

DIVISION OF ENTOMOLOGY

REPORT OF WORK
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**Leaf-Hoppers and their
Natural Enemies**

(PT. VI. MYMARIDAE, PLATYGASTERIDAE)

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LETTER OF TRANSMITTAL.

Honolulu, T. H., October 23, 1905.

To the Committee on Experiment Station, H. S. P. A., Honolulu, T. H.

Gentlemen:—I, herewith, submit for publication the sixth part of the Bulletin on "Leaf-Hoppers and Their Natural Enemies," which deals with some of the parasites that destroy the eggs of leaf-hoppers.

Yours obediently,

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INTRODUCTORY REMARKS ON THE MYMARIDAE.

The Mymaridae are a family of excessively minute insects, and authorities are not agreed as to the position that it should occupy in the great groups of Hymenoptera. Almost all the known species are parasitic in the eggs of other insects. Those species with which I am personally acquainted always emerge singly from the egg that they have destroyed, but others are bred in some numbers from a single egg. Probably they attack the eggs of almost all orders of insects, as I have bred them from those of Lepidoptera, of Rhynchota, Homopterous and Hemipterous, and also of Neuroptera, and they likewise destroy those of Coleoptera. Some are recorded as having been bred from scale-insects and plant-lice. Of the species hitherto described, in comparatively few cases, are the hosts known, and it is safe to say that all the species hitherto collected by Entomologists do not amount to one in hundreds, that exist. Some of the larger species may be obtained in numbers with the sweeping net by anyone with good eyesight, and others are frequently seen in plenty running on glass windows, especially those of hot-houses in cold countries, as the English collectors observed three-quarters of a century ago. The majority of the species that exist, however, are not likely to be met with, except by breeding them, for many are so minute, that except by chance they cannot be collected in the field. Some species do not exceed one-third of a millimeter in length and others are said to be even smaller, while the pallid color of many of the minute species renders them almost invisible to the naked eye.

The long and very slender wings, fringed with long hairs, are one of the most striking characteristics of the family, and with these delicate organs of flight some even of the smallest species can fly better than might have been expected. Many of them have a frequent habit of rising slowly and vertically upwards on the wing, and as they cannot withstand a moderately strong current of air, this habit must lead to a much quicker and wider distribution of the species than could ever be attained by their own unaided powers of flight. The legs of most species are

long and some of them, especially a species of *Alaptus* that I have studied, can run with astonishing rapidity.

Even though they be unacquainted with the Mymaridae themselves, most entomologists know that the family contains most of the very few parasitic Hymenoptera that are known to enter the water of their own accord. Some of these species swim by means of their wings, others of their legs, and they are parasitic in the eggs of insects that are wholly or partly aquatic, such as dragon-flies,* water-bugs and water-beetles.

During the past six months I have bred many thousands of several species of those Mymaridae, that are parasitic in the eggs of leaf-hoppers, in order to distribute them to the different sugar plantations troubled with the pest. Consequently I have had many opportunities of observing their habits, which while alike in most respects, yet differ somewhat in detail.

GENERAL ACCOUNT OF *PARANAGRUS OPTABILIS*.

Though not one of the smallest, since it measures about $\frac{3}{4}$ mm. this species is of very slender and delicate form, and has long fringes to both front and hind wings. It has that habit of rising slowly upwards on the wing, often with more or less spiral flight, that I have already alluded to. In captivity it is quite easily seen as it runs actively about on the leaves of the cane plants continually touching their surface with the tip of its antennae. On arriving at a fresh scar, marking the place where a leaf-hopper has laid its eggs, it thoroughly investigates this with the characteristic dilated club-joint of the antennae. After this investigation it sometimes passes on, but at others it proceeds to thrust the tip of the ovipositor into the egg chamber of the leaf-hopper, still keeping the tips of the antennae in touch with the surface. (Pl. XIII fig. 3.) Since the antennae are directed vertically (or nearly so) downwards, and are relatively of great length, in order to bring their tips in contact with the surface of the leaf the parasite is obliged to raise itself high on its two front pair of legs, and consequently assumes a characteristic position during oviposition. The ovipositor, when freed from its sheaths and in action, forms a strong angle with the lower surface of the abdomen, in some cases approaching a right angle. When the scar, that marks an egg-chamber, is after investigation passed by, though it is evidently recent,

* In these remarks the genus *Prestwichia* is included, since it has generally been assigned to the Mymaridae (but erroneously) and its habits have been specially studied.

and the parasite almost immediately proceeds to investigate another, and to lay therein, it is probable that the eggs in the first one have been already parasitized, though of course it may be simply that the egg of the leaf-hopper has advanced beyond a proper stage of development for being parasitized. In eggs examined I found no advanced stage of development of the leaf-hopper embryo, when they contained a larva of the parasite. However this may be, a suitable egg-chamber having been found, the ovipositor is kept inserted for a considerable time, sometimes for several minutes. Both in the preliminary examination of the egg-chamber and during the process of oviposition, the parasite may sometimes be seen by a very rapid turn through half a complete revolution, to exactly reverse its position, and this sometimes takes place more than once. Chalcids of other families, with habits similar to the Mymarids, behave in precisely the same way, and are even more rapid in their movements, so that these can only be appreciated by our eyes owing to the change of position, the head and tail end of the parasite having as it were, changed places instantaneously. The number of eggs of leaf-hopper in a single chamber varies from one to twelve or more, six or eight being common, and all these eggs may be stung, or some may escape. I have not examined the egg of the parasite which presumably is thrust into the leaf-hopper's egg, and in that case is likely to be hardly or not at all visible amongst the opaque contents of the latter. The mature larva is the usual apodous grub, and it may be seen performing its curious rotatory movements amongst the fluid contents of the egg that contains it. It has also a habit at times of violently throwing forward its anterior segments, so that the head of a half grown larva, which reaches to the middle of the hopper's egg, will, at its greatest extension, nearly attain the operculum. According to authors in *Polynema*, there is a very remarkable second form or '*Histriobdella*' stage of the larva. I have not yet observed this in *Paranagrus*, but the third form (as figured by me) greatly resembles that of *Polynema*. The smallest larve examined by me measured $\frac{1}{16}$ mm., the largest $\frac{1}{8}$ mm. so that the main growth must be in this stage. Except in size the smallest and largest larvae did not noticeably differ.

The head of the larva has a quite remarkable armature as is represented under very high magnification on Pl. XIII, fig. 5 and 5a, from a half grown example extracted from the egg of its host. The pupa almost or quite fills this egg (excluding the opercular portion) and before it is fully developed is generally

on the other hand have a mobile, pedicellate abdomen and in these and petiolate forms, the very structure prohibits the presence of such a mesophragma in the abdominal segments. Yet in spite of these profound differences we find insects of the first class ovipositing in the eggs of leaf-hoppers laid in the leaves of cane or grass; those of the second doing precisely the same, as well as piercing the eggs of Heteroptera, imbedded in a similar manner in the cane leaf. It does not appear to me improbable that, when a special study is made of the peculiarities of the Mymaridae, and this study is based on a rich and well prepared collection, the group will prove to be of more than family rank and itself to contain some very distinct families.

The Mymaridae, or at least such as I have studied in connection with this paper, appear to me to be most nearly allied to certain of the Eulophidae. Some of the latter have to a large extent the same structure of the thorax as the Mymarids, and in this point amongst others the latter at once differ from any true Proctotrupids known to me. It is further a somewhat remarkable fact that various Mymarids of very different groups have a pattern and arrangement of markings identical with that of certain Eulophidae. The wings are of the most characteristic form, and are very different from those of the egg-parasites of the family *Trichogrammidae*, from which I exclude Ashmead's sub-family *Oligositinae*, believing it will be sooner or later associated with the Eulophidae in spite of the three-jointed tarsi. In the presence of a great mesophragma extending far into the abdomen, the sessile-bodied Mymarids agree with many Eulophids and Trichogrammids, indeed in some of the latter this structure is enormously developed and extends almost to the apex of the body.

Ashmead who has published the latest classification of the Chalcidoid families, and has probably spent more time on this study than anyone living and whose views are therefore worthy of the most careful consideration, gives as the leading characters to define the Mymaridae:

"Hind wings exceedingly narrow, linear, pedunculate at base; ovipositor issuing from beneath just anterior to tip of abdomen; antennae without a ring-joint, the scape rather small, short, compressed."

All the species considered here agree with this definition in two particulars (1) the hind-wings are narrow and pedunculate, (2) the antennae have no ring-joint. In other respects the characters do not agree with any of my species. Thus the ovi-

positor issues from close to the base of the abdomen in all of these, and is in all respects similar to that of many species of Eulophidae or of other Chalcid families. ((See Pl. XIII fig. 3 and fig. 6.) Further the scape of the antennae is always slender and elongate, except in a very few males. I am therefore led to ask myself whether there are species of Mymaridae with the structure of the ovipositor as described by Förster and Ashmead, and which would partly account for the fact that several of the greatest of entomologists placed the group in the Proctotrupids, with which in this respect they were thought to nearly (though not exactly) agree, and if so, whether the family is really a natural one. It is certainly remarkable that, whereas in other respects my species and genera fall readily into the sub-families and tribes, that have been suggested, yet they do not agree in the structure of antennae nor in the ovipositor with the family characters.

An important character requiring further study is the structure of the mesonotum. In some species this appears to be formed much as in many Eulophidae, the axillae being produced forwards acutely into the parapsides. In others I can detect no marked forward extension of the axillar pieces. In all the species specially examined by me, this forward extension is correlated with a sessile abdomen and does not occur in the pedicellate and subpetiolate forms.

In conclusion the species which I have most particularly studied, viz: those here described under the genera *Anagrus*, *Paranagrus*, *Gonatocerus* and *Alaptus* appear to me to be most nearly allied to certain Eulophidae, though differing greatly from these in the structure of wings and antennae, and further, amongst themselves present differential characters of perhaps even family value.

LIST OF MYMARIDAE HERE DESCRIBED.

1. *Ooctonus australensis*, sp. nov.
2. *Polymena* (?) *reduvioli*, sp. nov.
3. *Gonatocerus cingulatus*, sp. nov.
4. *Alaptus immaturus*, sp. nov.
5. *Anagrus frequens*, sp. nov.
6. *Anagrus columbi*, sp. nov.
Paranagrus, gen. nov.
7. *Paranagrus optabilis*, sp. nov. et typ. gen.
8. *Paranagrus perforator*, sp. nov.

TABLE OF GENERA AND SPECIES HERE
CONSIDERED.

- 1 (6) Abdomen sessile, with a wide thoracic mesophragma extending well into it; front wings very narrow, the apical cilia much longer than their width.
- 2 (3) Tarsi 5-jointed (antennae of male 10-jointed; of female 8-jointed).....*Alaptus immaturus*.
- 3 (2) Tarsi 4-jointed (antennae of male 13, of female 9-jointed.)
- 4 (5) Third antennal joint elongate almost as long as the fourth*Paranagrus*.
Ovipositor only slightly exerted behind the body.
.....*P. optabilis*.
Ovipositor exerted behind the body for a length equal to that of the 4 joints of the hind tarsi together.
.....*P. perforator*.
- 5 (4) Third antennal joint very short, much shorter than fourth.....*Anagrus*.
Front wings with a distinct bare longitudinal line on lower half.....*A. frequens*.
Front wings more evenly hairy (Pl. XIII fig. 8 & 8a.)
.....*A. columbi*.
- 6 (1) Abdomen pedicellate or subpetiolate, and without a mesophragma extending back into it; front wings with the apical fringe short, much shorter than the width of the wings.
- 7 (8) Tarsi 5-jointed; antennae of female 11-jointed.
Abdomen pedicellate.....*Ooctonus australensis*.
Abdomen not pedicellate.....*Gonatocerus cingulatus*.
- 8 (7) Tarsi 4-jointed, antennae of female 9-jointed.
Abdomen pedicellate.....*Polynema redúvioli*.

DESCRIPTION OF GENERA AND SPECIES.

In the following descriptions important structural characters are generally given under the generic names, owing to the fact that I do not feel sure that the species are always placed in the right genera, for reasons that I have already stated. The nervation does not differ greatly in these genera, being much as in the *Paranagrus* figured, though in some forms the sub-marginal

vein is longer relatively to the marginal. The latter is of much the same form in all and can hardly be called punctiform in any.

Ooctonus Hal.

Male antennae with 13 joints, the scape flattened and short, the second joint very small and roundish, the following ones subequally elongate, flattened and wide, but not so wide as long. Antennae of female 11-jointed; scape very long, set on an elongate pedicel, so as to appear *obsoletely* 2-jointed, and as long as the three following joints together; club as long as the five preceding joints together. Posterior ocelli wide apart, perhaps placed close to the eye margins, the collapse of the head in dried specimens making it impossible to ascertain this point. Scutellum large and elongate, longer than the mesonotum; the axillae encroaching little or not at all on the scapulae; propodeum with two raised lines or longitudinal carinae. Tarsi 5-jointed. Apical cilia of front wings short, many times shorter than the greatest width of the wing. Abdomen pedicellate. (For figures of antennae see Pl. XIII fig. 2; the lower two antennae representing male and female of this genus.)

Ooctonus australensis, sp. nov.

Black, shining, antennae of the male black, of the female with the scape mostly pale yellowish-brown, the second joint also more or less brownish, the following three blackish, the sixth also dark but less so than the preceding, 7th, 8th and 9th white, 10th much wider than the 9th and black, club black. Legs brownish yellow or testaceous, posterior tibiae more or less darkened. Abdomen pedicellate, brownish black or piceous. Length $1\frac{5}{8}$ mm.

Hab: Cairns, Queensland; two examples extracted from eggs of a conspicuous *Tettigonia* common in the cane fields.

Gonatocerus, Nees.

Female: Antennae 11-jointed, the scape elongate, about equal to the next three joints together, second joint widened, much wider on its flat surface than the following; flagellar joints not differing greatly in length, the basal ones being, however, rather shorter than the following; club as long or longer than the three preceding. Front wings with short apical cilia, several times

shorter than the greatest width of the wing; axillae of mesonotum not encroaching on the parapsides; tarsi 5-jointed; posterior ocelli remote from the eye margins; abdomen subsessile. (Plate XIII fig. 2; uppermost antenna represents that of female of this genus; fig. 6 abdomen of the female.)

Gonatocerus cingulatus, sp. nov.

Female: Yellow; the face, the whole of the flagellum of the antennae, two adjacent spots on the front of the mesonotum which do not reach back to the middle, one on the anterior angle of the scapulae, another on each side adjoining the tegulae and a median one between these, the propodeum, the meso- and metoppleura, the hind coxae, all the tibiae, the tarsi above, two bands near the middle of the abdomen (appearing as one very broad one in contracted specimens) and the sheaths of the ovipositor dark, black or blackish fuscous. The scape and second joint of the antennae and the front and middle coxae are more or less dark on their margins. Front tibiae with distinct, small, stout spines, placed remotely and in line. Length 1 $\frac{3}{8}$ mm.

Hab. Brisbane, Queensland; bred from the eggs of a *Tetti-gonia* on sugar cane (Koebele No. 2241.)

Polynema, Hal.

The single species here described under this genus has a shorter marginal vein than any of the others dealt with in this paper, but it is less punctiform than in some other species, that I have examined.

Polynema reduvioli, sp. nov.

Third and ten following joints in the male elongate, subequal, in the female the third, fourth and fifth are very slender and elongate the following three much shorter and wider, the club about as long as the three preceding together. The fringe at the apex of the front wings is much shorter than the greatest width of these. The basal joint of the hind tarsi is very long, subequal to the other three joints together.

Black and smooth, except for very fine microscopic sculpture, the three basal joints of the antennae in both sexes, all the legs, except the apical joints of the tarsi, and the abdominal pedicel are yellow, or brownish yellow. The pedicel is elongate, and

about equal in length to the hind coxae. The surface of the wings is uniformly clothed with short dark hairs. Length 1 mm.

Hab: Hawaiian Islands; parasitic in eggs of *Reduviolus blackburni*.

N. B.—A second species closely allied to this, but differing slightly in color, and with a shorter marginal vein has probably similar habits, as also *P. hawaiiensis* described by Ashmead. (Faun. Haw. Vol. 1, p. 332.) which agrees in nearly all structural points with the one here described. These two species are usually bred from leaves covered with Aphis and might easily be supposed to be parasitic on plant-lice by a careless investigator.

Alaptus, Hal.

Antennae of female 8-jointed, the scape elongate, the second joint dilated and much wider than the following, third slender, elongate, rather shorter than the fourth, 5th, 6th, and 7th, increasing in width, club nearly as long as the four preceding. Antennae of male 10-jointed, the scape elongate, second wider than the following, third elongate, but shorter than the fourth, which is subequal to the following joints. Posterior ocelli close to the eye-margins, the three forming a triangle with extremely wide base. Tarsi 5-jointed. Abdomen sessile. (Plate XII, fig. 5; antennae of female in two aspects and that of the male.)

Alaptus immaturus, sp. nov.

Female: Pallid ochreous, the head sordid and also the thorax along its posterior margin; abdominal segments with obscure sub-quadrate, lateral, blackish or sordid spots. Antennae with two basal joints pale, the rest dark. Length $\frac{3}{4}$ mm.

Hab: Bundaberg, Queensland, bred from cane leaves containing leaf-hopper eggs, but I do not feel sure that it is parasitic on these.

Anagrus, Hal.

Ocelli in a subequilateral triangle, and close together, the posterior very remote from the eyes; antennae of female 9-jointed, scape long, second joint widened, third very short, the fourth and following equal, club about equal to two preceding. Antennae of male filiform 13-jointed, second joint dilated, third also wide on its flat face and short, much shorter than the following, all the other joints subequal. Axillae produced forwards into

the scapular region of the mesonotum; tarsi 4-jointed, wings with long apical cilia, much longer than the greatest width of the wing. Abdomen sessile, ovipositor a little exerted. (Plate XII, fig. 4 and 6; antennae.)

Anagrus frequens, sp. nov.

Female: Orange red or reddish yellow, the occiput for a large part, the antennae except the two basal joints, two contiguous or subcontiguous large marks on the front of the mesonotum, one on the anterior end of each of the scapulae, one on the axillae, two or three of the basal abdominal segments more or less, as well as their lateral margins very narrowly, and the sheaths of the ovipositor, dark, blackish or fuscous. Wings hairy, but with a long bare area on the lower side of the apical half. Ovipositor very little exerted.

Male generally like the female apart from the structural differences in the antennae as stated above, and in the usual abdominal characters. Markings as in the female, probably more pronounced as a rule, but similarly situated, the abdomen apically dark above. Length $\frac{3}{8}$ mm.

Hab: Queensland; bred from eggs of Delphacids. An apparently slightly different race inhabits Fiji, but I cannot separate it specifically.

Anagrus columbi, sp. nov.

Apparently almost identical with the preceding in form and structure, but at once distinguished by the fact that the hairs on the apical part of the front wing are of more general distribution and do not leave the large bare space noticeable in *A. frequens*. In specimens mounted in balsam in 1903, the color characters are as follows: Luteous, head sordid or smoky yellow, antennae with three basal joints yellow (but the scape is somewhat darkened in part) the rest fuscous. Mesonotum yellowish fuscous, the parapsides darker in front, the axillae also infuscate. Abdomen sordid yellowish. In life the markings are very probably almost identical with those of *A. frequens*, but whether the general color is as red as in that species, it is impossible to say. Length $\frac{3}{8}$ mm.

Hab: Columbus, Ohio (Koebele, No. 2320) bred from eggs of *Liburnia* on grass.

Paranagrus, gen. nov.

Like *Anagrus*, but more slender and elongate, and with the third joint of the antennae in the female elongate, not much shorter than the following and quite slender. Otherwise as in the preceding genus. Ovipositor either slightly or strongly exerted behind the abdomen. Antennae of male 13-jointed, as in *Anagrus*, but with the third joint slender and elongate, as in the female. (Plate XII, fig. 1 and 2.)

Paranagrus optabilis, sp. nov.

Male; flavous, head more or less sordid or smoky; a large elongate subtriangular spot on either side of the middle line of mesonotum, the apex of these spots reaching nearly to the scutellum; a spot usually triangular on the parapsides, and one on the axillae, dark; abdomen with at least the apical segments more or less dark, blackish or fuscous; all the joints of the flagellum smoky or fuscous.

Female, like the male, but with the thoracic markings generally much fainter, though occupying the same positions; spots on the axillae sometimes not discernable, the abdomen not dark on the apical segments. Length $\frac{3}{4}$ mm.

Hab: Queensland; bred in all localities from the eggs of *Perkinsiella saccharicida*. A very similar form inhabits Fiji, but the material is insufficient to determine whether they are specifically identical.

Paranagrus perforator, sp. nov.

Female; yellow or orange red; head subinfuscate, the whole of the flagellum of the antennae, two long triangular spots on the mesonotum, nearly or quite reaching the scutellum, one on the front angles of each of the parapsides, another on each of the axillae, an interrupted band on the first abdominal segment, and an entire one on the second and third, the lateral margins of at least some of the apical segments, and the sheaths of the ovipositor, dark, blackish or piceous. Ovipositor extending well behind the abdomen, for a length equal to that of all the joints of one of the hind tarsi taken together. Length $\frac{2}{3}$ mm.

Hab: Fiji; bred from eggs of Delphacid leaf-hoppers.

PROCTOTRUPOIDEA.

In the course of our investigation of the parasites of leaf-hopper, several species of an anomalous form belonging to the Proctotrupoid series were bred. These species, I believe, form a genus not yet described, which at present is best located in the Platygasteridae, in the group which contains the genus *Inostemma*, Hal. In some respects they remind one of the well-known egg-parasites of the genus *Baeus* and its allies, in the Scelionidae; in others of the likewise anomalous genus *Bacuncura* of Foerster. They too are egg-parasites, attacking those leaf-hoppers' eggs, which are not imbedded in the tissues of plants, but such as are entirely external. The eggs that we found to be attacked by them, were those of such conspicuous leaf-hoppers, as are included in the genera *Siphanta*, *Platybrachys*, etc., and of others allied to these. These parasites are of very great economic value in Australia and without their aid, vegetation in many localities would suffer very greatly from leaf-hoppers of the genus *Siphanta*, which indeed are, as it is, quite capable of doing damage under certain conditions in that country. In many places, however, we found that from every egg in nearly every egg-mass that we collected, we bred one or other of these parasites, and further we saw them in extraordinary numbers crawling over and ovipositing in eggs in the field.

They always escape by gnawing a roundish hole in the egg, so that it is very easy to distinguish between the egg-masses from which parasites have escaped and those from which young leaf-hoppers have emerged. (Pl. XI, fig. 2, 3 and 7.) We were not able to pay very much attention to the eggs of such leaf-hoppers as those mentioned above, so that I anticipate that great numbers of species of these parasites are to be found in Australia, and probably they are represented by similar or cognate forms in other countries. The parasites themselves, when bred from eggs of such species of leaf-hoppers as cover their eggs with white mealy powder, are frequently so disguised by the adherence of this same substance, that unless it be carefully cleaned off, their proper structure and appearance cannot be made out.

GENUS AND SPECIES HERE DESCRIBED.

Aphanomerus, gen. nov.

Aphanomerus bicolor, sp. nov. et typ. gen.

2. *Aphanomerus niger*, sp. nov.
3. *Aphanomerus rufescens*, sp. nov.
4. *Aphanomerus pusillus*, sp. nov.

These species may be easily separated by the distinctions given in the table below. I may add there is another species very closely allied to *A. rufescens*, represented by a single example, which I have not thought it advisable to describe at present.

1. (6) Thorax black.
2. (5) Abdomen largely or entirely ferruginous.
3. (4) Larger; abdomen wholly ferruginous.....*A. bicolor*
4. (3) Smaller; abdomen dark at least on the apical part.
.....*A. rufescens*.
5. (2) Abdomen almost entirely black.....*A. niger*
6. (1) Thorax yellow or ferruginous.....*A. pusillus*.

Aphanomerus, gen. nov.

Moderately or quite robust, the head transverse, and very strongly inflexed, the ocelli very widely separated from one another, the anterior one placed very far forwards. Antennae 7-jointed in the female; 8-jointed in the male, the club solid and one-jointed in both sexes. Maxillary palpi two-jointed, labial one-jointed; mandibles bidentate. Pronotum very little visible in some aspects; the parapsidal furrows of the mesonotum fine, but evident, and widely separated even at the base; post scutellum more or less prominent in the middle. Legs with uneven claws, the one being much longer than the other. Wings with the submarginal vein terminating in a round knob in the field of the wing, and not reaching the costa, the basal nervure more or less obsolescent, the basal cell incomplete, but its position marked by a darker streak in the position of the median vein. Abdomen with longitudinal wrinkles or costae at the base. (Plate XI, fig. 1, 4, 5, 6,, 8 and 9.)

Aphanomerus bicolor, sp. nov.

Black, the abdomen ferruginous, the antennae, legs and tegulae paler, more testaceous, the club of the antennae in the female largely dark.

Head and thorax opaque or subopaque, the mesonotum and scutellum with minute microscopic, sculpture and punctuation, so that it appears coriaceous under a lens, clothed with minute gray pubescence, and with longer gray hairs at the posterior

angles of the thorax. Abdomen with a series of short longitudinal costae or wrinkles at the base, and pubescent at the sides near these, the four apical segments with short grey pubescence, the large segment preceding them being smooth and glabrous. Length $1\frac{1}{2}$ mm. (Pl. XI, fig. 1 and 4.)

Hab: Queensland; common. From one batch of eggs, Koebele (No. 2293) bred 48 parasites and 7 young hoppers. As in the other species, only one parasite emerges from each egg.

Aphanomerus niger, sp. nov.

Black, the legs and antennae for the most part yellow or ferruginous, the club of the latter infuscate in the female, the tip of the abdomen ferruginous, as well as the apical margins, very narrowly, of the second and following segments.

Thorax dull, appearing coriaceous from the dense minute sculpture, consisting of fine punctures and rugulosity of the surface, and clothed with very fine gray pubescence. Abdomen at the base with the usual row of costae and externally to these pubescent, and with very delicate microscopic rugulosity, the second segment smooth, shining and glabrous, the terminal ones slightly pubescent. Length $1\frac{3}{4}$ mm.

Hab: Bundaberg, Queensland; male and female bred from eggs of a Fulgorid on *Melaleuca* by Mr. Koebele. The specimens are unnumbered and the eggs are those of a species of *Platybrachys* or some allied form.

Aphanomerus rufescens, sp. nov.

Black, the abdomen ferruginous except at the apex and on the lateral margins, which are more or less dark; antennae and legs testaceous or yellowish, the club of the former more or less dark in the female, while in the male the dark color of the abdomen is extended further towards the base.

Head, and thorax above, subopaque or at least not very shining, with microscopic sculpture, and clothed with fine gray pubescence, the pleura for the most part smooth and much more shining, the propodeum about the insertion of the abdomen more or less pale colored, or piceous. Abdomen with longitudinal costae at the base and pubescent on either side of these; the following great segment glabrous and impunctate. Length $\frac{3}{4}$ mm. (Plate XI, fig. 6.)

Hab: Cairns, Queensland; bred from egg-masses of Fulgorids.

Some specimens bred by Koebele are numbered 2276 erroneously, his note under that number referring to other insects.

Aphanomerus pusillus, sp. nov.

Yellowish or ferruginous, the head in the female black or dark, and the club of its antennae somewhat obscured.

Mesonotum opaque or nearly so, with dense and very fine microscopic sculpture, and minute pale pubescence, much as in the other species of the genus, the pleura smooth and shining. Abdomen with the base costate, the following large segment very smooth and shining, the rest finely pubescent. Length $\frac{7}{8}$ mm. (Plate XI, fig. 5.)

Hab: Queensland; very abundant in the eggs of *Siphanta*, and allied forms.

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DESCRIPTION OF PLATES.

Plate XI.

- 1 *Aphanomerus bicolor*.
- 2 Eggs of *Siphanta* sp. from each of which an example of *Aphanomerus pusillus* emerged.
- 3 Eggs of a Fulgorid, probably a species of *Platybrachys*, from which *A. bicolor* was bred. Only a few eggs are figured, but of the whole mass 48 produced parasites, and from 7 young hoppers emerged; a few others contained dead parasites.
4. *A. bicolor*; male and female antennae.
5. *A. pusillus*; male and female antennae.
6. *A. rufescens*; female antenna.
7. Eggs of a species of leaf-hopper allied to *Siphanta* all parasitized by *A. rufescens*.
8. Maxillary palpus of *A. bicolor*
9. Claw-joint of tarsus of the same, showing the unequal claws.

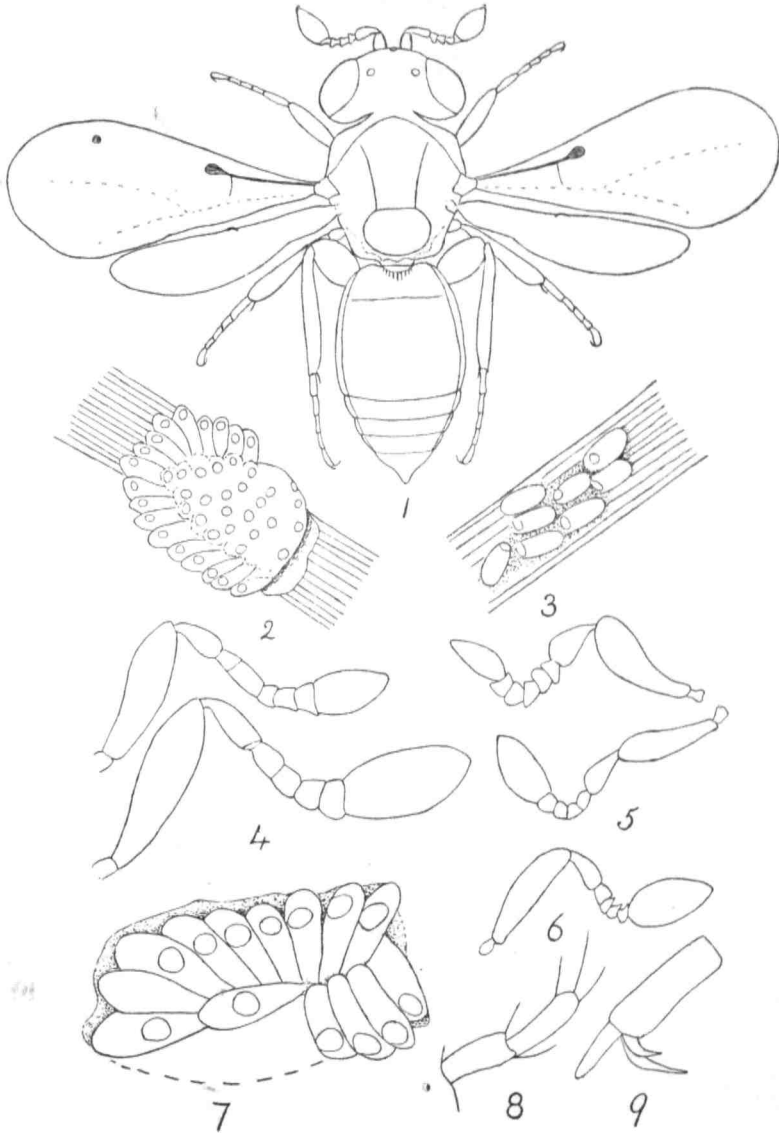
Plate XII.

1. *Paranagrus optabilis*.
2. Antenna of female and male of the same.
3. & 3a. Antennae of male and female *Polynema reduvioli*.
4. Antenna of female *Anagrus columbi*, in two aspects.
5. Antenna of female in two aspects, and antenna of the male, of *Alaptus immaturus*.
6. Antenna of male and female of *Anagrus frequens*.

Plate XIII.

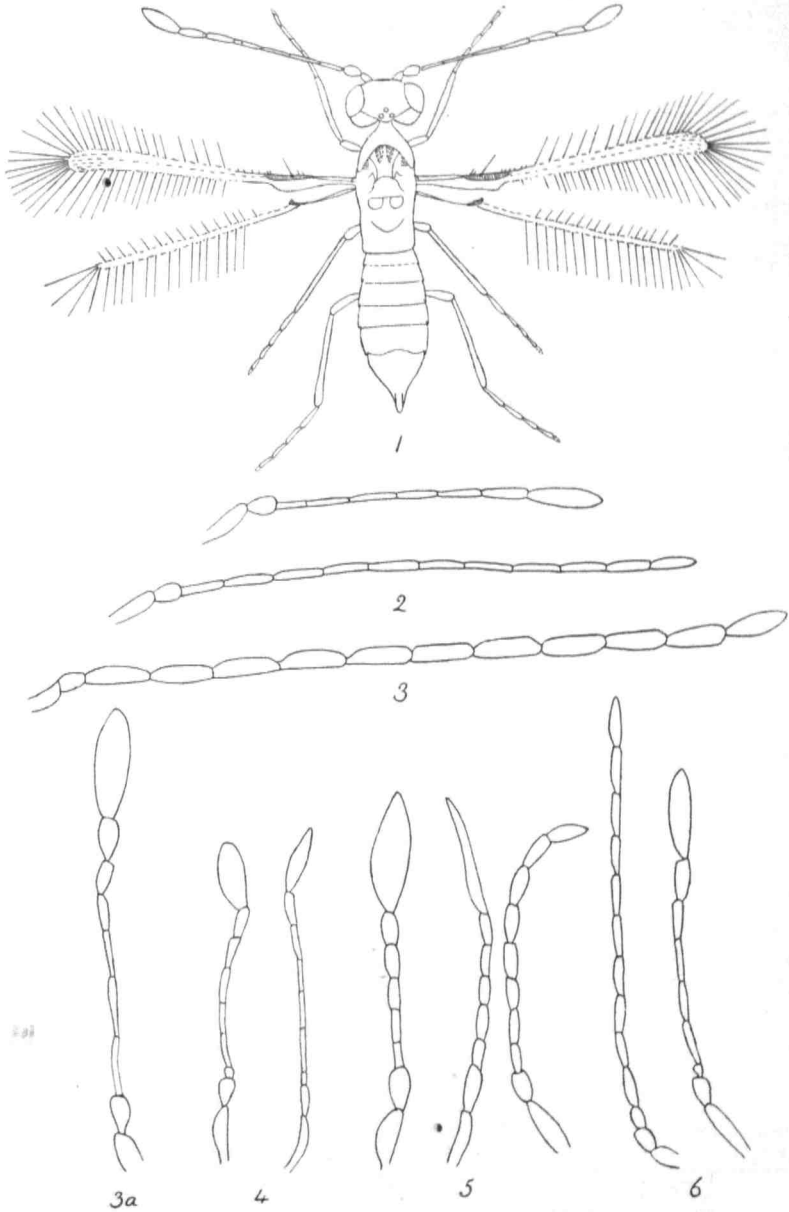
2. Antenna of female *Gonatocerus cingulatus* above; of female and male *Ooctonus australensis* below.
3. *Paranagrus optabilis* female, ovipositing in the eggs of *Perkinsiella*, which are imbedded in the leaf, and further hidden beneath a white mealy covering.
4. Pupa of *Paranagrus* within the egg of *Perkinsiella*.
5. Larva of the same; the egg contents had been partly removed in order that the larva might be rendered more visible, and they are not figured in the upper part of the hopper's egg.
- 5a. Head extremity of the larva of the same.

6. Abdomen of *Gonatocerus cingulatus* showing the insertion of ovipositor at its base.
7. Upper extremity of eggs of *Reduviolus blackburni* and the exit holes of the parasite (*Polynema reduvioli*) in the surface of the cane-leaf.
8. & 8a. Diagrammatic of disposition of hairs on the surface of front wing of *Anagrus frequens* and *A. columbi*.



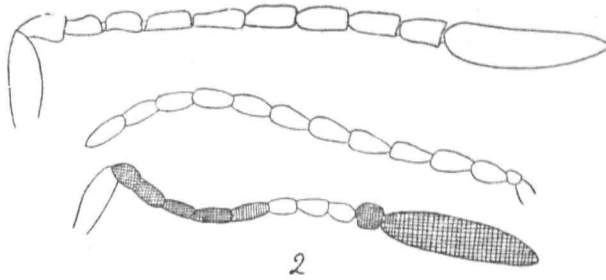
Perkins del.

PLATE XI.

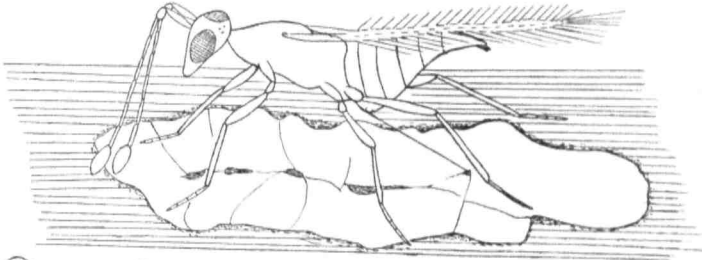


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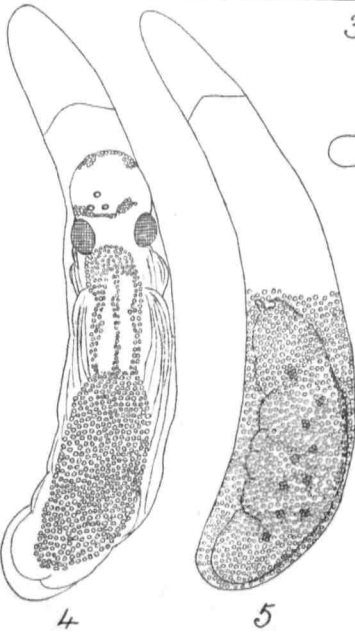
PLATE XII.



2

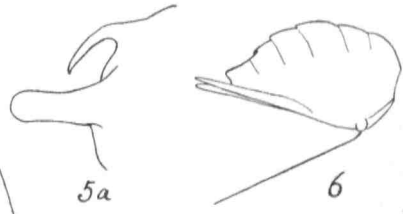


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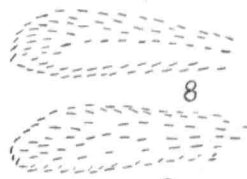


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6



7



8

8a

Perkins del.

PLATE XIII.