus* Nyl. subsp. *subumbratus* Viereck. *L. umbratus* has long been known as a circumpolar species comprising several races, or subspecies and varieties, the names and known geographical distribution of which are recorded in the following list:

**PALEARCTIC FORMS.**

*L. umbratus* subsp. *umbratus* Nyl.  
subsp. *mixtus* Nyl.  
var. *mixto-umbratus* Forel  
var. *umbrato-affinis* Ruzsky

Northern and Alpine Eurasia from Britain to Japan.  
Russia.

**NEARCTIC FORMS.**

subsp. *mixtus* var. *aphidicola* Walsh  
Canada, Central and Atlantic States.

subsp. *subumbratus* Viereck  
British America, Rocky Mts.

subsp. *speculiventris* Emery  
Known only from New Jersey.

subsp. *vestitus* Wheeler  
Known only from Idaho.

subsp. *minutus* Emery  
Central and Atlantic States.

In Europe, according to Wasmann and Donisthorpe, the var. *mixto-umbratus* is more common than the typical *umbratus* or *mixtus*, between which it is intermediate in size, color and pilosity.

In the Eastern United States *aphidicola* is certainly the most

¹ Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 136.
abundant form of *umbratus*. The subspecies *speculiventris* and *vestitus* are imperfectly known, the latter from a single female specimen, the former only from the types taken many years ago by Pergande at Caldwell, N. J. The subspecies *minimus* is very sporadic. During the past eight years I have found only a single colony of it in the vicinity of Boston. The types of the subspecies *subumbratus* were taken by Professor Cockerell at Beulah, N. M. (alt. 8,000 ft.). I have taken it at Williams, and on Mt. Lemmon in the Santa Catalina Range (9,000 ft.), Ariz., at Cloudcroft, N. M. (9,000 ft.), Lake Tahoe, Calif. (8,000 ft.), near Ottawa, Ontario, and Hull, Quebec and have seen specimens from Digby and Bedford, Nova Scotia. It is therefore the most boreal and stenothermal of all the North American subspecies of *umbratus* and, as I have stated in a former paper (1917), properly belongs to the Canadian zone.

To the ethologist *umbratus* is of unusual interest, because in Europe it is a temporary parasite of *L. niger* and in turn serves as the host of *L. (Dendrolasius) fuliginosus*, which is therefore a true temporary social hyperparasite. The young *umbratus* queen is adopted by a colony of *niger* workers, which bring up her brood. Eventually these workers die off, probably in the course of four or five years, and the *umbratus* colony, now pure, becomes very populous. Then it may in turn adopt a queen of *fuliginosus*, the offspring of which eventually supplant the *umbratus* colony. In both cases the host queens are eliminated, probably by being assassinated either by their own workers or by the parasitic queens. The various phases in the development of the *umbratus* and *fuliginosus* colonies have been studied by European myrmecologists. The occasional occurrence of mixed colonies of *umbratus* and *niger* and *umbratus* and *fuliginosus* was noted by Schenck, Adlerz, Forel, Wasmann and de Lannoy, but Emery and Forel in 1908 first suggested that they might be interpreted as arising from temporary social parasitism. Later Crawley and Donisthorpe fully demonstrated the truth of this conjecture by showing that the typical *umbratus* is parasitic on the typical *niger*, the subspecies *mixtus* on the subspecies *alienus*, and that *umbratus* regularly functions as the temporary host of *fuliginosus*.

Although North America is so rich in *umbratus* forms, no one has hitherto been able to prove from observations in the field that any
of them is parasitic on some one of our varieties of *L. niger*. I have repeatedly found deilated queens of *aphidicola* in small cavities under stones as if in the act of founding colonies independently in the same manner as most ants, but never with brood. Nor have I ever been able to find a mixed colony of *L. niger* var. *americanus* and *aphidicola*, even in Illinois where both forms are common in the same localities. The only indication that any American form of *umbrratus* may be a social parasite is furnished by some specimens of *subumbratus* collected by Mr. W. Reiff in Nova Scotia and some experiments by Tanquary on *minatus*. At Bedford, near Halifax, Mr. Reiff took six deilated *subumbratus* queens from three colonies of what I recorded at the time (1910) as "the large yellowish form of *Lasius niger* var. *neoniger* Emery." Since the discovery of Pergande's types of Alaskan *neoniger* I can now state definitely that this variety is *sitkaësis*. As Reiff's specimens were not accompanied by notes, the parasitism of *subumbratus* could only be conjectured. Tanquary introduced successively some eighty-eight of the small, active queens of *minatus* into twenty different colonies of *L. americanus*, *nearcticus*, *brevicornis*, *clariger* and *interjectus* and obtained one case of adoption. This was in a colony of eight workers and a large number of cocoons of *americanus*. He concludes that "although one adoption out of 88 attempts is a small percentage, yet I think the case with which this queen was adopted is very suggestive, and taken together with the facts mentioned above, namely the sporadic occurrence of the species, the very large number of females produced, the small size of the females, the fact that these females have not been seen in the act of founding a colony and one additional fact that may be mentioned, the mimetic coloration of the females (the color of these females is exactly the same as that of the darker form of *americanus*), I think justifies us in concluding that the queen of this species is in all probability, temporarily, parasitic upon the common *L. americanus*."

My observations at Cloudcroft leave no doubt concerning the parasitism of the subspecies *subumbratus* on two forms of *L. niger*, the var. *sitkaësis* Pergande and the var. *neoniger* Emery. The former, as I have recently shown (1917), is the common form of *niger* at higher altitudes and latitudes from Alaska to Maine and Nova Scotia and southward along the ranges of the Sierra Nevada.
and Rocky Mountains. The worker and female of this variety are large, brown or yellowish brown, with numerous erect or suberect hairs on the legs and antennal scapes. It passes over into the var. neoniger, which is smaller and darker, but has hairy legs and scapes, unlike our common and more xerothermic var. americanus, which closely resembles the European alienus in having the legs and scapes merely finely pubescent. At Cloudcroft silkaënsis is everywhere abundant in the pine forests at an altitude of 9,000 to 9,500 feet, and nests by preference under large stones. The females and workers have a peculiar and rather agreeable aroma, which is much stronger than that of americanus and much like the odor of subumbratus. On rocky slopes, exposed to the sun, especially along the edges of the alpine meadows, the typical silkaënsis is replaced by neoniger and forms intermediate in size and coloration. At altitudes of 7,000 to 7,500 feet or at higher elevations in very warm, dry situations the var. americanus and forms transitional to neoniger are not uncommon. At Cloudcroft I failed to find subumbratus below 9,000 feet. Its colonies are very populous and live under large stones, usually in the shade of the pines. Its habits, like those of the other subspecies of umbratus, are decidedly hypogaeic. It does not make carton like the European umbratus. This is generally true also of our eastern aphidicol a. I have, however, found a few colonies of this ant at Colebrook, Conn., and Ottawa, Ontario, nesting in dark brown carton nests in the centers of rotten logs.

The observations proving that the young queens of subumbratus establish their colonies with the aid of silkaënsis and neoniger workers may now be transcribed from my note-book:

July 3 and 5. Four colonies of subumbratus were found under large stones. Two were of considerable size and the superficial chambers of the nests were full of black males and golden yellow females ready for the marriage flight.

July 8. The marriage flight of subumbratus must have occurred on July 6 or 7 as there were numerous dealated females running about among the stones on an open, sunny slope where many of the stones covered nests of neoniger. My son Ralph assisted me in carefully turning over the stones and examining these nests. In one area, about 200 feet in diameter, nearly every nest had from one to five dealated subumbratus queens running about in the large
shallow superficial chambers. By shading the chambers, which were occupied by numerous neoniger workers and cocoons, the behavior of the yellow queens could be readily studied. They ran in and out of the chambers and galleries leading into the soil and, when accosted by the neoniger workers, made peculiar supplicatory movements with the antennae, precisely like those of Formica consocians queens seeking adoption in nests of F. incerta. The neoniger workers, however, resented the intrusion and frequently seized the legs and antennae of the queens, though they soon released their hold. The queens thus liberated often escaped from the nest and hid under stones near it or even in unfrequented nooks in the superficial chambers of the nest itself. On several occasions we saw a queen seize a neoniger worker, carry it out of the nest and release it uninjured. One queen was seen to snatch up a worker cocoon, carry it out of the nest and conceal it under an adjacent pebble. This is very suggestive of the behavior of the young Formica sanguinea queen that has entered a nest of F. fusca, but though it undeniably shows an interest on the part of the subumbraeus queen in the neoniger brood, her method of colony formation is not that of F. sanguinea, for we soon discovered a depauperate neoniger colony which had undoubtedly adopted a subumbraeus queen. The latter was moving to and fro very slowly and amicably in the midst of several neoniger workers and their cocoons in a small recess under a stone. The ants were watched for some time and behaved precisely like members of a single colony. That the queens are nevertheless occasionally treated much more severely by the neoniger workers, is apparent from the fact that we found a few recently killed and one partially eaten in the superficial chambers of some of the nests.

July 9. Visited another rocky slope and an adjoining pine forest about a mile east of Cloudcroft and two miles from the locality of yesterday's observations. Under the stones covering neoniger and sitkaënsis nests there were many deïlated subumbraeus queens eagerly seeking adoption. The following three colonies showed clearly that some of the queens had been or were being accepted:

1. A populous sitkaënsis colony under several large contiguous stones among the pines. The superficial galleries of the nest were filled with workers and worker, male and female cocoons nearly
ready to hatch. Under two of the stones a couple of *subumbratus* queens was found, each lurking quietly in a little cavity at the edge of a mass of cocoons nearly filling a large, shallow superficial chamber.

2. A similar but even larger *sitkaënsis* nest, also under a pile of stones, under three of which *subumbratus* queens were found. One of the queens was in a small cavity at the edge of a heap of cocoons while each of the others was resting on the very center of a collection of cocoons nearly as large as my palm. These queens had certainly been adopted and the picture presented was precisely like that of the recently adopted *Formica consocians* queens mounted on the cocoons and surrounded and fondled by the workers of *F. incerta* (Wheeler 1906). When the nest was disturbed the queens hurried into the galleries and disappeared in the soil. They had evidently become strongly negatively heliotactic, unlike queens that are still running about on the soil immediately after the marriage flight.

3. A fine *sitkaënsis* nest under a single large stone among the pines had an adopted *subumbratus* queen surrounded by dozens of workers in the center of a pile of worker and female cocoons nearly as large as my hand. She quickly slipped into a burrow and was only recovered by digging down into the soil to a depth of more than six inches. In this nest a few of the female *sitkaënsis* pupae were naked, *i.e.*, not enclosed in cocoons.

Further search in the same locality brought to light two mixed colonies consisting of *subumbratus* and *sitkaënsis* workers. I failed to find the queens of the former species, which were probably present but hiding deep in the soil. The failure to find them is not surprising as one very rarely secures the mother queen of a fully developed colony of any of our species of *Lasius* without extensive and very careful excavation of the nest.

The foregoing observations show that the *subumbratus* queen has to acquire the brood odor of the host before she can be accepted. She therefore lurks very near the cocoons in a small earthen cavity and somewhat later, in the early stage of adoption, like *Formica consocians*, takes up a position on the brood. This renders her immune to attack by the host workers and gradually accustoms them to her presence. That adoption can be secured in very populous and flourishing colonies of *sitkaënsis* is shown by the
observations of July 9. Nevertheless these observations throw no light on three interesting problems, which may be briefly considered:

1. The first problem relates to the elimination of the host queen, evidently a conditio sine qua non of successful colony formation by such temporary social parasites as subumbratus. The elimination is supposed to be effected in one of three ways: Either adoption succeeds only in host colonies that have already lost their rightful queen through death by accident or old age, or the queen is killed by her own workers after and because the young parasitic queen has secured their allegiance, or the latter assassinates the host queen. The first hypothesis seems to be supported by the above described adoption of a subumbratus queen in a depauperate colony of neoniger, although it is by no means certain that this colony was queenless. The large sitkaënsis colonies containing recently adopted subumbratus queens, however, would seem to support the second or third hypothesis. In regard to this problem in the European umbratus, Donisthorpe (1915) says: "No cases are known of the host queen and the parasite living together in a nest, so unless a female can only be adopted by a queenless colony, it must sometimes happen that a female is accepted by a colony already possessing a queen of its own species. In such a case the intruder must either kill the rightful queen herself, as the female of (non-British) Bothriomyrmex kills the queen of her host Tapinoma or the workers of the host species must themselves assassinate their own queen, as do the workers of Tetramorium caespitum when they have accepted a female Anergates atratulus." He adds, however, that "Crawley confined several queens of umbrata with queens of nigra and the latter were always killed by the former, which although a little the smaller, is stronger and possesses more powerful mandibles." It seems to me that the morphological peculiarities suggested by Donisthorpe, namely the much broader and larger head and stronger mandibles so characteristic of the female of all umbratus forms as compared with the same sex of nigra, indicate very clearly that the parasite actually decapitates the host queen in much the same manner as Bothriomyrmex decapitans was seen by Santschi (1906) to decapitate the Tapinoma erraticum queen and the queen Wheeleriella santschii, the queen of Monomorium solomonis (Forel 1906).
2. The fact that one of the *sitkaënsis* colonies observed July 9 contained two fully adopted *subumbratus* queens and one on the verge of adoption suggests the question as to whether all three queens would survive as mothers of the compound colony or whether two of them would be subsequently eliminated. This question can, of course, be answered only by further investigation. But as the various species of the genus *Lasius* hitherto observed are decidedly haplometrotic it seems probable that at least in the majority of cases of adoption of several *subumbratus* queens by a *sitkaënsis* or *neoniger* colony, the number must be subsequently reduced to unity either by combats among the queens or by the regulatory intervention of the workers.

3. My field observations leave some doubt as to whether *sitkaënsis* or *neoniger* is the true, or normal host of *subumbratus*. Indirect evidence, however, points to the former variety, since the queens and workers of *subumbratus* are much more like the corresponding phases of *sitkaënsis* in size and coloration and since pure adult colonies of these forms prefer the same shady environment and have the same hypogeeic habits. Reiff’s Nova Scotia specimens of *subumbratus* queens from *sitkaënsis* nests may also be cited in this connection. *L. neoniger*, therefore, would be an unusual or perhaps recently acquired host, and the conditions would be comparable to those of the typical European *umbratus*, whose normal host is the typical *niger*, though it is occasionally parasitic, as Donisthorpe has shown (1915), on the subspecies *alienus*, the normal host of *mixtus*.

The rather large number of observed cases of adoption of *subumbratus* seems to indicate that the queen of this subspecies is specially favored as compared with the queens of some other temporary social parasites (*e.g.* *Formica rufa* and *truncecola*) by the possession of peculiar myrmecophilous characters (trichomes, exudate organs). I believe that the beautiful golden yellow color and pilosity of the *subumbratus* queen, which make it resemble the queens of *Formica consocians*, *ciliata*, *criniventris* and *areas*, the smaller stature and the delicate odor may be designated as such characters. In this connection I may call attention to the queen of *Lasius crinitus*, long ago described by Frederick Smith from Cashmir, as being in all probability a temporary social parasite on *L. niger* or one of its varieties. I have recently seen a few queens
of crinitus from Sikkim and was struck by their remarkable resemblance in color and pilosity to the queens of the Colorado F. ciliata. The source of the delicate odor of subumbratus, of the strong, lemon-verbena odor of our North American Lasius of the subgenus Acanthomyops and of the peculiar pungent, sweetish odor of the Eurasian fuliginosus, is worthy of further investigation. Meinert and Bönner believe that in umbratus and fuliginosus it comes from the salivary glands. Forel had previously traced it to the head as this portion of the body when crushed emitted a more violent aroma than the thorax and gaster. I have been under the impression that it might originate in the epinotal glands. Since it is so powerful and pervasive that it even saturates the walls of the nest a renewed and careful investigation may be required before its precise source in the body of the insect is known.

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NOTES ON THE MARRIAGE FLIGHTS OF SOME SONORAN ANTS.

By William Morton Wheeler.

Myrmecological literature contains many accounts of the marriage-flight of ants, but in nearly all cases the descriptions are fragmentary, owing to the complexity of the phenomena, the great area over which they occur and the obstacles, such as forests, hills or buildings which in most localities interfere more or less with observation. Moreover, the actual mating of the males and females often takes place high in the air or even at night, so that one is apprised of the occurrence of a flight only by finding the recently fecundated and dealated queens running about on the ground. The following observations made during the past summer near Cloudcroft, N. M., and later while I was accompanying the Cornell Biological Expedition across the deserts of southern Arizona, are in some respects as incomplete as others which have been published, but since they illustrate interesting peculiarities in the behavior of a few of the more conspicuous ants of the Sonoran region, it seems advisable to record them.

1. Liometopum apiculatum Mayr.

This ant, which has huge females and males, out of all proportion to the small workers, is peculiar to the live-oak zone, or "encinal" of the dry mountains of Texas, New Mexico, Arizona and Colorado and therefore does not live at altitudes above 6,000-7,000 feet. At the latter altitude near Wooten, in the Sacramento Mountains of New Mexico, I found it to be very scarce. Undoubtedly it is abundant at lower elevations in the same range. During the marriage flight, however, the males and females are carried by air-currents to considerably greater altitudes. July 3, while walking down Haine's Canyon, a few miles from Cloudcroft, I saw numerous males of *apiculatum*, which had fallen on the road at altitudes between 8,000 and 8,500 feet. As some of them were still alive the marriage flight of the species must have occurred on this or the preceding day. They were being rapidly dragged away as food by foraging *Formica fusca* workers. July 5, near Russia, at an altitude of 9,400 feet, I detected four dealated *apiculatum* queens, each in a small cavity under a stone. All of them were dead and
more or less decomposed, showing that they had been wafted to this altitude the previous summer and had perished, probably from cold, while endeavoring to found colonies. These observations strengthen Forel's and my contention that in mountainous regions queen ants are often borne up by air-currents to elevations at which the physical conditions will not permit them to establish the species. It is very probable that this process continues year after year and that it may constitute an appreciable drain on certain ant-populations at lower altitudes.


July 29 we visited the ancient ruins of Casa Grande, nine miles south of Florence, Ariz. In the rooms on the ground-floor of the three-storied portion of the structure still standing we found vast numbers of males and females of *Pogonomyrmex barbatus rugosus*, only a small portion of which were still living. The marriage flight of these large ants must have occurred a day or two previously, and the swarms, for some reason, had entered the low, narrow doorways of the ruin and accumulated on the floor in such masses that several bushels could have been collected.


At Tempe, Ariz., the marriage flight of this ant took place at 5 p. m., July 31, nearly a month later than the flights I observed many years ago in Central Texas. Thousands of males and females issued from the large, flat nests in the irrigated fields about the town and soon disappeared in the cloudless sky. On the following day, August 1, the fecundated females were seen in great numbers digging their craters in the soil. They preferred the damp margins of the puddles left by recent rains and the banks of the irrigating ditches. So numerous were the little craters that their peripheries were often in contact. The females were busily bringing up the moist earth in their psammophores as pellets one-eighth of an inch in diameter and depositing them near the orifice of the eccentric burrow.


Near Deming, N. M., I witnessed the marriage flight of this ant at 10 a. m., July 12. The black males were flying rapidly to
and fro about the branches of a few small lote bushes (*Zizyphus lycioides*) in the open desert, in precisely the same manner as I have seen the males of *Prenolepis imparis* dancing about the Japanese barberry bushes in April in the Arnold Arboretum, near Boston. The winged females of *imberbiculus* were far from numerous and were found running on the ground near the lote bushes. Mating was not observed.

5. *Atta (Moellerius) versicolor* Pergande.

The marriage flight of this fungus-growing ant is very different from that of any ant I have observed, and was witnessed under unusually favorable conditions. We had left our camp July 30 about 30 miles north of Florence, Ariz., and were crossing the desert on our way to Phoenix. The air was very still and clear after a heavy rain on the preceding day. At 5.50 a. m., just after sunrise, we entered a region several miles in extent where the marriage flight of *Atta versicolor* was in full swing. The ants were aggregated in numerous sharply defined swarms, each of which was egg-shaped or elliptical, about six to ten feet long and three to four feet broad, stationary some twenty to thirty feet above and with its long axis perpendicular to the surface of the earth. In some places the swarms were only about forty or fifty feet apart but more frequently the distance between them was fully a hundred feet or as many yards. As far as the eye could see over the desert similar swarms could be discerned. Within each swarm the large dark brown males and females were darting about in vertiginous, zigzag flight. Closer examination showed that each swarm was constantly receiving single males and females flying straight to it from a distance, but it did not grow in size because pairs of ants *in copula* were constantly raining down to the ground from its lower extremity, so that under each swarm there was a dense layer, often a yard or more in diameter, of writhing and struggling ants. One of the swarms happened to be poised above a puddle of water so that the surface of the latter became black with the fallen pairs. We rode for fully half an hour through these swarms, which must have comprised hundreds of thousands of ants. The activity of the insects was truly surprising, for the workers of *versicolor* are sedate and slow-moving like all other *Atti*. The whole phenomenon was rendered remarkably clear and striking
by the large size and dark color of the ants and their wings, the stillness and purity of the air and the unobstructed view over the level desert. Unfortunately our haste to reach Phoenix before night and the prospect of a very muddy road ahead, made it impossible to stop and observe the conclusion of the flight and the subsequent behavior of the versicolor queens. On previous visits to Arizona I had found the species in the neighborhood of Benson, Tucson and Yucca. The past summer I took it also near Oracle in the Santa Catalina Mountains, near Casa Grande and a few miles from Texas Pass on the western slopes of the Dragoon Mountains. In all these localities the colonies are sporadic and by no means abundant so that it is difficult to account for the vast number of males and females engaged in the flight described above, unless we assume that they represented the entire annual sexual output of a large number of colonies distributed over a very extensive territory.

THE PLEOMETROSIS OF MYRMECOCYSTUS.

By William Morton Wheeler.

It has long been known that the colonies of some species of ants never possess more than a single fertile queen, whereas in other species several such queens are normally present. Wasmann has recently named the former condition "haplometrosis," the latter "pleometrosis." Among North American ants the species of Camponotus, Polyergus, Pogonomyrmex, Aphiogaster and Lasius are normally haplometrotic, whereas the species of Formica, Tapinoma, Crematogaster, Pheidole, Monomorium and Myrmica are pleometrotic. This condition undoubtedly arises in most colonies secondarily from a primitive haplometrosis through the dealation and adoption of one or more daughter queens. Large colonies of Formica obscuriventris, e. g., often contain a number of daughter queens in various stages of dealation. The number of queens thus accumulated in some colonies is considerable. I have counted more than thirty in a single medium-sized colony of the typical F. fusca, and a single mound of F. exsectoides may contain nearly

1These terms are equivalent to "monogyny" and "polygyny" employed by students of the social wasps, though somewhat more expressive as they call attention to the maternal or nursing activities.
or quite as many. Occasionally, however, the pleometrosis is primary. In other words, two or more queens may establish a colony together. Forel, Bönner and I have found cases in which two queens of the European *Lasius flavus* were starting a colony in the same small cavity under a stone. Donisthorpe has seen three and Crawley and Wasmann four queens of this species in similar association. On two or three occasions I have also seen twin queens of our North American *L. brevicornis* with young brood under a stone. In some of these cases the colony undoubt-edly becomes secondarily haplometrotic by one queen killing the other or by the colony splitting into two, each with its own queen. According to von Buttel-Reepen, Mrázek and Crawley, this seems to be regularly the case with *L. niger*, when two or more queens are constrained to found a colony together in an artificial nest.

The following observation, made during the past summer while I was with the Cornell Biological Expedition, throws some additional light on primary pleometrosis. On July 29 the heaviest rain in six years fell in Phoenix, Ariz., and temporarily inundated parts of the desert south of that city in the neighborhood of Higley. On July 30 we left our camp about 30 miles north of Florence and proceeded along the road to Phoenix over soil which had been drenched by this rain, with the result that our three motor cars were repeatedly stuck in the mud. While the younger and lustier members of the party were extricating our cars and two others which had been stalled all night in deep puddles, I took advantage of the delay to study the ants along the roadside. Many colonies of various species, whose nests had been inundated, were moving to drier ground. My attention was especially attracted by dozens of incipient nests of *Myrmecocystus melliger* Forel subsp. *mimicus* Wheeler. The large reddish queens had evidently celebrated their nuptial flight immediately after the storm and were now busily digging into the wet adobe soil, making small craters about two inches in diameter with eccentric opening. The wall of the craters consisted of small pellets about one-eighth of an inch in diameter, evidently carried up in the psammophore, or crate of peculiar stiff hairs with which the gular surface of the head is furnished in these ants. On seizing a queen just as she was carrying out and dropping her pellet on the wall of the crater I was surprised to see
another queen leave the entrance with a similar burden. This led me to examine some twenty nests—all, in fact, that I had time to excavate before I was obliged to proceed with the party. My rather hurried observations showed that about half of the craters had been established by single queens but that the others were each the work of two cooperating queens. One crater actually contained five queens, four dealated and one with intact wings! It appears, therefore, that about 50 per cent. of the colonies of mimicus are pleometrotic in origin. That they probably remain so is indicated by the fact that on former excursions in Arizona I have on several occasions taken more than one dealated queen from a single adult colony of this ant.

The foregoing observation is of interest to the myrmecologist, because the mimicus queens were actively cooperating in the construction of a single nest as if they had been so many workers, whereas in the rare cases of Lasius flavus and brevicornis above cited the consociation of two queens may be interpreted as due to an accidental meeting under the same stone just after the marriage flight. Of course, it is very probable that in all the cases the queens in the same nest were sisters that had met after fecundation, since queens from different maternal nests would hardly work together so harmoniously. Nevertheless, the very high percentage of cases of primary pleometrosis in mimicus points to the existence in this ant of a pronounced tendency for recently fecundated sisters to assemble in pairs or even greater numbers for the purpose of founding and developing a colony in common.

THE DISTRIBUTION OF THE NOSE FLY AND OTHER SPECIES OF GASTROPHILUS IN THE UNITED STATES.1

By F. C. Bishop,
Bureau of Entomology, Dallas, Texas.

The distribution of the species of bot flies in the United States is a question which has been much neglected. Each is of considerable importance to stock raisers and farmers in this country and

1 Published by permission of the Chief of the Bureau of Entomology.
it seems strange that more facts regarding their introduction, spread and local and seasonal abundance have not been recorded.

The common horse bot or nit fly, *Gastrophilus intestinalis* De Geer, on account of its abundance and comparatively slow flight, has been most readily observed and most frequently mentioned in literature. It was undoubtedly introduced into this country many years ago and has become widely spread throughout the United States. We have records of its occurrence in nearly all parts of the country though it seems to vary much in local abundance. At high elevations it seems to be rare.

The chin fly, *G. nasalis* L., also appears to be well distributed over the United States. We have rather clear records of its occurrence in practically all states from Texas to North Dakota and from New York to California; also in the western part of Canada. It occurs, no doubt, in the eastern part of Canada, and in the eastern states of the Union.

The nose fly, *G. hemorrhoidalis* L., is undoubtedly the most important economic species of the three when it is present in abun-
dance, due to the worriment caused by the adult during the period of oviposition.

The distribution of the nose fly was less known than the others until the work of the Bureau of Entomology on this pest was taken up three years ago. The common name which is generally used over the territory where it abounds and the scientific name of one of the other species (G. nasalis) has led to some confusion. It may be said that neither of these names are very appropriate as the eggs of G. hamorrhoidalis are laid on the lips and those of G. nasalis under the jaws. The last named species has received the vernacular names of "chin fly" or "throat bot fly." The employment of the common name "nose fly" for the former species seems to be justified by usage among farmers and the name "throat bot fly" is preferred for the latter on account of the egg-laying habits of the female and the habit of the larve of this species of attaching occasionally at least in the cospaghagus.

The early history of the occurrence of this species in the United States seems to be clouded. Lugger, in his second Minnesota Report (p. 242), records it positively from that state. The actual specimen upon which the statement is based is not in existence, however, according to Prof. C. W. Howard. Some seem to have accredited the species to Kentucky, based on Professor Garman's statements in the Kentucky Experiment Station Report of 1894, but he does not record the species from that state, and informs me he has never seen the fly there.

During the summer of 1914 the writer made preliminary inquiry into the distribution, history of spread, and the injuriousness of the nose fly in the north-central states, where it had been reported to the Bureau as a serious pest of horses. At that time the insect appeared to exist throughout the greater part of North and South Dakota, eastern Montana, and possibly to occur in limited numbers in western Minnesota. No effort was made to determine the exact limits of distribution. It is evident, however, that the species has been spreading southward and eastward, as shown by statements of numerous farmers more recently interrogated in different sections. While there is some disparity the statements agreed remarkably well as to the time of first appearance in a given community. In 1914 it appeared that the fly had become established south of the center of South Dakota only within the
preceding four or five years. In working northward and westward the dates set by farmers as the time of first appearance became earlier until Minot, N. D., was reached where a rather authoritative record was secured of the occurrence of the fly eighteen years before (1896).

During the spring of 1915 and 1916 Mr. W. E. Dove and the writer made further inquiry into the distribution of this insect in parts of South Dakota and Minnesota, and Mr. Dove was located in this region and made further inquiry regarding the history of the spread of the insect during the summers of 1915 and 1916. His work largely substantiated the earlier findings.

To supplement personal observations and questioning, a large number of letters of inquiry were sent to farmers and horse breeders in the region from Indiana to Washington, and Kansas to Canada. About 350 replies were received. One correspondent each in Colorado, Idaho, Utah and Oregon, and three in Washington replied that the nose fly is present, but there is reason to believe they were mistaken in the identity of the insect, except possibly two in eastern Washington. All reports from Indiana, Kansas and Missouri were negative. Three affirmative ones were received from Illinois and two from Wisconsin. While neither was corroborated with specimens it is practically certain that infestations, possibly more or less local, occur in these states. Montana and North and South Dakota are generally infested at this time and central western Minnesota, northern Nebraska and northeast Wyoming undoubtedly so. It appears from replies and personal examinations that the insect is more or less scattered over Iowa, but probably not numerous except in the northwest part.

In Canada we have learned through correspondents of the presence of the nose fly in southern Manitoba and Saskatchewan.

A very interesting discussion regarding the occurrence of the nose fly in Canada appeared in the Proceedings of the Entomological Society of Ontario for 1915. Professor Lochhead there presents extracts from some correspondence from men in western Canada. It is my opinion that these correspondents, except one from Ontario, refer especially to G. hemorrhoidalis although one sent in specimens of G. nasalis, which is much more easily caught.

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1Since this article was submitted for publication the localities in Wisconsin and Washington have been visited. The nose fly is well established in western Wisconsin but its presence in central Wisconsin and eastern Washington could not be verified.
This apparently led to some confusion as to the species concerned and the use of the term "nose fly" led to further confusion. It should be remembered that this vernacular name is applied with few exceptions to *G. hamorrhoidalis* by horse breeders and farmers. These men write of the presence of the insect in Alberta as well as Manitoba and Saskatchewan, and it probably occurs still farther west.

The dates of first appearance in the different sections as reported by correspondents agree quite well with what has been found by inquiry by Mr. Dove and the writer. The earliest date given was 1883, by a correspondent in western North Dakota, and a correspondent in central Montana (Fergus County) states that they were there in 1898, and another slightly farther west in Montana gives 1890 as the date of appearance. Wyoming and Minnesota seem to have been invaded during the last seven years, Nebraska within the past six years, Iowa about five years ago, and the other states more recently.

Just why *G. hamorrhoidalis* did not come into prominence as a pest of horses years ago it is difficult to tell. It seems almost certain that the species was brought into this country at an early date with shipments of horses from Europe. Failure to establish itself may have been due to conditions surrounding the imported animals after arrival here; such as adverse climatic conditions. It is possible that climate may have a marked influence on the perpetuation of the species in any region and that it will not thrive in the more humid area east of the present area of great abundance in the Dakotas. It is also barely possible that the species may have been present in parts of this country years ago and then became extinct or nearly so, but this is hardly plausible. Certainly our investigations indicate a comparatively recent establishment of the insect in the United States, and that the point of first establishment was in western North Dakota or eastern Montana, or possibly in southern Saskatchewan.

The habits of the insect indicate that its dissemination is largely brought about by the movement of horses. The long time which the larvae spend within the host and the rather extended period during which they normally leave the animal add to the danger of spread by shipping or driving horses from infested to uninfested territory. The great number of horses recently shipped from in-
fested regions to concentrating points from which they were trans- 
shipped to Europe for military purposes may have resulted in 
the establishment of other foci of infestation not now known. 
Increased activity at this time in the shipment of horses from the 
infested territory for use in our own cavalry and for agricultural 
purposes will no doubt give every opportunity for the insect to 
become widely established if some natural agencies do not prevent 
or steps are not taken to destroy the bots before horses are shipped. 
The accompanying map shows the probable present distribution 
of the species in the United States, and indicates the points where 
its presence has been observed by us or recorded by correspondents. 
The comparatively small number of large dots in North Dakota 
is explained by fewer circulars being sent there rather than by a 
smaller number of nose flies.

PRELIMINARY EXPERIMENTS WITH SODIUM FLU- 
ORIDE AND OTHER INSECTICIDES AGAINST 
BITING AND SUCKING LICE. 

By F. C. Bishopp and H. P. Wood, 
Bureau of Entomology, U. S. Department of Agriculture.

The very satisfactory results secured by the authors with the use 
of sodium fluoride against various species of biting lice (Mallo- 
phaga) on chickens and other domestic fowls has naturally has led 
to inquiry from many sources as to the effect of this compound on 
lice of cattle, horses, and other domestic animals. So it is thought 
advisable at this time to publish a few preliminary notes on the 
results of the use of this material and other insecticides against 
several species of Mallophaga and sucking lice on such hosts. A 
few experiments carried out during 1910 and 1912 indicated that 
the standard arsensical dip usually known as the B. A. I. formula 
(8 lbs. white arsenic, 24 lbs. sal soda, 1 gal. pine tar, to 500 gals. 
water) is a very effective insecticide against both the Mallophaga 
and Anoplura. In these tests it was found that one thorough spray- 
ing or dipping of cattle quite heavily infested with biting lice 
(Trichodectes scalaris Nitzsch), and the short-nosed ox louse 
(Hematopinus eurysternus Nitzsch) completely destroyed them in

1 See Farmers' Bulletin No. 801.
two treatments at weekly intervals. It was not ascertained, however, if one application would be sufficient.

More recent work included tests of a considerable number of insecticides. The results of the early tests with arsenical solution were completely borne out and it appeared that all forms of both the biting louse (\textit{T. scalaris}) and the long-nosed ox louse (\textit{Linognathus vituli} \textit{L.}) were destroyed with one dipping. In one experiment with arsenical solution of one-half the normal strength both adults, larvae, and eggs of \textit{T. scalaris} were destroyed. The use of this strength against the long-nosed ox louse did not accomplish complete destruction. The action of the arsenical solution against the biting lice was quite prompt, but the sucking lice were killed more slowly, as in the case of ticks.

All of our tests prove that the biting lice are quite susceptible to the action of caustic or poisonous substances. They seem to be killed uniformly more easily and quickly than the sucking species. In a series of experiments against the biting lice of cattle the following substances were used in addition to arsenical dip: Kerosene emulsion (2 gals. kerosene, \(\frac{1}{2}\) lb. laundry soap, 1 gal. water, reduced 1 to 8 and 1 to 12); flowers of sulphur (\(\frac{1}{2}\) lb. per animal); 40 per cent. nicotine sulphate (1 to 800); soap and water (1 oz. per gal.); sodium fluoride (commercial, 90 to 98 per cent.) as dust and dip. All of these substances, with the exception of the soap and water, killed all stages. The soap and water destroyed everything but the eggs, which hatched successfully.

The sodium fluoride (97 to 98 per cent.) was used as a spray at the rate of one ounce and also one-half ounce per gallon. In both of these strengths all stages were promptly destroyed. When applied as a dust the material was put on with flour in the proportion of one ounce to five ounces of flour, six ounces of this mixture being used on a yearling. Three ounces of sodium fluoride were applied to an animal with a shaker and the material worked into the hair, and in another test one ounce was applied with a bellows dust gun. In each of these tests the destruction was complete.

A number of experiments were also conducted with the use of sodium fluoride against the biting dog louse (\textit{Trichodectes latus} \textit{Nitzsch}). Some of the animals treated were very heavily infested and covered with sores evidently caused by the presence of the lice. In some tests the material was applied by hand with a dust can,
about one ounce being used to each animal, and in others it was applied as a dip, the sodium fluoride being dissolved in water at the rate of one ounce to the gallon. In all of these tests the destruction was complete and the lesions promptly healed.

Experiments conducted thus far with sodium fluoride clearly show its efficacy in the case of Mallophaga on domestic animals. Owing to the comparatively high price of the substance (about 50 cents per pound) it is inadvisable to recommend its use in the form of a dip for large animals as other equally effective dips which are much cheaper may be used. The tests indicate, however, that the substance may be very useful for the winter treatment of animals, especially in the northern states where dipping during the cold weather is impractical. Attention also should be called to the fact that infestations are normally heaviest during the winter and spring months, just at a time when the practice of dipping might be dangerous. The application of sodium fluoride with a dust gun is not laborious, and since it appears that only about one ounce of material per animal is necessary the treatment would not be expensive. Our preliminary tests also indicate that if all animals in a herd are treated at one time in this way, one application will be sufficient. Although we have found that lice may live from 7 to 15 days when removed from the host it appears that under usual circumstances sodium fluoride is retained in the hair for sufficient length of time to destroy any lice which may happen to return to the host.

While there appears to be some possibilities in the use of sodium fluoride against sucking lice the experiments thus far conducted indicate that it can not be relied upon for use against any of the members of this order.
GEOMETRID NOTES.

By L. W. Swett, Boston, Mass.

I am convinced, after a careful study of the genitalia, that the American form of Eucymatoge, now listed as Horisme vitalbata, D. & S., is distinct from the European. I have received a number of specimens, of the American form of vitalbata through Mr. Wolley Dod from Calgary, Alberta, and of the European through Dr. Bastelberger and I can find only very slight external differences. The American form of vitalbata seems to have the yellow band of primaries, more of a grayish cast, where the European is a deep yellow. Also the band of the primaries seems narrower than the European and at the apex is more clouded. It is very hard to draw any definite characters for separating them except on the genitalia which prove most distinct and so would list the American form as a race, if not later may turn out to be a good species.

Horisme vitalbata D. & S. var. incana nov.

The valvæ are narrower and longer than the European vitalbata and the saccus is most distinct, being bifurcate at tip. It resembles slightly the shape of a boy's mitten, with the thumb projecting at an angle. In the European vitalbata this process is rounded with but a single jointed projection. Also the penis of the American form is thicker than the European and the cædeagus is spined in the middle, which is lacking in vitalbata. The tip of the penis is bulbous with short spines apparently knobbed at the base, and the vesica has wide and long cornuti. The saccus is broad and rounded. The ductus bursa of the female genitalia has three elongated patches from which long stout spines protrude. At the junction of the neck or ductus bursa and the bag or bursa there is a row of very stout spines projecting at all angles. The bursa is instrate or covered with fine spines not heavy and thick as in vitalbata. The edge of the bursa in vitalbata is surrounded with heavy spines, where in incana they are not any thicker than in the other sections. The true vitalbata D. & S. may possibly occur in North America as our material at present is so limited, so I have listed the American form as a race until we know more about
the life-histories. It is evident from my study of the genitalia that we need large series of specimens, field notes and life-histories before we can list forms, races or species on our present scanty knowledge, as at present it is more or less individual opinion. I have made the male, from which I prepared my best slide, as the type, in case the true vitalbata D. & S. should occur in North America.

Expanse 27-29 mm.

Holotype ♂ — VI — 5, 1914, Calgary, Alberta, from Mr. Wolley Dod.

Allotype ♀ — VI — 26, 1907, Calgary, Alberta, from Mr. Wolley Dod.

Paratype ♀ — VI — 26, 1914, Calgary, Alberta, from Mr. Wolley Dod.

All the above are in my collection.

NOTE ON THE ICHNEUMONID GENERA CYANO-CRYPTUS AND LAMPROCRYPTUS.

By CHARLES T. BRUES.

When collecting insects in the Peruvian Andes several years ago, I secured a large metallic blue Ichneumonid which proves to be the female of Cyanocryptus metallicus, a species described by Cameron in 1903 from a male specimen collected in Ecuador. Since then I have received through Dr. F. E. Lutz of the American Museum of Natural History a quite similar insect from Southern Patagonia apparently referable to Cameron’s genus Lamprocryptus, which can hardly be separated from Cyanocryptus.

Since the female of Cyanocryptus metallicus has not been described and as there is some confusion concerning the name Lamprocryptus, the following note is presented.

Cyanocryptus Cameron.

The Entomologist, Vol. 36, p. 121 (1903).

Type: C. metallicus Cameron.
Cyanocryptus metallicus Cameron

The Entomologist, Vol. 36, p. 121 (1903) (♂).

Female. Length 19 mm., ovipositor 10 mm. Brilliant metallic blue; head and thorax with purplish reflections, especially on the cheeks and propodeum; first two segments of abdomen strongly purplish; remaining ones bluish; antennae black with a white annulus from the middle of the second flagellar joint to the tip of the ninth, the second and basal half of the third black above. Tarsi, palpi, mandibles, and ovipositor with its sheaths black; four anterior tibiae dark brown, with but little metallic color. Wings black, with brilliant blue and purple reflections. Antennae slender, tapering; first flagellar joint four times as long as thick; second and third but little shorter; fourth half as long as the first, fifth and sixth each slightly shorter. Propodeum coarsely reticulated, with well developed, but not large lateral teeth; without complete transverse carinae, but with the anterior one indicated medially as a short curved ridge bent forward at the middle where it is contiguous to a very small basal area. Abdomen shining, microscopically roughened and punctulate but not sufficiently so to render its surface opaque. Transverse median vein almost interstitial with the basal vein, the submedian cell barely longer.

Aside from the position of the transverse median vein which Cameron describes as "not interstitial" and the abdomen which is "shining, impunctate" in the male there are no conspicuous differences between the sexes. The female I took near Matucana, Peru at an altitude of 7,500 feet. The male type from Ecuador was taken at between 7,000 and 8,000 feet altitude. This insect is evidently common in the Peruvian Andes as I saw numerous specimens in Professor Townsend’s collection taken by him in the same part of Peru.

Lamprocryptus Schmiedeknecht.

Schmiedeknecht, Gen. Insect. fasc. 75, p. 11, pl. 1, fig. 7, pl. II, fig. 5 (1908) (six species described).

Type: L. gracilis Schmiedeknecht.
**Lamprocryptus Cameron.**


Type: *L. kinbergi* Holmgren.

Schmiedeknecht first used the name in 1904 in his Opuscula Ichneumonologica without designating any type. In the Genera Insectorum (1909) he again lists "Lamprocryptus nov. gen." and describes six species, one of which has been designated as the genotype by Viereck who dates the genus from 1904.

Cameron used the name in December 1909 and refers to the generic key in Schmiedeknecht's 1904 paper, but through a peculiar lapsus attaches the name Lamprocryptus to his new genus. As Cameron's genus hardly seems distinct from Cyanocryptus it appears unnecessary at the present time to propose a new name.

Several South American species, including the new one described below, may be tentatively placed in Cyanocryptus, as follows.


*C. kinbergi* Holmgren (type of Lamprocryptus Cameron). Eugenias Resa, Ins., p. 397 (1868) Argentina.


*C. fulgidus* sp. nov. South Patagonia.

**Cyanocryptus fulgidus** sp. nov.

Female. - Length 11 mm., ovipositor 6 mm. Brilliant metallic blue with violaceous reflections, the latter most noticeable on the head, upper surface of thorax and on the first three segments of abdomen; antennae black, without annulus; hind femora and tibiae bright ferruginous; front femora beneath and their tibiae entirely ferruginous; middle tibiae dull ferruginous; all tarsi black, the trochanters and the four anterior femora with the metallic reflections much less pronounced than on the body. Wings deeply infuscated, but not black. Head seen from above strongly emarginate both on the front and the occiput, the paired ocelli widely separated, farther from one another than from the eye margin. Face strongly convex medially, with a sharp depression on each side next to the eye below the insertion of the an-
tenna, face rather finely and closely striato-punctate medially, more sparsely and coarsely punctate laterally; clypeus strongly convex, with a few large punctures; front reticulate medially to the ocelli, on the sides smooth and almost impunctate as are also the back of head and cheeks. Malar space one-third as long as the eye, not grooved, but with finely sculptured band from the eye to the mandible. Antennae 50-jointed, slender and tapering, not distinctly thickened medially; first, second and third flagellar joints gradually shorter, the third three times as long as thick and as long as the two following together; following all distinctly wider than long. Mesonotum polished, with a few scattered punctures on the anterior half, those on the median lobe closer together and elongated to form a semi-striate sculpture; parapsidal furrows strong on anterior half, entirely absent behind. Scutellum strongly convex, with a deep impression at base that is bounded by high lateral carinæ and bears a series of square foveæ at its bottom. Propodeum coarsely irregularly rugose- reticulate, with large flattened teeth at the posterior angles; anterior transverse carina very weak, but complete; posterior slope deeply concave, the concavity extending above the lateral spines; viewed from the side the declivity is almost as long as the dorsal surface and nearly perpendicular. Propleuræ almost smooth at top, elsewhere coarsely more or less horizontally wrinkled; mesopleura with a shining callosity at its upper posterior angle and a series of oblique wrinkles along the posterior edge, elsewhere irregularly rugose-reticulate, as are also the metapleuræ and sides of the propodeum. Abdomen entirely smooth, impunctate and without trace of aciculations or other fine sculpture. Petiole sharply bent, strongly expanded at tip, with a complete carina passing through the spiracles and a large crescentic impression above each spiracle. Second segment with a curved impressed line on each side below the spiracle and a less distinct one passing through the spiracle. Tarsi and middle tibiae strongly spinulose. Areolet large, its sides weakly convergent above; radial cell short and narrow; submedian cell barely shorter than the median; discocubital vein simple; cubital vein entirely wanting beyond the areolet, transverse median vein in hind wing broken near lower third.
Type: South Patagonia, B. Brown; in the American Museum of Natural History.

The following key will serve to separate the species of this group:
1. Antennae annulate with white .......................................... 2
   Antennae not annulate ........................................... fulgidos sp. nov.
2. Legs entirely black ................................................. metallicus Cam.
   Legs partly ferruginous or rufous ............................... 3
3. Abdomen minutely transversely aciculate ...................... 4
   Abdomen polished, without any sculpture, chalybeus Tasch.
   "Mesonotum densely, somewhat longitudinally, striate punctate" .......................... sericeous Tasch.

NOTE ON THE ADULT HABITS OF SOME HYMENOPTEROUS EGG-PARASITES OF ORTHOPTERA AND MANTOIDEA.

By Charles T. Brues,

Bussey Institution, Harvard University.

In a recent number of the Bulletin de la Société Entomologique de France Dr. Ét. Rabaud has called attention to an omission in a recent paper of my own, in which I failed to cite some observations of similar nature by French naturalists. In this paper I described an Indian Scelionid which attaches itself to the body of a locust and suggested that it probably had adopted this method of finding the eggs of locusts, upon which members of allied genera are known to be parasitic.

As Dr. Rabaud has assumed a rather critical attitude, I think it worth while to review the matter briefly. In the first place I must admit that I was unfamiliar with the observations of Xambeu at the time of writing my previous note, although they were soon afterward called to my attention by Mr. Nathan Banks who cited them some years ago. In the same paper, Banks gives another

1 1917, No. 10, p. 178, May 1917.
reference\(^1\) that was missed by both Dr. Rabaud and myself, in which a locust (\textit{Dichromorpha viridis}) was found by W. V. Warner bearing adults of a species of Scelio.

Rabaud unfortunately refers to the Lepidoscelio which I described (\textit{loc. cit.}) as a Chalcidid. It is a member of the Scelionidae, belonging to the Serphoidea (\textit{Proctotrypoidea}), an entirely different group of Hymenoptera, although the work of Xambeu, Giard, and Bordage is correctly stated as relating to Chalcidids. This phenomenon of phoresy thus appears in members of both the Chalcidoidea and Serphoidea. Rabaud is also wrong in thinking that I put forth as new either the fact that adult Scelionids attach themselves to Orthoptera, or the hypothesis that they locate the eggs of the host in this way. On page 137 of my paper I have quoted both the fact and the hypothesis as previously published by Ashmead in 1893: the text is absolutely clear on this point.

As the tiny species which has caused so much discussion has not before been figured I take this opportunity to add a drawing of it kindly made by Mrs. Brues.

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Offered for cash, but exchange preferred. Fitch and early Illinois reports; Insect Life; Harris's Insect; many others.—J. E. Hallinen, Cooperton, Okla.

Histeridæ. North American Histeridæ identified or unidentified, desired in exchange for beetles of other families. F. G. Carnochan, Bussey Institution, Forest Hills, Massachusetts.

Hemiptera-Heteroptera. I desire specimens of this group from all regions, especially New England. I will give in exchange species of this and other orders (except Lepidoptera), and will identify New England material. Correspondence desired.—H. M. Parsley, Smith College, Northampton, Mass.

Wanted: Psyche, Vol. IX, No. 300 (April, 1901). Address, giving price, Librarian, Stanford University, Cal.

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 Cremastochilæ of the world. Will give cash or Coleoptera, Hymenoptera and Diptera from the United States.—Wm. M. Mann, Bussey Institution, Forest Hills, Boston, Mass.

Want to correspond with collectors of Noctidæ in Northern Massachusetts. Subject to supply will pay any reasonable price for good specimens Catocela Sappho.—Howard L. Clark, P. O. Box 1142, Providence, R. I.

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

Wanted: Insects of the family Embiidae (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.

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

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INDEX TO VOL. XXIV. 1917.

INDEX TO AUTHORS.

Banks, N. Notes on Some New Species of the Genus Dioctria (Asilidae), 117.
Barber, H. G. Synoptic Keys to the Lygaeidae (Hemiptera) of the United States, 128.
Bishop, F. C. The Distribution of the Nose-fly and Other Species of Gastrophilus in the United States, 182.
Bishop, F. C., and H. P. Wood. Preliminary Experiments with Sodium Fluoride and Other Insecticides against Biting and Sucking Lice, 187.
Cockerell, T. D. A. Arthropods in Burmese Amber, 40.
Cockerell, T. D. A. New Social Bees, 120.
Gibson, E. H. Key to the Species of Leptoglossus Guér. Occurring North of Mexico (Heteroptera: Coreidae), 69.
Girault, A. A. The North American Species of Pachyneuron with Three New Species (Chalcid-flies), 88.
Girault, A. A. New Miscellaneous Chalcid-flies from North America, 91.
Girault, A. A. A New Species of the Genus Mymar from the Woods of Maryland with an Important Descriptive Note, 99.
Girault, A. A. A Metallic Species of Cirrospilopsis from Maryland (Hymenoptera, Eulophidae), 100.
Howard, L. O. An Interesting Manuscript, 87.
Howe, R. H. Distributional Notes on New England Odonata, 45.
Hungerford, H. B. The Life-history of Mesoselia multisanti White, 73.
Ludlow, C. S. Cyclolepteron Theobald (Diptera: Culicidae), 53.
Marchand, W. The Specific Differences between Apanthes nais Drury, A. vittata Fabr. and A. phalerata Harris, 59.
Parshley, H. M. Note of Correction (Hemiptera), 164.
Shinji, G. O. Notes on Aphids, 84.
Smith, H. E. Notes on New England Tachinidae, with the Description of One New Genus and Two New Species, 54.
Smith, H. E. Five New Species of North American Tachinidae, 137.
Smith, H. S. The Habit of Leaf-oviposition among the Parasitic Hymenoptera, 63.
Swett, L. W. Geometrid Notes, 190.
Van Duzee, M. C. Descriptions of a Few New Diaphorus from the Western States (Diptera), 33.
Wheeler, W. M. A New Malayan Ant of the Genus Prodiscothyrea, 29.
Wheeler, W. M. Notes on the Marriage Flights of Some Sonoran Ants, 177.
INDEX

(Wheel, W. M. The Pleometrosis of Myrmecocystus, 180.
Wilcox, A. M. Notes on Rearing Insects for Experimental Purposes and Life-history Work, 7.

INDEX TO SUBJECTS.

(New genera, new species and new names in boldface type.)

**Abies balsamii**, aphids on, 86.
**Acalypha lillianis**, 14.
**Acanthomyops**, 175.
**Achrysocharella pulchrella** 94.
**Allophorocera montana** 140.
**Alveotingis**, 24.
**Alectotis grossocerata**, 20, 25.
**Amber fossils**, 40.
**Anaphoidea conotacheli**, 93.
**Anthocyanin in Pterocomma**, 30.
**Ants, marriage flights**, 177.
**Apanteis nais**, 58.
**Apanteis phalerata**, 58.
**Apanteis rufifrons**, 58.
**Apensia electrophila**, 44.
**Aphides**, 85.
**Aphixidae aspideridium**, 95.
**Aphids, notes on**, 84.
**Atoposomoidea opimae**, 95.
**Atta versicolor**, 179.
**Blattide, fossils in amber**, 40.
**Blepharipa scutelata**, 63.
**Bombus impexus**, 121.
**Bombus lapidarius**, 131.
**Bombus niveatus callophenax**, 122.
**Bombus terrestis fulcrinetus**, 121.
**Bombus terrestris similicvensis**, 121.
**Bombus tunicatus**, 121.
**Bothriomyrmex decapitans**, 173.
**Burmeze amber fossils**, 40.
**Camponotus carce**, 27.
**Camponotus carce brunii**, 29.
**Camponotus carce clarithorax**, 28.
**Camponotus carce fallax**, 27.
**Camponotus carce enemidatus**, 28.
**Camponotus carce decipiens**, 27.
**Camponotus carce discolor**, 28.
**Camponotus carce fallax**, 28.
**Camponotus carce nearticicus**, 28.
**Camponotus herceleanus ligniperda**, 28.
**Camponotus carce himalayanus**, 29.
**Camponotus carce kamehsis**, 29.
**Camponotus carce lameriei**, 29.
**Camponotus ligniperda pictus**, 27.
**Camponotus maculatus althiops**, 27.
**Camponotus marginatus**, 29.
**Camponotus marginatus nearticicus**, 29, 28.
**Camponotus minutus**, 28.
**Camponotus navari**, 29.
**Camponotus novacoboracensis**, 27.

**Camponotus parvis**, 28.
**Camponotus panceipilis**, 28.
**Camponotus pavidus**, 28.
**Camponotus quadrimontatus**, 29.
**Camponotus rufus**, 28.
**Camponotus ruszkii**, 29.
**Camponotus subhirtellus**, 28.
**Camponotus tanquaryi**, 28.
**Camponotus vitiferous**, 29.
**Cecidomyia betula**, parasite of, 93.
**Cecidomyiae** in amber, 40.
**Chetogwria monticola**, 63.
**Chaitophorus coleoptralis**, 86.
**Chalcid-flies from North America**, 91.
**Cheyletus burmicicus**, 41.
**Chionia, habits of**, 142.
**Chionia araneoides**, 142.
**Chionia crassipes**, 142.
**Chioniaセルta**, 143.
**Chionia califomica**, 142.
**Chrysoa, eggs parasitized by Perilampus**, 67.
**Cirrospilopsis metallicus**, 100.
**Closterocerus var**, 101.
**Correction to paper by H. M. Parshley**, 164.
**Compsilura concinna**, 57.
**Corythucha**, 13.
**Crapoidea inarticulatus**, parasite of, 93.
**Cricorhina intermedia**, 153.
**Cricorhina nigricrinitis**, 154.
**Cricorhina verticillata**, 154.
**Crossoceras siricoides**, 63.
**Cryptobates rugosissimus**, 43.
**Cynocryptus**, 191.
**Cynocryptus chalybeus**, 193.
**Cynocryptus fulgidus**, 193.
**Cynocryptus kineberri**, 193.
**Cynocryptus metallicus**, 191, 192.
**Cynocryptus sericus**, 193.
**Cycloleppteron**, 53.
**Dendroaspis fulginoas**, 168.
**Dermestes larvalis**, 43.
**Diprachus adustus**, 35.
**Diprachus californicus**, 33.
**Diprachus contigus**, 35.
**Diprachus gibbosus**, 36.
**Diprachus inornatus**, 38.
**Diprachus junctus**, 35.
**Diprachus lambellatus**, 34.
**Diprachus nudus**, 34.
Diaphorus opacus, 35.
Diaphorus snowii, 36.
Diaphorus sparsus, 36.
Diaphorus spectabilis, 37.
Diaphorus variabilis, 39.
Diaphorus vulsus, 39.
Dialaniopsis, 93, 100.
Dibraeys clisocampae, 92.
Dibraeys nigrocyaneum, 89.
Dioctria albicans, 117.
Dioctria brevis, 117.
Dioctria flavipes, 119.
Dioctria longicornis, 118.
Dioctria longicornis vari tibialis, 118.
Dioctria media, 118.
Dioctria pleuralis, 118.
Dioctria pasto, 119.
Dioctria rubidus, 119.
Dioctria sackenii, 119.
Elateridae, fossil in amber, 40.
Electrogaenus graeciplices, 41.
Empididae, fossil in amber, 40.
Encyrtus siphonophorae, 102
Enicocephalidae, fossil in amber, 40.
Enicocephalus spinicollis, 42.
Eohyria, 57.
Ephebomyrmez imberbiculus, 178.
Ephebeleia magnicornis, 63.
Epimexus platypus, 91.
Eutelus betulae, 93.
Eutelus salicis, 94.
Evanidiidae, fossil in amber, 40.
Exchange column, 31, 61, 103, 136, 165, 197.
Ezorista spinipennis, 58.
Ezoristoides slossonae, 58.
Fenestrella, 14.
Fenestrella aceata, 155.
Fir, aphids on, 86.
Formica atrata, 28.
Formica carphya, 26, 27.
Formica ligniperda, 26, 27.
Formica herculana, 26, 27.
Formica norvegica, 26.
Formica subsericea, 26, 27.
Formicinae subumbrae, habits, 167.
Fossil Arthropods, 49.
Galcatus peckhami, 15.
Gastrophilus homorrhoidalis, 182.
Gastrophilus intestinalis, 183.
Gastrophilus nasalis, 183.
Geometridae, notes on, 190.
Gonatocerus illinoiensis, 91.
Grotiusomyia flavicorne, 95.
Habrocytus onercati, 94.
Harmatopinus curvirostros, 187.
Hentz, manuscript of, 87.
Hesperotenis, 21.
Hesperoptingus antennata, 21.
Hesperoptingis antennata, var. borealis, 24.
Hesperoptingis fusca, 24.
Homoeonycha raper, 139.
Horisme vitalbata incana, 190.
Insect blood cells, growth in vitro, 1.
Lamprocyptus, 192.
Lampropohilus, fossil in amber, 49.
Lamprostatus canadensis, 96.
Lasius fuliginosus, 105.
Lasius saltans, 173.
Lasius umbrator, habits, 167.
Lasius subminor, habits, 167.
Leaf-oviposition in parasitic Hymenoptera, 63.
Lepidosaphes ulmi, parasites of, 95.
Lepidoscelio viatrix, 196.
Lepismatidae, fossil in amber, 40.
Leptohya rhodoleucri, 15.
Leptoglossus, key to North American species, 69.
Leptoglossus ashmeadi, 72.
Leptoglossus clypealis, 71.
Leptoglossus corculus, 71.
Leptoglossus fulvicornis, 70.
Leptoglossus gonagra, 72.
Leptoglossus occidentalis, 71.
Leptoglossus oppositus, 71.
Leptoglossus phyllogopus, 72.
Leptoglossus zonatus, 72.
Leptophya costata, 16.
Lice, control of, 187.
Linognathus sanguinis, 188.
Linometopum apiculatum, 177.
Lipeurus aberrans, 112.
Lipeurus baenulus, 109.
Lipeurus brevicephalus, 105.
Lipeurus bishoipi, 111.
Lipeurus clavatus, 113.
Lipeurus constrictus, 111.
Lipeurus crotophagine, 105.
Lipeurus diphtheroides, 112.
Lipeurus habreus, 104.
Lipeurus introductus, 115.
Lipeurus lineatus, 114.
Lipeurus macgregori, 106.
Lipeurus mississippiensis, 107.
Lipeurus picturatus, 106.
Lipeurus squallidus, 111.
Lipeurus stramineus, 108.
Lipeurus temporalis, 111.
Lipeurus texanus, 109.
Lipeurus toxoceros, 105.
Lipeurus variabilis, 114.
Lygus acrrips, 141.
Lyguside, synoptis key of genera, 128.
Index

Mallophaga, new North American, 105.
Marriage flights of ants, 177.
Masieera celer, 138.
Megorismus lastoofera, 97.
Megorismus poloni, 97.
Melanorhopola clavata, 17, 159.
Melanorhopola duryi, 17, 19, 159.
Melanorhopola infuscata, 19.
Melanorhopola stenos, 24.
Melanorhopala, key to species, 18.
Melanorhopola lurida, 18, 160.
Melanorhopola uniformis, 18, 160.
Mesorecta mulsanti, life-history of, 73.
Miscogaster obnornicola, 96.
Miscogaster biguttata, 97.
Miscogaster flora, 99.
Malleriuss versicolour, 179.
Monogony, 180.
Monomorium pharaonios, 26.
Monomorium solonises, 173.
Mosquitoes of America (review), 161.
Myrm cincinnati, 90.
Myrm lyndalli, 100.
Myrm cenustum, 99.
Myrmecocysts, habits, 180.
Myrmica cerasi, 26.
Myrmica moketa, 26.
Netcorisiphum rubico, 84.
Neomphaloides cincinnatus, 92.
Neomyrm, 100.
New England Odonata, 45.
Nose-fly, distribution in U. S., 182.
Odonata of New England, 45.
Olivier, copy of manuscript by, 87.
Orsillacias, 129.
Oviposition in parasitic Hymenoptera, 63.
Pachyneuron albiuitis, 88.
Pachyneuron allograpfa, 89.
Pachyneuron aliscuda, 89.
Pachyneuron anthomyia, 89.
Pachyneuron aphidivoros, 102.
Pachyneuron californicua, 90.
Pachyneuron hammari, 89.
Pachyneuron maidaphids, 102.
Pachyneuron micarea, 102.
Pachyneuron nigrocyanum, 88.
Pachyneuron siphonophora, 90.
Pachyneuron syphii, 88.
Pachyneuron texanum, 90.
Pachyneuron virginicu, 89, 90.
Paleocampa, 41.
Pales parida, 63.
Parasitic Hymenoptera, habit of leaf-oviposition, 63.
Parshley, corrections to paper by, 104.

Pelatachimia pellucida, 57.
Perilampus crysope, oviposition of, 66.
Perilampus hyalinus, oviposition of, 64.
Phoresy in parasitic Hymenoptera, 196.
Phiiromomama operculata, parasite of, 92.
Physatochella, 17.
Physatochella, key to Nearctic species, 155.
Physatochella major, 158.
Physatochella parshleyi, 156.
Physatochella plexa, 156.
Physatochella variegata, 156.
Pilatae muticornis, 188.
Pilatea unicolor, 137.
Plaeometrosis in Myrmecocystus, 180.
Pogonomymrnx barbatos molefaciens, 178.
Pogonomymrnx barbatos rugosus, 178.
Pogonomyrnx imberbicus, 178.
Polynema bicassiatepinnse var. varium, 92.
Polyxenex burmiticus, 40.
Polygya, 180.
Proneuris imparis, 179.
Prodiscothyrea bryanti, 29.
Propachyneuronia, 102.
Propachyneuronia aphidivoros, 102.
Propachyneuronia maidaphids, 102.
Propachyneuronia micra, 102.
Propachyneuronia siphonophora, 102.
Pseudiglyphomyia marilandica, 91.
Pseudotypochenia, 54.
Pseudotypochenia webberi, 54.
Psiloflyr cz zimmeri, 143.
Psychodidae, fossil in amber, 40.
Pterocomma smithi, 39.
Rearing insects, methods, 7.
Rhipiphoridae, fossil in amber, 40.
Rubus parvisorus, aphids on, 85.
Sciara, fossil in amber, 40.
Sciasma frontalis, 56.
Scleroderma tuberculatum, 41.
Scleroderma luteocolle, 44.
Scleroderma quadridentatum, 43.
Snow-fly, habits of, 112.
Trigona atoraria, 127.
Trigona beccarii jombenensis, 123.
Trigona bilineata, 127.
Trigona bipunctata, 127.
Trigona brunneari, 125.
Trigona clavipes, 126.
Trigona currici, 123.
Trigona fericauda, 127.
Trigona flavula, 126.
Trigona flavocineta, 127.
Trigona frontalis, 126.
Trigona goeldiana, 127.
Trigona lineata, 126.
Trigona magrettii, 123.
<table>
<thead>
<tr>
<th>Index</th>
<th>205</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trigona mediorufa</strong>, 124, 125.</td>
<td><strong>Solenopsis molesta</strong>, 27.</td>
</tr>
<tr>
<td><strong>Trigona mellea</strong>, 124.</td>
<td><strong>Spathimeigenia nigroventris</strong>, 139.</td>
</tr>
<tr>
<td><strong>Trigona mellicolor</strong>, 124.</td>
<td><strong>Stephanitis</strong>, 16.</td>
</tr>
<tr>
<td><strong>Trigona mirandula</strong>, 122.</td>
<td><strong>Tachinidae</strong>, new species of, 137.</td>
</tr>
<tr>
<td><strong>Trigona musarum</strong>, 123.</td>
<td><strong>Thermotropism in Chionea</strong>, 149.</td>
</tr>
<tr>
<td><strong>Trigona nitidula</strong>, 126.</td>
<td><strong>Thimbleberry</strong>, Aphids on, 85.</td>
</tr>
<tr>
<td><strong>Trigona postica</strong>, 125.</td>
<td><strong>Trydymus aeneicornis</strong>, 98.</td>
</tr>
<tr>
<td><strong>Trigona salvatoris</strong>, 124, 125.</td>
<td><strong>Trydymus poloni</strong>, 98.</td>
</tr>
<tr>
<td><strong>Trigona zonata</strong>, 123.</td>
<td><strong>Winnertziola burmitica</strong>, 42.</td>
</tr>
<tr>
<td>Sodium fluoride as insecticide, 187.</td>
<td><strong>Zelus socius</strong>, 15.</td>
</tr>
<tr>
<td><strong>Solenopsis fugax</strong>, 26.</td>
<td></td>
</tr>
</tbody>
</table>
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