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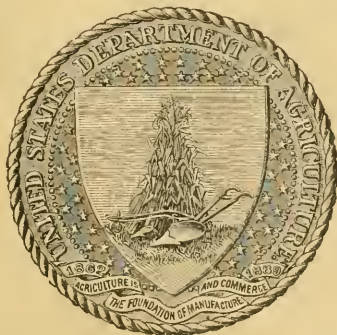
APHELININÆ OF NORTH AMERICA

A SUBFAMILY OF HYMENOPTEROUS PARASITES
OF THE FAMILY CHALCIDIDÆ.

BY

L. O. HOWARD,

ENTOMOLOGIST.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.

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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
DIVISION OF ENTOMOLOGY,
Washington, D. C., June 15, 1895.

SIR: I have the honor to submit for publication the first number of the proposed technical series of bulletins, which, on account of their character, are intended especially for working entomologists, learned societies and periodicals, and libraries. The Aphelininae, which are monographically considered in this first number, are insects of great economic importance, since they comprise the most abundant of the parasites of our destructive scale insects.

Respectfully,

L. O. HOWARD,
Entomologist.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

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EXPLANATORY TO THE NEW SERIES.

While the work of the Division of Entomology is entirely carried on with the practical end in view, a certain amount of work of a technical character is constantly being done by different members of the force. The condition of our knowledge of North American insects at the present time is such that many forms which from time to time spring into prominence as destructive species, or as connected with destructive species, either as parasites or predatory enemies, are found to be new to science. They must be classified, described, and given names before they can be intelligently considered in economic publications. The practice which has prevailed to a limited extent of naming and describing new species in practical bulletins and reports is one which has met with much disfavor among systematic workers. Isolated descriptions of new species are in themselves sources of great annoyance to all workers, and when these isolated descriptions are published elsewhere than in scientific journals or the proceedings of scientific societies the annoyance becomes intensified. The force of the Division of Entomology comprises several specialists who are doing descriptive work, and largely upon material accumulated in the course of the regular divisional work. They are doing this work as a necessary supplement to the purely economic output of the Division, and to facilitate the investigations of the entomologists of the State Agricultural Experiment Stations. It becomes important that the results of their labors should be published promptly, and as all available sources of publication in this country, such as the Proceedings of the United States National Museum and the Transactions of the American Entomological Society, are chronically overcrowded with manuscripts, and are not published with any degree of promptitude, it is necessary that they should be issued by this Department.

L. O. H.

THE APHELININÆ OF NORTH AMERICA.

By L. O. HOWARD.

The minute and structurally interesting species of the chalcidid subfamily Aphelininæ have been studied by systematic workers since the founding of the type genus by Dalman in 1820. This author differentiated the species *A. insidiator* and *A. abdominalis* from the older genus *Entedon*, with which they had previously been associated. In 1833 Westwood established the genera *Coccophagus* and *Agonioneurus*, Dalman's *Aphelinus* having contained species of each. In 1834 Nees von Esenbeck established the genus *Myina*, which corresponded exactly with *Agonioneurus*. In 1839 Walker placed both Westwood's genera together under *Aphelinus*, but in 1846 separated Westwood's *Coccophagus*. Foerster, in his Hymenopterologische Studien, discarded *Aphelinus* on account of its poor definition and *Agonioneurus* on account of its length, retaining *Myina* of Nees and establishing the family Myinoidea, with the genera *Myina*, *Mesidia*, and *Coccophagus*. In 1876 Thomson revived *Aphelinus* and established the tribe Aphelinina. In 1878 Foerster, in his Kleine Monographie parasitischer Hymenopteren, added the new genera *Encarsia* and *Centrodora*, and referred incidentally to the group as Coccophagoidæ. In 1880 the writer, following Thomson in the revival of the original genus *Aphelinus*, established the higher group as the subfamily Aphelininæ and described a number of species in the genera *Aphelinus* and *Coccophagus*. Since then he has described occasional species in these two genera and has erected three new genera, viz, *Ablerus*, *Aspidiotiphagus*, and *Prospalta*. In 1851 Haldeman erected the genus *Eriophilus* to contain a single species, *E. mali*, parasitic upon *Schizoneura lanigera*, but, as shown by the writer in 1880, this genus is but a synonym of *Aphelinus*. Haldeman made no effort to determine the affinities of his genus, beyond stating that it belonged to the family Chalcididae. In the previous year, however, Haldeman erected another genus, *Eretmocerus*, to contain the single species *E. corni*, which he reared from *Aleyrodes* found upon the leaves of dogwood. This genus, which Haldeman considered to be allied to *Mymar*, is, as I am able to show by the rearing of new species, a true aphelinine. In 1891 Ashmead placed the genus *Ennotus* of Walker in the subfamily Aphelinina (Proc. Entom. Soc. Wash., vol. II, p. 108). Foerster had previously noticed the resemblance of this insect in certain characters to this group, but had removed it to the Pteromalina, evidently on account of

the number of antennal joints. Later investigations, and particularly the discovery of two new closely allied genera which the writer has described in the Journal of the Linnæan Society of London as *Herbertia* and *Erotolepsia*, have, however, convinced Mr. Ashmead, as he tells me in conversation, that *Eunotus* must properly be placed with the Pireninae.¹

On the whole, not much attention has been paid to the insects of this subfamily in Europe. This is probably largely due to the fact that almost no attempt has been made to rear the parasites of Coccidæ. It results, therefore, that the aphelinine fauna of the United States is better known than that of Europe. A number of species were reared in the Department of Agriculture by Professor Comstock when he was engaged upon his study of the scale insects of the United States in 1880, and it fell to the lot of the writer to describe the new forms. Since then others have been reared from time to time and described as indicated above. Mr. Ashmead has also described several forms. Fitch described one which he placed in the genus *Platygaster*; Haldeman, as above stated, described two; Le Baron described one (placing it, by the way, in the proper genus), and the Abbé Provancher has described two, viz., *Coccophagus brunneus* and *C. pallipes*. Unfortunately, however, *C. brunneus* is evidently a tetrastichine, while *C. pallipes* is a *Sympiezis* belonging to the subfamily Eulophinae.

The Aphelininae are distinguished from their nearest allies, the Eupelminæ and Encyrtinae, by the fact that the mesopleura are divided, the middle legs are not specially developed for saltatory purposes (although the insects jump well), and the first tarsal joint of the middle legs is not incrassate, the antennæ are not more than eight-jointed, and the parapsidal sutures are distinct. The mandibles are small, two to three dentate, the maxillary palpi are three-jointed, and the labial palpi are represented by an elongate tubercle. The antennæ are inserted near the clypeus; the scape is long and slender. The front wings lack the postmarginal vein and the abdomen is broadly sessile. In the yellow species, when mounted in balsam, the curious internal structure which is called by Bugnion in his "Développement, etc., de l'*Encyrtus fuscicollis*," the "mesophragma" (and which, from the fact that it seems to originate from the hinder portion of the mesoscutellum, is probably

¹The host relations of *Eunotus* were not known until *E. lividus* Ashm. was found in a lot of parasites sent me by Mr. W. G. Johnson, of the Illinois State Laboratory of Natural History on May 1, 1895. Mr. Johnson had reared this series from a *Lecanium* on plum, together with many specimens of *Pachyneuron altiscula* How. The *Eunotus* is probably a primary and the *Pachyneuron* a secondary parasite of the *Lecanium*. This coccid parasitism would apparently strengthen the idea of the aphelinine affinity of *Eunotus*; but it must be remembered that *Tomocera californica* How., a true Pirenine, is the most abundant parasite of *Lecanium* scales in California and Hawaii.

properly identified) is seen to extend far back into the abdomen, much farther than with Bugnion's Encyrtus.

The insects of this subfamily are all, so far as we know, parasitic either upon the Coccidæ, Aleyrodidæ, or Aphididæ. They are evidently many-brooded, and issue from their hosts indifferently throughout the warmer months of the year, and through the winter in the insectary. With the Aleyrodidæ, Aphididæ, and the Diaspinæ among the Coccidæ, but one specimen, apparently, issues from a single host insect. With the larger naked scale insects, however, several parasites may issue from a single host. Sufficient observations have not been made upon the early stages of the Aphelininæ. Their larvæ feed both upon the body of the scale insect and upon the eggs. They attack both sexes of the host, issuing when full grown through circular holes cut through the body walls, and, in the case of the Diaspinæ, through the scale. With the scale insects of the genus *Pulvinaria*, the aphelinine larvæ live within the body of the female and not in the waxy egg mass which she secretes.

Economically, the Aphelininæ are by far the most important of the parasites of the Diaspinæ. Other scale insects are more abundantly parasitized by species of other groups, notably the Encyrtinæ, but with the Diaspinæ it is really difficult to find an affected tree which does not bear scales pierced by the exit holes of some aphelinine. It was with a species of the genus *Aphelinus* that LeBaron made the first attempt at the transportation of a scale parasite from one region to another in which the parasite was supposed not to occur. As a matter of fact, however, while the numbers of the Diaspinæ are undoubtedly frequently reduced to a considerable extent by the work of the members of this subfamily, I have never seen a plant affected by scale insects in which the Coccidæ were even approximately exterminated by these insects. The claims which were at one time made in California of the extraordinarily beneficial work of *Aspidiotiphagus citrinus* upon *Aspidiotus aurantii* have always seemed to me unjustified, and in this opinion I am supported by the evidence of Mr. D. W. Coquillett, who states that upon personal examination of the orchard in which it was claimed that this parasite had nearly exterminated the scale he found that but a small proportion of the dead scale insects contained the issuing holes of the parasites. The great majority of them seemed to have been killed by some disease.

The larvæ of the early generations of the species of the genus *Aphelinus*, as may be inferred from what I have said in the previous paragraph, feed upon the body of the scale insect, but those of the late generations feed upon the eggs. Confirmatory evidence of the incompleteness of the work of the species of *Aphelinus* has been gained by the careful examination in the early spring of a large number of scales of *Mytilaspis pomorum* parasitized by *Aphelinus mytilaspidis*. Under

the healthy wintering scales of the *Mytilaspis* will be found a varying number of sound eggs, but seldom less than 50, while nearly 100 may be found in a few. Examinations which Mr. Pergande made for me in the early spring of 1895 showed that while some of the specimens of *Aphelinus* had issued from the scales late the previous fall (evidently considerably after the egg laying of the females had been completed), others were present in the full-grown larval condition, ready to transform to pupæ. The latter were in the great majority. In no case, however, had all of the scale-insect eggs been devoured, even with those scales from which the parasite had emerged the previous autumn. Under these latter scales from 5 to 11 sound eggs were found, while under the scales containing full-grown parasitic larvæ from 2 to 18 sound eggs were found. It seems, therefore, that the work of the last generation of *Aphelinus* is no more effective than that of a ladybird beetle, probably not so much so. These beetles tear open the scales and eat the eggs, but frequently do not eat them all. In the latter case, however, the exposure of the eggs may result in their death, whereas the eggs which are left by the *Aphelinus* will undoubtedly hatch. It is unfortunate that the *Aphelinus* larva is not capable of eating everything in sight in the shape of *Mytilaspis* eggs, but we must take the facts as we find them, and it is plain that the good work of these parasites has been overestimated.

When these insects are properly mounted they are not especially difficult to study. The yellow forms have a delicate exoskeleton, and when mounted dry shrivel to some extent. The face falls in and the thorax becomes distorted. If thrown into alcohol they become discolored. If mounted in balsam they also become more or less discolored. All the yellow forms should be mounted in glycerin in a thin cell of Brunswick black. They should be mounted under a lens, and some care taken to spread the wings, legs, and antennæ. Several specimens may be mounted to advantage under a single cover glass. In all cases, however, it is important that a colorational description be drawn up from fresh material, since even with glycerin mounts the colors change to some extent and become more sordid. With the black species, as of *Coccophagus*, the shriveling is not so liable to occur, and the larger species particularly can be studied to advantage from dry mounts on tags. Even so, however, where more than one specimen of a given species is collected or reared, it is very advantageous to mount a portion of the series in glycerin, as above described. Details of structure, aside from sculpture, can be more readily studied from slide mounts.

Twigs and leaves infested with scale insects from which it is expected that these little parasites will issue are preferably placed in small, wide-mouthed jars, the mouth of each jar being wide enough to admit the hand. The mouth of the jar is then covered with thin muslin held

in place by a rubber band, or the glass cover may be placed over the mouth. Careful examination of the sides of the jar with a three-quarter-inch lens will usually enable one to find the parasites after they have emerged. It becomes then a critical question how to get them out of the jar and into a very small vial. This is done by turning the jar on its side with the bottom toward a window. The parasites will immediately jump or fly toward the light, when the cover may be removed and the hand, holding a little vial, inserted. The vial is placed over the parasite, which will immediately give a frantic jump back into it, when the orifice may be closed by the finger and the hand withdrawn from the jar. A little wad of cotton saturated with chloroform is then inserted in the neck of the vial, and as soon as the parasite ceases to move it can be taken out with a delicate brush and mounted, as above indicated.

It is sometimes convenient to use a large vial instead of a wide-mouthed jar for this rearing. In this case, as the hand can not be inserted, it is a more complicated operation to remove the parasites after they have issued. Mr. Pergande accomplishes this in an ingenious way by taking a very small vial and wrapping the outside of its mouth with several thicknesses of paper until it forms a stopper to the larger vial. The combined vials are then held with the small one toward the window, and the parasites will immediately fly into the smaller one, where they may be easily killed and from which they may be removed and mounted. It is fortunate that they have this irresistible impulse to fly toward the light, otherwise it would be most difficult to remove them before mounting.

I have not had an opportunity of examining identified European forms of the subfamily. Twenty-seven species were catalogued by Kirchner, as follows:

MYINIDÆ Foerster.

511. G. Agonioneurus Westw.

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|--|---|
| 1. abdominalis Nees. Deutsch. | 11. Idæus Walk. Eng. |
| 2. Acestor Walk. Eng. | 12. locustarum Giraud. Wien. |
| 3. Argyope Walk. Eng. | 13. lycimnia Walk. Eng. |
| 4. Asychis Walk. Eng. | 14. Inaron Walk. Eng. |
| 5. basalis Walk. Eng. | 15. Moeris Walk. Eng. |
| 6. daucicola Foerst. Aachen. | 16. Proelia Walk. Eng. |
| 7. dubius Foerst. Aachen. | 17. tibialis Nees. Wien. Aus <i>Aphis chenopodii</i> . |
| 8. facialis Foerst. Aachen. | 18. varipes Foerst. Wien. Gezog. aus <i>Aphis ricia</i> . |
| 9. flavicornis Foerst. Wien. Gez. aus <i>Aphis papaveris</i> Fb. | |
| 10. flavus Nees. Deutsch. | |

512. G. Coccophagus.

1. insidiator Dalm. Deutsch., Wien.
2. obscurus Westw. Eng. (*Aphelinus obscurus* Walk. Mon. Chal. I, p. 6.)
3. scutellaris Dalm. Schweden.

513. *G. Mesidia* Foerst.

1. *M. pallida* Kirch. Im Grase im Prater, Augarten, und bei Klosterneuburg.

546. *G. Coccobius* Rtzb. (under Encyrtinae).

1. *annulicornis* Rtzb. Preussen.
2. *circumscriptus* Rtzb. Preussen. In *Coccus pini*.
3. *flavus* Nees. Preussen; (*Pallidus* Rtzb..) aus *Coccus tiliae* und *aceris*. Wien.
4. *luteus* Rtzb. Preussen. In *Coccus pini*.
5. *notatus* Rtzb. Preussen. In *Aspidiotus roseae*. Wien.

The Ratzeburgian species of *Coccobius*, five in number, are catalogued with the Encyrtinae. I have examined the original descriptions of nearly all of the species listed above, but with little satisfaction. They are invariably insufficient to establish specific identities, although their generic affinities can in many cases be told. Thus, of Kirchner's list, *abdominalis* Dalman (not Nees), *tibialis*, *asychis*, *basalis* Westwood (not Walker), *flavus* and *proclia* belong to *Aphelinus*; while *argiope*, *moeria*, *inaron*, *lycimnia*, and *idrus* belong apparently to *Coccophagus*. *Flavicornis* and *varipes* are probably species of *Aphelinus*. Of Ratzeburg's species, described under *Coccobius*, *notatus* is a *Coccophagus*, and *pallidus* is an *Aphelinus*. The position of the remaining three is doubtful, but I should not be surprised if it were eventually ascertained that *annulicornis* belongs to *Physeus*, *circumscriptus* to *Prospalta*, and *luteus* to *Ablerus*. Mr. Ashmead possesses a pair of specimens from Germany labeled in Foerster's handwriting "*Coccophagus xanthostictus* Ratz.," which, as a matter of course, are correctly placed generically, and which differ specifically from any of our North American species, resembling most closely *C. flavifrons* Howard, from California.

As to possible identities between European and American forms, we can only guess at present.¹ It is possible that *Aphelinus mali* (Halde- man), the widespread American parasite of Aphididae, will prove to be a synonym of *A. basalis* Westwood, while *Coccophagus lecanii* (Fitch) may prove a synonym of *C. scutellaris* (Dalman), and *C. immaculatus* Howard may prove identical with *C. insidiator* (Dalm.). The question can not be satisfactorily settled by existing descriptions. To give an idea of the difficulty surrounding this question we give Dalman's description of *C. scutellaris*: "Niger, scutelli macula flava, antennis fuscis;

¹Since the above was written I have received a small sending of parasites of Coccidae from Prof. A. Berlese, Scuola Reale di Portici, Italy, in which I have been able to recognize three of the species treated in this revision. These are *Aspidiotiphagus citrinus* (Craw), which Professor Berlese has reared from a species of *Mytilaspis* on olive, from an *Aspidiotus* on *Acacia longifolia*, and from *Diaspis rosa* on *Ribes rubrum*; *Aphelinus fuscipennis* How., from an *Aspidiotus* on *Acacia longifolia*, and *Prospalta aurantii* (How.), from *Aspidiotus ederae*, and from *Leucaspis pinifolia* on *Pinus canariensis*. It is impossible to say whether these three species are of European or American origin. If European, as is quite likely, I am totally unable to identify them with published European descriptions. For the present, therefore, the American names must hold.

pedibus flavis femoribus posticis nigris; alis immaculatis." (Kongl. Vetenskaps—Akad. Handlingar, 1825, p. 365.)

An Indian species, *Aphelinus theæ* Cameron, has been reared by Mr. E. E. Green, of Punduloya, Ceylon, from *Aspidiotus theæ*, and described by Cameron in the Mem. and Proc. Manchester Lit. and Philosoph. Soc., series 4, vol. IV, p. 183.

HOST RELATIONS OF THE SPECIES HERE TREATED.

LIST OF PARASITES AND HOSTS.

<i>Parasite.</i>	<i>Host.</i>
Eretmocerus corni	Aleyrodes corni.
Eretmocerus californicus.....	Aleyrodes on Quercus agrifolia.
Pteroptrix flavimedia	Aleyrodes spp. on Iris.
	Fuchsia.
	Sonchus.
	Willow.
	Sambucus.
	Aquilegia.
Perissopterus pulchellus	Asterolecanium on basswood.
	Chionaspis pinifoliae.
	Prosopophora on cottonwood.
	Aspidiotus sp. on currant.
Perissopterus mexicanus	Ceroplastes sp.
	Pseudococcus yuccæ.
	Lecanium hesperidum.
Aphelinus mali	Schizoneura lanigera.
	Glyphina eragrostidis.
	Aphis brassicæ.
	Pemphigus fraxinifolii.
	Aphis monardæ.
	Siphonophora rosæ.
Aphelinus mytilaspidis.....	Mytilaspis pomorum.
	Chionaspis pinifoliae.
	Diaspis carueli.
	Aspidiotus perniciosus.
Aphelinus abnormis.....	Mytilaspis pomorum.
Aphelinus diaspidis	Diaspis rosæ.
	Mytilaspis sp. on Dycaste.
	Aspidiotus juglans-regiæ.
Aphelinus fuscipennis.....	Aspidiotus perniciosus.
	Aspidiotus camelliae.
	Chionaspis enonymi.
	Mytilaspis gloverii.
	Mytilaspis pomorum.
Encarsia luteola	Aleyrodes sp.
Encarsia coquillettii.....	Aleyrodes sp. on Sonchus.
Encarsia angelica.....	Aleyrodes sp. on willow.
Aspidiotiphagus citrinus.....	Aspidiotus aurantii var. citrinus.
	Aspidiotus perniciosus.
	Aspidiotus ficus.
Coccophagus lecanii	Lecanium quercitronis.
	Pulvinaria innumerabilis.
	Lecanium prunosum.

<i>Parasite.</i>	<i>Host.</i>
Coccophagus lecanii	Lecanium persicae. Lecanium on plum. Pseudococcus aceris. Lecanium hesperidum.
Coccophagus fraternus.....	Lecanium persicae.
Coccophagus cognatus	Lecanium hesperidum. Lecanium sp. on plum. Lecanium persicae.
Coccophagus immaculatus ..	Eriococcus azaleae.
Coccophagus flavifrons.....	Lecanium sp. on Pinus australis.
Coccophagus flavoscutellum..	Lecanium hesperidum. Lecanium spp. from California. Dactylopius destructor. Lecanium tulipiferae. Pulvinaria on plum. Pulvinaria on Sullengia. Pulvinaria immuerabilis. Lecanium on plum. Lecanium sp. on Adenostoma. Lecanium sp. on Aretostaphylos.
Coccophagus californicus ...	Icerya purchasi.
Coccophagus imulatus	Aspidiotus aurantii.
Coccophagus sentatus.....	Kermes sp. on Quercus agrifolia.
Coccophagus ochraceus	Lecanium sp. on Adenostoma fasciculatum.
Prosopalta murtfeldtii	Aspidiotus uvae. Aspidiotus sp. on cherry. Aspidiotus sp. on currant.
Prosopalta aurantii	Aspidiotus aurantii var. citrinus. Aspidiotus ancyclus. Aspidiotus pini. Aspidiotus juglans-regiae. Mytilaspis citricola. Mytilaspis albus var. concolor. Mytilaspis eucalypti. Lecanium persicae. Chionaspis sp. on undetermined food plant.
Ablerus elisiocampae	Chionaspis furfuris. Aspidiotus sp. on pear and apple.
Physcus varicornis.....	Aspidiotus ancyclus. Chionaspis quercus. Chionaspis americana Johnson MS.

LIST OF HOSTS AND PARASITES.

Family APHIDIDÆ.

<i>Hosts.</i>	<i>Parasites.</i>
Aphis brassicae	Aphelinus mali.
Aphis monardae	Aphelinus mali.
Siphonophora rosa	Aphelinus mali.
Glyphina eragrostidis	Aphelinus mali.
Pemphigus fraxinifolii.....	Aphelinus mali.
Schizoneura lanigera	Aphelinus mali.

Family COCCIDÆ.

Aspidiotus ancyclus	Prosopalta aurantii. Physcus varicornis.
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<i>Hosts.</i>	<i>Parasites.</i>
<i>Aspidiotus aurantii</i> , var. <i>citrinus</i>	<i>Aspidiotiphagus citrinus</i> . <i>Coccophagus lunulatus</i> . <i>Prosopalta aurantii</i> .
<i>Aspidiotus pini</i>	<i>Prosopalta aurantii</i> .
<i>Aspidiotus ficus</i>	<i>Aspidiotiphagus citrinus</i> .
<i>Aspidiotus perniciosus</i>	<i>Aphelinus fuscipennis</i> . <i>Aphelinus mytilaspidis</i> . <i>Aspidiotiphagus citrinus</i> .
<i>Aspidiotus uvæ</i>	<i>Prosopalta murtfeldtii</i> .
<i>Aspidiotus camelliae</i>	<i>Aphelinus fuscipennis</i> .
<i>Aspidiotus juglans-regiæ</i>	<i>Aphelinus diaspidis</i> . <i>Prosopalta aurantii</i> .
<i>Aspidiotus</i> sp. on <i>Sonchus</i>	<i>Encarsia coquillettii</i> .
<i>Aspidiotus</i> sp. on cherry	<i>Prosopalta murtfeldtii</i> .
<i>Aspidiotus</i> sp. on currant	<i>Prosopalta murtfeldtii</i> . <i>Perissopterus pulchellus</i> .
<i>Aspidiotus</i> sp. on pear and apple	<i>Ablerus elisiocampæ</i> .
<i>Diaspis carneli</i>	<i>Aphelinus mytilaspidis</i> .
<i>Diaspis rosæ</i>	<i>Aphelinus diaspidis</i> .
<i>Mytilaspis albus</i> var. <i>concolor</i>	<i>Prosopalta aurantii</i> .
<i>Mytilaspis citricola</i>	<i>Prosopalta aurantii</i> .
<i>Mytilaspis eucalypti</i>	<i>Prosopalta aurantii</i> .
<i>Mytilaspis gloverii</i>	<i>Aphelinus fuscipennis</i> .
<i>Mytilaspis pomorum</i>	<i>Aphelinus mytilaspidis</i> . <i>Aphelinus abnormis</i> . <i>Aphelinus fuscipennis</i> .
<i>Mytilaspis</i> on <i>Dycaete</i> sp.	<i>Aphelinus diaspidis</i> .
<i>Chionaspis euonymi</i>	<i>Aphelinus fuscipennis</i> .
<i>Chionaspis furfuris</i>	<i>Ablerus elisiocampæ</i> .
<i>Chionaspis pinifolia</i>	<i>Perissopterus pulchellus</i> . <i>Aphelinus mytilaspidis</i> .
<i>Chionaspis quercus</i>	<i>Physeus varicornis</i> .
<i>Chionaspis americanus</i>	<i>Physeus varicornis</i> .
<i>Lecanium hesperidum</i>	<i>Perissopterus mexicanus</i> . <i>Coccophagus lecanii</i> . <i>Coccophagus cognatus</i> . <i>Coccophagus flavoscutellum</i> .
<i>Lecanium persicæ</i>	<i>Coccophagus lecanii</i> . <i>Coccophagus fraternus</i> . <i>Coccophagus cognatus</i> . <i>Prosopalta aurantii</i> .
<i>Lecanium prunosum</i>	<i>Coccophagus lecanii</i> .
<i>Lecanium quercitrionis</i>	<i>Coccophagus lecanii</i> .
<i>Lecanium tulipiferae</i>	<i>Coccophagus flavoscutellum</i> .
<i>Lecanium</i> sp. on <i>Arctostaphylos</i>	<i>Coccophagus flavoscutellum</i> .
<i>Lecanium</i> sp. on <i>Adenostoma</i>	<i>Coccophagus flavoscutellum</i> .
<i>Lecanium</i> sp. on <i>Adenostoma fasciculatum</i>	<i>Coccophagus ochraceus</i> .
<i>Lecanium</i> sp. on plum	<i>Coccophagus cognatus</i> .
<i>Lecanium</i> sp. on <i>Pinus australis</i>	<i>Coccophagus flavifrons</i> .
<i>Lecanium</i> spp. from California	<i>Coccophagus flavoscutellum</i> .
<i>Asterolecanium</i> on basswood	<i>Perissopterus pulchellus</i> .
<i>Pulvinaria innumerabilis</i>	<i>Coccophagus lecanii</i> . <i>Coccophagus flavoscutellum</i> .
<i>Pulvinaria</i> sp. on <i>Sullengia</i>	<i>Coccophagus flavoscutellum</i> .

Genus **ERETMOCERUS** Haldeman.

Eretmocerus Hald., Amer. Journ. Science, vol. ix, pp. 110, 111, May, 1850.

This genus, which Haldeman did not place, was put by Cresson, in his Synopsis, in the Mymarinae, which subfamily was located with the Proctotrypidae. The reason for this placing was probably the fact that Haldeman placed the genus *Amitus*, described immediately before *Eretmocerus*, in the Mymarinae. Mr. Ashmead, in his monograph of the Proctotrypidae, places *Amitus* in the proctotrypid subfamily Platygasterinae, and in making the necessary studies upon this genus, recognized the aphelinine affinities of *Eretmocerus*, the antennae figured by Haldeman resembling very considerably the antennae of the genus *Plastocharis* Förster. In studying a series of parasites reared by Mr. Coquillett in California from *Aleyrodes*, I have been delighted to recog-

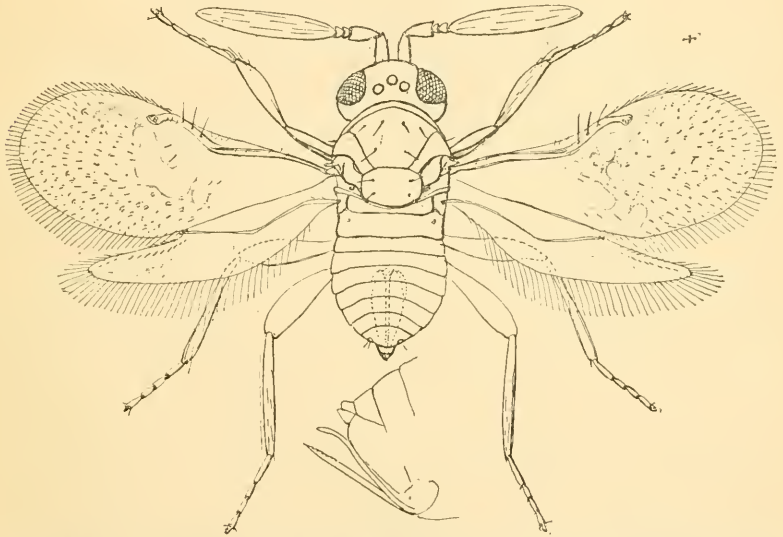


FIG. 1.—*Eretmocerus californicus* Howard: female, showing side view of genitalia below—greatly enlarged (original).

nize a form which belongs, with little doubt, to *Eretmocerus*. Haldeman described the genus only from two mutilated specimens reared from *Aleyrodes corni*, and which he states were “imperfectly examined.” Among Mr. Coquillett’s specimens were fortunately many males, so that I am able to redescribe the genus in full. The differences between the form which I have studied and Haldeman’s description are as follows:

Haldeman states that the tarsi are “apparently pentamerous,” eyes hairy, and antennal club oar-shaped (whence the generic name).

In the form which I have studied, the tarsi are 4-jointed (a discrepancy owing, no doubt, to the fact that I have been able to see them clearly under a high power), the eyes are not hairy, and the antennal

club is subellipsoidal. The two latter differences, then, are specific simply, and the first is apparently founded upon imperfect observation on the part of Haldeman.

The generic characters are plainly brought out in the figures. Especial attention is drawn to the fact that the marginal vein is about equal to the stigmal in length. The apical cilia of the forewings are short; the lower border of the mesosentar parapsides is strongly curved, the male genitalia are, in most specimens, strongly exerted, and the penis is not perceptibly notched. The female genitalia are not produced beyond the tip of the abdomen. The male antennæ are 3-jointed, lacking all trace of the two ring joints seen in the female. The club is very long, twice as long as that of the female, subcylindrical, rounded at tip, and furnished with many long sensory spots. The mandibles are 3-dentate.

ANALYSIS OF THE SPECIES OF ERETMO CERUS.

Eyes hairy, antennal club of female oar shaped.....*corni*
 Eyes naked, antennal club of female ellipsoidal.....*californicus*

Eretmocerus corni Haldeman (fig. 2).

Eretmocerus corni Haldeman. American Journal of Science, vol. IX, pp. 110, 111, May, 1850.

Haldeman's original description included both generic and specific characters confused together. The species has not been found since, and we can only quote his words:

"Two mutilated specimens of another species of parasite were raised with the preceding and imperfectly examined. The color is pale flavous; the wings have a subcostal nerve not quite straight, ending in a short stigmal branch about the middle, the wings in all other respects as in *Amitus*; feet slender and apparently pentamerous; eyes black, covered with numerous short erect bristles, more distinct than in

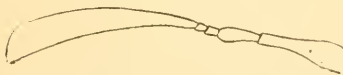


FIG. 2.—Antenna of *Eretmocerus corni* Haldeman—very greatly enlarged (re-drawn from Haldeman).

Chelonus; head, thorax, and abdomen closely united, thorax large, abdomen with sides parallel and the apex obtusely rounded; in one specimen (δ ?) the abdomen seems but half the width of the thorax, and in the other its sides form straight lines with it; antennæ (see annexed figure) 5-articulate, shorter than the body, scape narrowed toward its apex, second articulation obconic, third and fourth very short, fifth oar-shaped (whence the generic name), longer than all the preceding united, widened toward the apex, which is obtusely rounded. It may possibly be parasitic in the larva of the *Amitus* described above, as it is somewhat less in size. I propose to name the genus *Eretmocerus*, and the species *E. corni*."

Eretmocerus californicus n. sp. (figs. 1 and 3).

Female (fig. 1).—Length, 0.8 mm.; expanse, 1.5 mm.; greatest width of fore-wing, 0.23 mm. Antennal scape short, inserted just above

border of mouth. Flagellum a little longer than width of head. Pedicel large, triangular, followed by two ring joints and a long, stout, ellipsoidal club. General color uniform pale yellow; eyes black; ocelli coral red; wing veins nearly hyaline. Ovipositor scarcely visible from above.

Male (fig. 3).—Differs from female mainly in structure of antennæ. Scape subjointed, ring joints are absent, and club is very long and as stout as pedicel. Club is flexible and is usually bent downward, the bend occurring a little below the middle; it is a little longer than head and thorax together. The genitalia are strongly exserted, the intromittent organ pointed at tip, and resembling an ovipositor.

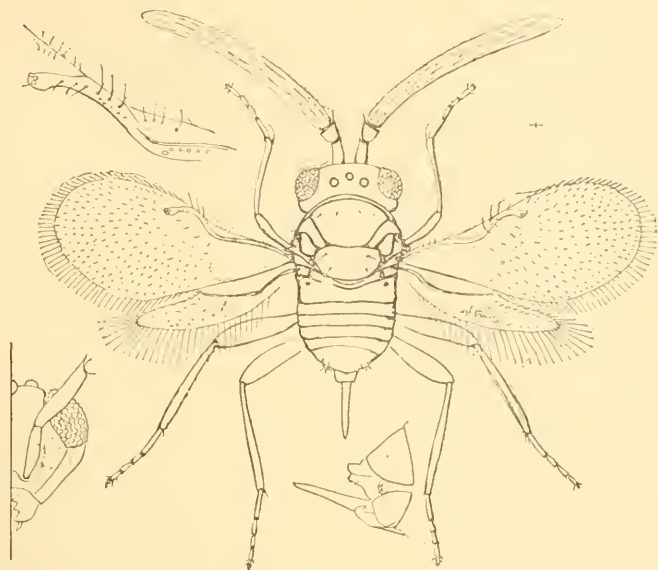


FIG. 3.—*Eretmocerus californicus* Howard: male, showing genitalia below, wing venation and front view of head at left—greatly enlarged (original).

Described from many male and female specimens reared in June and October from an undescribed *Aleyrodes* on *Quercus agrifolia* at Los Angeles, Cal., by Mr. D. W. Coquillett.

Genus **PTEROPTRIX** Westwood.

Pteroptrix Westwood. Lond. and Edinb. Phil. Mag., vol. III, 1833, pp. 333, 334.

It is a pleasure to restore Westwood's *Pteroptrix* to the group with which he originally considered it to be affiliated. In his original description his opening statement is that it is near *Agonioneurus* (*Aphelinus*). The 4-jointed tarsi of this insect have, however, misled other writers. Foerster, largely on this account, placed it in the Tetrastichinae, but showed that it differed from the majority of these forms in the lack of the furrows of the scutellum, and suggested its

affinity with the Trichogramminæ. He seems, however, to have had another and true tetrastichine form before him which he considered identical with *Pteroptrix*. In his Nachtrag he changes the name *Pteroptrix* (which, by the way, he spells *Pterothrix*, as amended by Nees) to *Gyrolasia*, on account of the preoccupation of the former name by a genus of composite plants. On account of the probability that he had before him a true tetrastichine, we can retain the genus *Gyrolasia* in the Tetrastichinæ, and since we have what is, with little doubt, Westwood's form, which, upon close study, proves to be an aphelinine in spite of its 4-jointed tarsi, Westwood's original name may be revived under its original form, Foerster's reasons for changing the name being insufficient. The doctrine that "once a synonym always a synonym" will hardly hold here, if we are correct in our supposition that Foerster

had a different form before him.

The main characters by which the genus may be distinguished are as follows:

Antennæ 8-jointed, pedicel broad and very short, joints 1 and 2 of flagellum very short and narrow, as in *Aphelinus*, third, fourth, fifth, and sixth joints forming the club, third sometimes distinct from the club. Mesoscutar

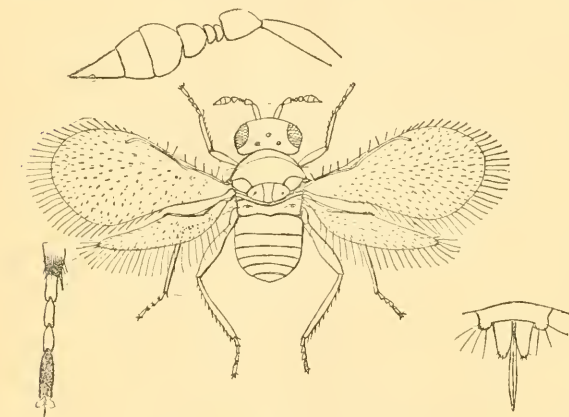


FIG. 4.—*Pteroptrix flavimedia* (Howard): male; female genitalia at right, enlarged middle tarsus at left, antenna above—greatly enlarged (original).

parapsides short, reaching only to tegulae; sentellum transversely elliptical; marginal vein of forewings long, much longer than stigmal. Wings with rather long marginal cilia. Abdomen rounded, perfectly sessile; middle tibial spurs short; tarsi 4-jointed; first, second, and third joints subequal in length, fourth joint considerably longer. This last is an unusual character and would indicate the possible coalescence of the normal fourth and fifth joints.

Pteroptrix flavimedia (Howard) (fig. 4).

Gyrolasia flavimedia Howard. Report of the Entomologist, Annual Report Department Agriculture, 1880, p. 369, Pl. XXIV, fig. 5.

Male and female.—Length, 0.7 mm.; expanse, 1.9 mm.; greatest width of fore wing, 0.32 mm. Antennæ short, sparsely covered with short hairs; scape slender; pedicel broader, twice as long as broad; funicle 3-jointed, joint 1 very minute (a true ring joint), joint 2 nar-

rower than pedicel, broader than long, considerably larger than joint 1. Joint 3 longer than 1 and 2 together and broader than long. Club very broad at base, 3-jointed, acuminate at tip, broadest portion near end of first joint. Joint 3 longest, joint 1 next, joint 2 shortest. Head with sparse but very noticeable stout hairs. Eyes naked. General color deep black, with slight metallic reflections on dorsum of thorax. Second abdominal segment yellow, but when abdomen is bent upward or shrunk this color is hidden. Antennal scape black; remaining joints yellowish brown; tarsi yellowish; last joint dark brown or black. Femora and tibiae dark brown, except front tibiae, which are lighter. Entire abdomen sometimes light brown, particularly with male, the venter being lighter than dorsum. Mouth-parts honey yellow or light brown, with a honey-yellow band on prosternum at insertion of front coxæ. Wing veins black, very distinct, forewings with a large dusky patch below submarginal vein.

Described from many male and female specimens. Types were reared in this office from specimens of *Aleyrodes* collected by Professor Comstock on *Iris* at Los Angeles, Cal., and from an *Aleyrodes* on *Fuchsia* collected in the same locality by Alex. Craw in 1879. A large series of the same species was also bred by Mr. Coquillett eight years later at Los Angeles, Cal., from the same *Aleyrodes* on *Fuchsia* (October 4); from an *Aleyrodes* on *Sonchus* (September 16–21); and from another species of the same genus on willow (September 17), as well as from an *Aleyrodes* on *Sambucus* (October 21). Another series of nine specimens was reared by Mr. T. D. A. Cockerell from *Aleyrodes* on *Aquilegia* at Las Cruces, N. Mex., November 20, 1894; and a single male of what may be the same species was also reared by Mr. Cockerell from an *Aleyrodes* at Kingston, Jamaica.

Genus **MESIDIA** Foerster.

Mesidia Foerster. Hymenopterologische Studien, Heft. 11, p. 30, 1856.

This genus is unknown to me. A very brief characterization, however, which Foerster gives distinguishes it well from all other genera. The forewings have the oblique hairless line, and the three joints before the club of the antennæ are of equal length. It is said to be intermediate in its characters between *Coccophagus* and *Aphelinus*.

Genus **CENTRODORA** Foerster.

Centrodora Foerster. Kleine Monographien. 1878, pp. 66, 67.

This genus is also unknown to me. The head is as broad as the thorax, the antennæ 6-jointed, scape of male broad; with the female the pedicel is of the usual form, with two ring joints following, of which the first is smaller than the second. The third funicle joint is somewhat longer than the pedicel, and the fourth is very long, but not as

long as the others together. The parapsidal sutures of the mesoscutellum are plain; the mesoscutellum and the mesoscutum are large, the abdomen is as long as the head and thorax, and the ovipositor extrudes about one-third the length of the abdomen; the middle tibia with a long spur, the front femora of the male strongly thickened. The wings are longer than the abdomen, and narrow. The marginal vein is as long as the submarginal and reaches the middle of the wings. The stigmal is short; the hind-wings only have long apical cilia.

PERISSOPTERUS new genus.

Type: *Aphelinus pulchellus* How.—Ann. Rept. Dept. Agr., 1880, p. 356.

Antennæ apparently 6-jointed, inserted below middle of face; scape not long, swollen toward tip; pedicel one-third length of scape; funicle joints 1 and 2 very small, almost like ring joints; funicle joint 3 as long as pedicel, broadening toward tip and forming with club a broad-ovate mass; club undivided, about twice as long as funicle joint 3. Face

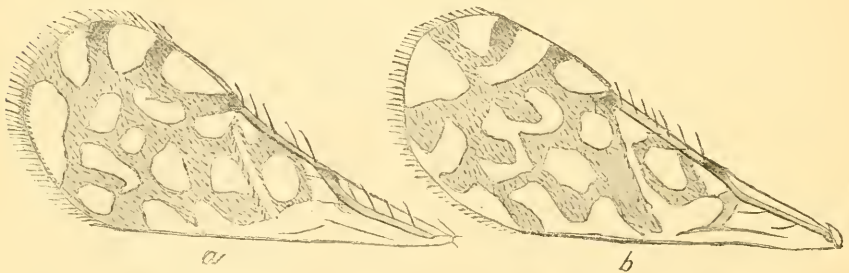


FIG. 5.—Wings of *Perissopterus*: a, *pulchellus*; b, *mexicanus*—greatly enlarged (original).

excavated, vertex wide, ocelli at angles of nearly right-angled triangle. Mesoscutar parapsides narrow, very oblique; mesoscutellum broad, rounded at tip; mesopostscutellum and metascutum plainly divided transversely into three sclerites, the central one of each triangular, its rather sharp point directed posteriorly. Forewings with a narrow, oblique, hairless streak, and ornamented with an irregular pattern of rather broad, dark lines, composed of stout black cilia with granular dark dots between; the cells and spaces between these dark lines silvery white and bearing smaller and more delicate white discal cilia; submarginal and marginal veins subequal in length; stigmal given off at about half the wing length, very short and stout; marginal cilia moderate. Hind wings rather broad, rounded at tip, hyaline. Abdomen very concave above in dry specimens, perfectly sessile, rounded at tip; ovipositor extruded for about one-fifth length of abdomen.

This remarkable and handsome genus approaches *Aphelinus* in the structure of its antennæ and *Centrodora* in its extruded ovipositor. Its middle tibial spur is stronger than is common among the Apheli-

ninae, and its extraordinary wing markings, as well as the peculiar formation of the notal sclerites behind the mesoscutellum distinguish it widely from hitherto described genera. The type described by the writer as *Aphelinus pulchellus* in the Annual report of the Department of Agriculture for 1880 is known from a single female specimen only, which was reared from a common *Asterolecanium* on linden in the District of Columbia. Upon this single specimen I did not care to erect a new genus. Recently, however, several specimens of an allied though congeneric species have been reared from Coccidæ sent in by Mr. C. H. Tyler Townsend from Guadalajara, Mexico. One specimen he reared himself some three years ago from a *Ceroplastes*, another specimen we have reared from *Pseudococcus yuccæ* collected by Mr. Townsend on Pelargonium at Aguas Calientes, Mexico, and three other specimens have been reared from specimens of *Lecanium hesperidum* collected by Mr. Townsend on lime at San Luis, Mexico.

ANALYSIS OF THE SPECIES OF PERISSOPTERUS.

General color white, tinged in spots with dark, reddish orange, dotted with black *pulchellus*
 General color light orange-yellow, dotted with black, no admixture of reddish or white *americanus*

(The specific differences between the two species in the wings, as shown in the figure, will enable the readiest recognition of the species.)

Perissopterus pulchellus (Howard) (figs. 5 a and 6).

Aphelinus pulchellus Howard. Report of the Entomologist, Annual Report Dept. Agric. 1880, p. 356.

Female.—Length, 1 mm.; expanse, 2.2 mm.; greatest width of forewings, 0.41 mm. (For some unexplained reason the measurements given in the original description are erroneous. Those just given were taken recently from the type.) Head and thorax quite uniformly but finely punctate; mesoscutellum more coarsely than other parts. Head and thorax white, tinged in spots with orange, except at sides of metathorax, which are blackish; propleura white; mesopleura blackish; mesosternum brown; eyes bluish white; antennal scape white, with a longitudinal narrow black stripe below; pedicel white, with a black stripe below, dark brown at base above. Joints 1 and 2 of funicle dark brown; joint 3 white, with a dark brown patch at base and above. Club with basal two-thirds dark brown, yellow at tip; two large brown spots on lower side of cheeks; face and vertex white; hairs on vertex brown, ocelli reddish. All legs white; femora spotted with black, tibiæ banded with black. Hind coxæ dusky, middle and fore coxæ white; each tibia with three equidistant black bands. First, second, and fifth tarsal joints black; third and fourth yellowish; middle tibial spur jet black. Abdomen yellowish, brown above, darker in middle, sometimes black; sides white, with irregular subcircular black markings; ovipositor black; wings hyaline, with an irregular pattern of open net-

work in fuscous; cilia upon fuscous portion very strong and black, on the remainder small and white. The pattern of the network of the type specimen is shown in fig. 5*a*, but it varies considerably, as is shown by recently reared additional specimens. The clear oblique line is narrow and perfectly straight; the hind-wings entirely hyaline.

Male.—Smaller than the female, which it otherwise closely resembles. The general color is darker and the black markings are broader. The penis is long; the abdomen of one specimen is entirely black above and of another yellowish, with black transverse bands at joints.

Originally described from one female specimen reared from *Prosopophora* on linden in the District of Columbia in 1879. Four additional specimens, two females and two males, were reared in April, 1895, from the same host insect. Other specimens have been reared from *Chionaspis pinifolii* received from Providence, R. I., and from a *Prosopophora*

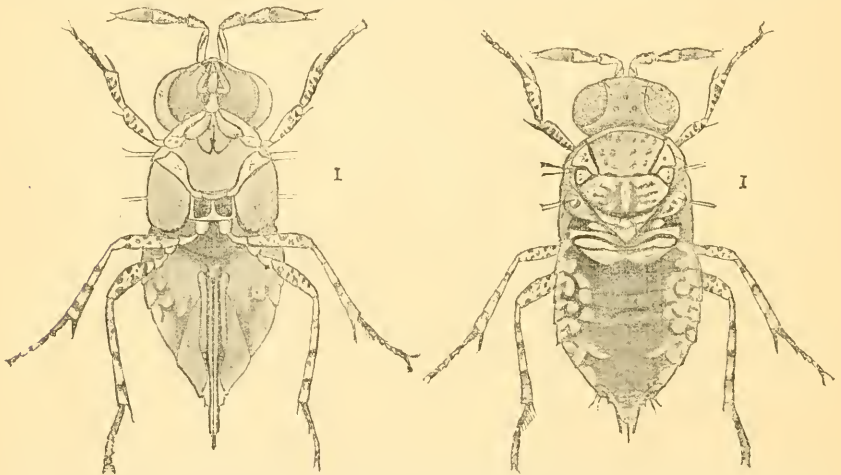


FIG. 6.—*Perissopterus pulchellus*, new species, female; ventral view at left, dorsal view at right (wings removed)—greatly enlarged (original).

on cottonwood from East Atchison, Mo., sent in by Mr. W. S. Connor, while a single specimen has been reared by Mr. W. G. Johnson, at Champaign, Ill., from a species of *Aspidiotus* on currant, and is now in the collection of the Illinois State Laboratory of Natural History. All the specimens vary somewhat in wing markings, but the general pattern remains the same as that shown at fig. 5*a*.

Perissopterus mexicanus n. sp. (fig. 5*b*).

Female.—Length, 0.84 mm.; expanse, 2.3 mm.; greatest breadth of fore-wing, 0.41 mm. Head and thorax closely and finely punctate; eyes smooth; dorsal surface of abdomen faintly shagreened; wing markings of type shown in figure. General color light orange-yellow, without the strong reddish hue and admixture of white seen in *pulchellus*. Pronotum, tegulae, postscutellum, metascutum, under side of abdomen and

pleura, whitish; mouth-parts also whitish. Antennal scape silvery white, with two oblique black stripes below. Pedicel black at base, the black extending farther forward on the upper side; otherwise silvery white. Ring joints black, third funicle joint concolorous with pedicel; club black at base and tip, with an orange stripe around the middle. All legs white, all femora with four black bands, all tibiae with three black bands, tibial spurs black. First and second dorsal segments of abdomen blackish, third and fourth yellow, fifth black. Mesoscutum and scutellum with many black dots; those on the scutellum number eight, arranged in two transverse rows; those in the anterior row far apart, and those in the posterior row close together. The two interior spots in the first row and the two outer spots in the second row are piliferous. Dorsum of abdomen black; ovipositor black.

Male.—Closely resembles female, differing only in the genitalia and the smaller size.

Described from three females and two males reared from *Lecanium hesperidum*, *Pseudococcus yuccae*, and *Ceroplastes* sp. Guadalajara, Mexico: C. H. Tyler Townsend.

Genus APHELINUS Dalman.



FIG. 7.—*Aphelinus diaspidis* Howard—greatly enlarged (from *Insect Life*).

Aphelinus Dalman. Sv. Akad. Handl., 1820, 181.

Agonioncurus Westwood. Mag. Nat. Hist., vol. VI, 1833.

Myiina Nees. Hymenopterorum Ichneumonibus Affinium, 1834.

Aphelinus Walker (in part). Monographia Chalciditum, London, 1839.

Coccobius Ratzeburg (in part). Ichneumonen der Forst-Insekten, vol. III, 195, 1852.

Eriophilus Haldeman. Proc. Bost. Soc. Nat. Hist., vol. VI, 402, 1860.

In this old and well-known genus the oblique hairless line of the front wings is very distinct. The ovipositor is very slightly extruded, or is entirely hidden. The fringed apical cilia of the fore-wings is very short; the body is robust, eyes naked in the yellow species and hairy

in the black species. The posterior border of the mesoseutellum is rounded and the anterior border is bounded by three straight lines. The antennæ are 6-jointed, scape long and slender, pedicel normal, joints 1 and 2 of the funicle very short, joint 3 about as long as or a little longer than the pedicel, club compact, not jointed, subellipsoidal. The middle tibial spur is very pronounced, mesoscutar parapsides rather small, marginal vein very long, longer than submarginal; stigmal and postmarginal short.

ANALYSIS OF THE SPECIES OF APHELINUS.

Eyes hairy; general color black; pedicel twice as long as thick.

Head jet black *mali*

Head bright orange *flaviceps*

Eyes naked; general color yellow; pedicel one and one-half times as long as thick.

Club twice as long as penultimate joint..... *mytilaspidis*

Club thrice as long as penultimate joint.

Scutellum pointed at base *abnormis*

Scutellum normal.

Forewings with only a faint cloud beneath stigma..... *diaspidis*

Forewings with a distinct fuscous cloud occupying the whole discal region
and accented below stigmal and at its proximal border .. *fuscipennis*

Aphelinus mali (Haldeman).

Eriophilus mali Haldeman. Proc. Boston Soc. Nat. Hist., vol. VI, p. 402, 1860.

Aphelinus mali Howard. Ann. Rep. Dept. Agric., 1880, p. 356.

Blastothrix rose Ashmead. Trans. Am. Entom. Soc., vol. XIII, p. 130, 1886.

Female.—Length, 1.2 mm.; expanse, 2.3 mm.; greatest width of forewing, 0.41 mm. Pedicel twice as long as thick; club nearly three times as long as penultimate joint; head and thorax smooth, shining; mesoscutum with sparse, irregularly placed, and fine punctures; mesoseutellum very faintly shagreened; abdomen perfectly smooth; mesopleura at tip faintly shagreened, smooth at base; hind coxæ also faintly shagreened; eyes plainly hairy; vertex with rather dense black pile; sparse hairs of thorax black; abdomen ovate, as wide as thorax, concave above. Discal cilia of forewings proximally bordering hairless streak much longer and stouter than those on distal side of streak. Of these proximal cilia there are only two or three irregular rows, the remainder of base of wing being hairless, except immediately below marginal vein, and excepting also the normal bristles arising from the submarginal. General color black, not metallic; base of abdomen, and sometimes apex, yellow-brown; antennæ honey yellow. Front and middle femora and middle and hind tibiæ, dark brown, lighter at extremities; front tibiæ slightly dusky at base, but in general sordid yellow. Hind femora pale sordid yellow; all tarsi light; wings hyaline; submarginal vein dark brown, marginal much lighter.

Male.—Similar to female, slightly smaller; abdomen acuminate. Proximal cilia bordering hairless streak of fore-wings, consisting of a single row for a greater part of the wing width.

Redescribed from thirty-one male and female specimens reared by the writer from *Schizoneura lanigera*, at Washington, D. C., February 15 and September 20, 1879 (previously reared from the same species by Haldeman in Pennsylvania, Walsh in Illinois, and Riley in Missouri); by F. M. Webster from *Glyphina eragrostidis*, at La Fayette, Ind., September 6-10, 1885; by the same observer from *Aphis brassicae*, on turnip; by T. A. Williams, at Lincoln, Neb., from *Pemphigus fraxinifolii*, June 10, 1890; and by the same observer from *Aphis monardae* at Ashland, Nebr., May 24, 1890. Mr. Ashmead's specimens, which he described under the name of *Blastothrix rosa*, were reared from *Siphonophora rosa* in April, 1881, at Jacksonville, Fla.

Aphelinus flaviceps n. sp.

Male.—Belongs to the same group as *A. mali*, which it resembles in the proportions of the antennal joints and in the hairy eyes. It is a species of the same general size, and differs from *A. mali* in the following particulars: The pile of the head is much less conspicuous, and is yellowish instead of black; the mesoscutum is more or less thickly punctate, the punctures being arranged in rows; the mesoscutellum is more coarsely, though still finely, shagreened; mesopleura plainly shagreened over entire surface, not smooth on basal half; hind coxæ granulate. Entire thorax black; entire head uniform orange-yellow, except occiput, which has a dark transverse streak. Abdomen dark in the middle above; for the rest concolorous with head. All legs and antennæ uniform orange-yellow. Wings hyaline, veins light, the cilia at proximal border of hairless streak larger than those at apical border (more than twice as long and much stouter); they are irregularly placed, and on the lower half of the wing form approximately two rows.

Described from one male specimen collected in the Santa Cruz Mountains, California, by A. Koebele, in May. Probably parasitic on some Aphidid.

Aphelinus mytilaspidis Le Baron.

Aphelinus mytilaspidis Le Baron. American Entomologist, vol. II (1870), p. 360.

Female.—Length, 0.64 mm.; expanse, 1.28 mm.; greatest width of fore-wing, 0.22. Eyes naked; pedicel of antennæ one and a half times as long as thick, club twice as long as penultimate joint; thorax smooth, impunctate; abdomen ovate, as wide as thorax. Cilia at proximal border of hairless streak of forewings larger than those at apical border, but hardly twice as long. There are at least seven irregular rows, and they extend back nearly to base of wing, with slight interruption at two-thirds distance from tegula to hind border of hairless streak. General color bright lemon-yellow; scape of pedicel and sometimes funicle joints 1 and 2 of antennæ dusky; eyes blackish, ocelli carmine, mandibles brown, all legs yellow, wing veins bright yellow; wings perfectly hyaline.

Male.—Similar to female, slightly smaller; antennal club somewhat truncate at tip.

Described from many male and female specimens, mostly reared at the Department of Agriculture in 1879 and 1880. The species was reared by Le Baron from *Mytilaspis pomorum* Bouché, in Illinois; by Riley from the same species in Missouri; and it is probably the species which caused the round holes observed in this scale by Dr. Fitch in New York. At the Department of Agriculture it has been reared from *Mytilaspis pomorum* from Illinois and the District of Columbia; from *Chionaspis pinifolii* (District of Columbia), and from the same species by Riley in Missouri; and from *Diaspis carueli* Targioni on juniper.

Aphelinus abnormis Howard.

Aphelinus abnormis Howard. Ann. Rep. Dept. Agric., 1880, p. 355.

Female.—Length, 0.55 mm.; expanse, 1.4 mm.; greatest width of fore-wing, 0.23 mm. General proportions as with *A. mytilaspidis*, from which it differs only in the following respects: The scutellum is pointed anteriorly, seemingly entering a reentering angle on the base of meso-scutum; antennal club three times as long as penultimate joint; color, light lemon-yellow, lighter than the preceding species; antennæ dusky; legs with yellowish femora and dusky tibiæ and tarsi; wings perfectly clear; veins transparent.

Described from one female specimen reared from *Mytilaspis pomorum* on *Salix caprea*, District of Columbia. No other specimen of this peculiar form has ever been found. There is a possibility that it may be simply a dwarfed and distorted specimen of *A. mytilaspidis*.

Aphelinus diaspidis Howard (fig. 7).

Aphelinus diaspidis Howard. Ann. Rep. Dept. Agric., 1880, p. 355.

Female.—Length, 0.78 mm.; expanse, 1.9 mm.; greatest width of fore-wing, 0.27 mm. Differs at once from *A. abnormis* in the normal character of the scutellum and from *A. mytilaspidis* in the fact that the club is three times as long as the penultimate joint, instead of twice as long. It further differs from *A. mytilaspidis* in the following particulars: The entire space proximad of hairless line of forewing is densely ciliated, the cilia but slightly larger than those distad of this line. At the abrupt upward bend of the submarginal into the marginal a triangular clear space occurs, the distal side of which is curved, the apex touching the beginning of the marginal vein. The forewings have a delicate fuscous patch bending outward from below the stigma and covering the entire disk from that point back to the triangular clear space. The incision between the penultimate joint of the antennæ and the club is not well marked, joint 5 apparently forming part of the club. Color dull, rather dark yellow; eyes black, ocelli very dark red, antennæ dusky, darker at tip; a narrow dark transverse line on the occiput

behind the eyes. Femora and tibiae fuscous; tarsi nearly white; wing veins fuscous. Abdominal segments 1 to 5 each with a dusky transverse dorsal band interrupted toward the middle; abdomen subovate, somewhat truncate at tip; ovipositor slightly exerted.

Male.—Unknown.

Described from twelve female specimens reared from *Diaspis rosa* from Fort George, Fla., and the same species collected at Santa Barbara, Cal., and from the same species collected in the District of Columbia. All specimens were reared in February. Professor Riley reared nine females from a *Mytilaspis* on an orchid, an undetermined species of *Dycaste* from Japan, received February 6, 1874, from Mr. George Thurber, of The American Agriculturist.

Aphelinus fuscipennis Howard.

Aphelinus fuscipennis Howard. Annual Rep. Dept. Agric., 1880, p. 356.

Female.—Length, 0.6 mm.; expanse, 1.3 mm.; greatest width of forewing, 0.2 mm. Closely resembles *A. diaspidis*, the differences, aside from its smaller size and the more pronounced infuscation of the wing, being purely colorational. General color, dull honey yellow; antennæ fuscous, almost black at tip; eyes blackish; ocelli dark crimson; a distinct transverse black band on the occiput behind the eyes; the scutellum dusky at tip; abdomen with five dusky lateral transverse bands; legs and wing veins honey yellow; fore-wings with an indefinite fuscous patch below stigma and another well-defined, darker, somewhat crescent-shaped streak near the base, bounded by the basal clear space.

Male.—Closely resembles the female, but is slenderer and in general darker in color.

Described from many female specimens and comparatively few males, reared from *Aspidiotus perniciosus* at San Jose, Cal.; Los Angeles, Cal.; San Francisco, Cal.; New Brunswick, N. J., and Riverside, Md.; from *Chionaspis euonymi* from Fort George, Fla.; from *Mytilaspis gloverii* in hothouses in the District of Columbia, and from *Mytilaspis pomorum* on horse-chestnut in the District of Columbia. Professor Berlese has reared this species in Italy from an *Aspidiotus* on *Acacia longifolia*.

Genus PLASTOCHARIS Foerster.

Plastocharis Foerster. Hymenopterologische Studien, Heft. II, 145, 1856.

Tryphasius Foerster. Loc. cit., 83.

Thysanus Walker. Ann. Nat. Hist., 1839, p. 234. (Changed by Foerster on account of preoccupation.)

The best description of this genus is given by Foerster in his *Kleine Monographien*, page 68. It is not known to occur in this country. The male antennæ have one ring joint and a very long flagellar club. The female antennæ have three ring joints and a shorter club. The middle tibiae have a long spur and the tarsi are 5-jointed. The base of

the wing is hairless, and the oblique line is therefore lacking. The forewings on their last third have a very long fringe of hairs, their length not equaling the wing breadth. Basal half of forewing brown-

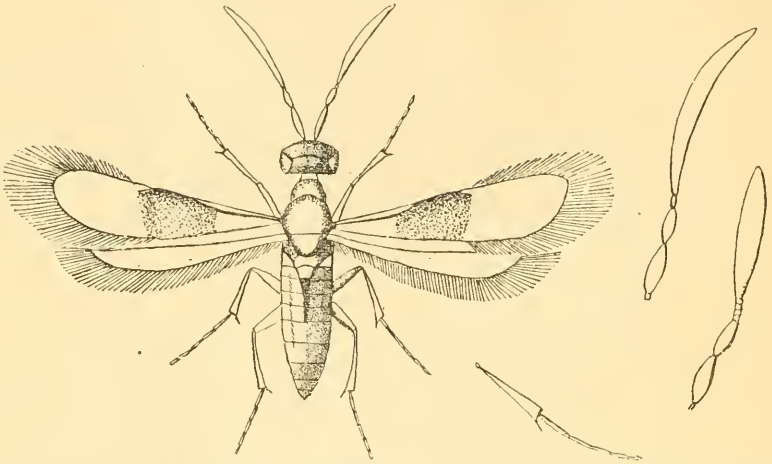


FIG. 8.—*Plastocharis ater* Walker: female; enlarged middle tarsus and male and female antennæ at right—greatly enlarged (redrawn from Haliday in Walker's notes).

ish. Hind-wings with very long marginal cilia, extending around upon the fore margin nearly to the vein; ovipositor is not extruded (fig. 8).

Genus **ENCARSIA** Foerster.

Encarsia Foerster, Kleine Monographien, 1878, pp. 65, 66.

The characters briefly given by Foerster include the following:

Head not so broad as the thorax; side of the ocelli about as far from the middle of the ocellus as from the border of the compound eyes. Antennæ 8-jointed, flagellar joints of equal length and cylindrical, last two closely joined. Mesoscutum broad, with sharp parapsidal furrows, scutellum very strongly developed, broad, almost semicircular. The abdomen as long but not as broad as the thorax and broadly oval pointed. Tarsi 5-jointed. The thickly ciliated wing has the submarginal not much longer than the marginal, the postmarginal wanting, and the stigmal very short and forming a considerable angle with the costa. The hairless line is wanting; the hind border of the hind-wings with long cilia.

But one European species, *E. tricolor*, is known.

ANALYSIS OF THE SPECIES OF ENCARSIA.

First funicle joint not swollen.

Pedicle one-third longer than first funicle joint; joint 2 considerably longer than joint 1.....*luteola*

Pedicle considerably shorter than first funicle joint; joint 2 equal in length to joint 1.....*coquilletti*

First funicle joint somewhat swollen, longer and broader than pedicle, and broader and slightly stouter than second funicle joint.....*angelica*

Encarsia luteola n. sp.

Female.—Length, 0.63 mm.; expanse, 1.3 mm.; greatest width of fore-wing, 0.19 mm. Pedicel stout, two-thirds as broad as long, and about one-third longer than first funicle joint. Joint 2 of funicle one-third longer than joint 1; joint 3 twice as long as joint 1; joints 4 and 5 as long as 3; terminal joint a trifle longer; all joints well separated, subcylindrical, increasing very slightly in width to club. Thorax without perceptible sculpture. Eyes dark, ocelli coral red, wings perfectly hyaline, general color yellowish. Vertex with black transverse line between the eyes. Upper portion of head somewhat orange, face lighter. Dorsum of thorax dark orange, becoming somewhat dusky at sides, particularly at insertion of wings; abdomen light pale yellow. All legs and antennæ uniform light yellow, club of antennæ slightly dusky. Submarginal vein fuscous, marginal and stigmal faintly yellowish.

Described from one female specimen reared August 14, 1881, from *Aleyrodes* at Washington, D. C.; food-plant unknown.

Encarsia coquilletti n. sp. (fig. 9).

Female.—Length, 0.88 mm.; expanse, 1.7 mm.; greatest width of fore-wing, 0.27 mm. Pedicel of antennæ twice as long as broad, a little more than half as long as and about as broad as joint 1 of funicle; remaining joints of funicle subequal in length, slightly rounded at extremities, and slightly flattened laterally. Dorsum of thorax faintly shagreened; abdomen smooth; abdomen broadly ovate. Eyes black, ocelli reddish, wings faintly dusky on basal half, general color black; joints between segments of abdomen lighter; all tibiæ and tarsi dusky, femora banded in the middle with black, trochanters pallid, antennal scape dark brown, funicle light brown.

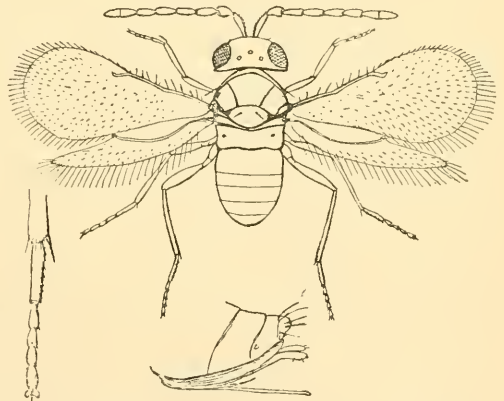


FIG. 9.—*Encarsia coquilletti* Howard: male; female genitalia below; enlarged middle tarsus at left—greatly enlarged (original).

Male.—Differs from the female in not having the abdomen broadly ovate, wings perfectly hyaline, legs all slightly fuscous, and entire abdomen yellow or light brown.

Described from five females and two males reared by Mr. D. W. Coquillett, at Los Angeles, Cal., from *Aleyrodes* on *Sonchus*, September 18-21.

Encarsia angelica n. sp.

Male.—Length, 0.74 mm.; expanse, 1.7 mm.; greatest width of forewing, 0.25 mm. Pedicel as broad as long, less than half as long as joint 1 of funicle; funicle joint 1 as wide as or slightly wider than pedicel, rounded at base, more truncate at tip, appearing swollen in comparison with next joint; joint 2 a little longer than joint 1 and narrower, cylindrical; joints, 3, 4, and 5 each a trifle longer than its predecessor, otherwise resembling it. Terminal joint a little shorter than its predecessor, rounded at base and tapering to somewhat pointed tip. Thorax and abdomen smooth. General color brownish yellow, darker on pronotum and anterior portion of mesoscutum at sides of parapsides and metanotum, and on dorsum of abdomen; a dark line between the eyes and under ocelli. Tegulae brown; all legs uniform pale straw-yellow.

Described from one male specimen reared from *Aleyrodes* on willow September 17, at Los Angeles, Cal., by Mr. D. W. Coquillett.

Genus ASPIDIOTIPHAGUS Howard.

Aspidiotiphagus Howard. Insect Life, vol. VI, p. 230, 1894.

Female.—Antennae 8-jointed; scape long, slender; pedicel a little longer than its apical width; funicle joints 1, 2 and 3 increasing in width, but each approximating pedicel in length: club long, distinctly 3-jointed, basal joint shortest, apical joints subequal, terminal joint pointed. Lateral ocelli equidistant from each other and margin of compound eyes. Parapsides of mesoscutum widely separated, very narrow posteriorly, broadening out rapidly toward tegulae; mesoscutellum like that of *Aphelinus*, its scapulae longitudinally elongate and extending forward to lateral widening of the parapsides; metanotum very narrow. Abdomen short, broadly sessile and broadly rounded at tip. Spur of middle tibiae very slender, as long as the short first tarsal joint. Forewings long, narrow; submarginal and marginal veins subequal in length; postmarginal lacking; stigmal very slight and parallel with costa, situated at half the wing length and exactly opposite to the termination of thickening of hinder margin of wing, this being also the widest point of the wing; cilia of wing surface rather sparse, a clear rounded space immediately below stigma, and a narrow clear line around margin; marginal vein bristly; marginal cilia very long, longer than wing width, those on costal margin just beyond stigma nearly as long as those on hind margin. Hind-wings very narrow, with long marginal cilia and but one row of discal cilia on outer third; marginal vein ending abruptly and extending up apparently beyond costa.

Differs from *Coccophagus* in wings and from *Encarsia* in antennae and wings.

Aspidiotiphagus citrinus (Craw). (fig. 10).

Coccophagus citrinus Craw. Destructive Insects, Sacramento, Cal., 1891.

Aspidiotiphagus citrinus Howard. Insect Life, vol. vi, p. 234, 1891.

Female.—Length, 0.58 mm.; expanse, 1.16 mm.; greatest width of fore-wing, 0.09 mm. Antennæ light yellow-brown; eyes black, ocelli bright red; head yellow; occiput dark brown; pronotum dark brown; mesonotum yellow; metanotum yellow-brown; abdomen brown; legs uniformly dusky yellow; wings with marginal vein dark fuscous, and a broad fuscous band extending directly across wing from marginal vein as a base. Spiraenlar hairs on pre-anal abdominal joint very long. Thorax somewhat wider than head or abdomen, these being subequal in width.

Redescribed from fourteen female specimens reared January 18 and 24, February 2, and March 13, 1889, by Mr. D. W. Coquillett from

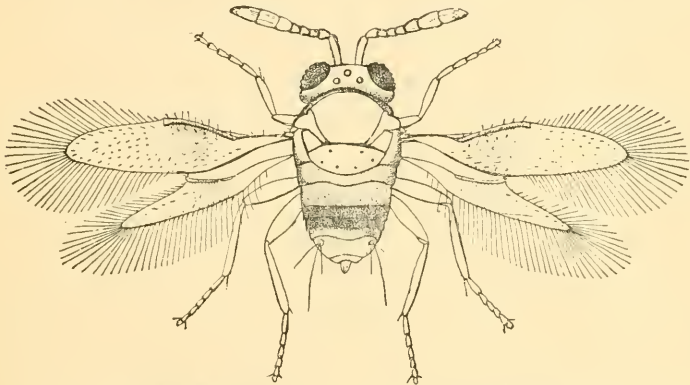


FIG. 10.—*Aspidiotiphagus citrinus* (Craw).—greatly enlarged (from Insect Life).

Aspidiotus aurantii Maskell, var. *citrinus*, from San Gabriel, Cal. Mr. G. W. Johnson has also sent me six specimens reared at the Illinois State Laboratory of Natural History from *Aspidiotus ficus* occurring on *Citrus decumana* in the university greenhouse. Professor Berlese has reared this species in Italy from an *Aspidiotus* on *Acacia longifolia* and from *Diaspis rosea*.

Genus **COCCOPHAGUS** Westwood.

Coccophagus Westwood. Philosoph. Mag., vol. III, 1833.

Aphelinus Walker (in part). Monographia Chalciditum, London, 1839.

Coccobius Ratzeburg (in part). Ichneumonien der Forst-Insekten, vol. III, p. 195, 1852.

Ratzeburg's genus *Coccobius* includes, as will be seen from the synonymical list, certain species of *Coccophagus* and certain species of *Aphelinus* as well. His antennal figure is that of *Aphelinus*, but his descriptions include species which apparently belong to *Coccophagus*, notably *C. notatus*.

In this genus the antennæ are 8-jointed, the scape rather short and stout; pedicel one-third the length of the scape and about the same

thickness. Joints 1, 2 and 3 of the funicle increase very slightly or not at all in thickness and decrease slightly in length. Club very plainly 3-jointed, a little broader at middle than at base, pointed or rounded at tip, and rather longer than funicle joints 2 and 3 together. With the male the club is less compact and is narrower than with the female. Mesoscutum large, posterior border with a slight re-entering angle. Parapsidal sutures curved, mesoscutellum about as long as broad, rounded behind; wings equally hairy, except at immediate base. No hairless line; marginal vein as long as or longer than submarginal; postmarginal lacking; stigmal very short. Middle tibial spur strong, not as long as first tarsal joint. Eyes invariably hairy.

The species of *Coccophagus*, with the exception of *C. ochraceus*, are all black in color, and frequently with a portion of the mesoscutellum and metanotum bright orange or yellow. With certain species the female



FIG. 11.—*Coccophagus lunulatus* Howard—greatly enlarged (from *Insect Life*).

has the scutellum partly yellow, while the male is entirely black. Of the sixteen species catalogued by Cresson, *annulipes* Ashmead, as there stated, belongs to the encyrtine genus *Aphyeus*; *brunneus* Provancher and *compressicornis* Provancher do not belong to this subfamily, but probably to the Tetrastichinae, while *pallipes* Provancher belongs to *Sympiesis*. Of the remaining species Fitch's *lecanii* will hold, and Ashmead's *flavoscutellum* and the writer's *viridus* are synonymical, and Ashmead's species has priority. There remain eight of the writer's species, certain of which have been thrown together after studying more abundant material, as will appear in the following pages. To these he has since added *californicus* (*Insect Life*, vol. I, p. 269), *aurantii* (loc. cit., vol. VI, p. 231), and *lunulatus* (loc. cit., vol. VI, p. 233). Of these *aurantii* should be placed in *Prospalta*, as indicated in *Insect Life* (vol. VII, p. 7.)

ANALYSIS OF THE SPECIES OF COCCOPHAGUS.

Females.

Wings hyaline.

General color dark honey-yellow..... *ochraceus*

General color black.

Hind border of mesoscutum with a band of yellow; scutellum entirely black..... *scutatus*

Hind border of scutum black; scutellum more or less yellow.

Head rather coarsely punctulate; apical two-fifths of scutellum yellow, except for black spot at tip..... *lunulatus*

Head not coarsely punctulate.

Scutellum with a narrow but complete marginal yellow band.

californicus

Scutellum with apical half yellow; tegulae black.

Punctures of scutum arranged in longitudinal rows; front and middle tibiae yellow..... *lecanii*Not so arranged; all tibiae dark..... *cognatus*Scutellum yellow only at tip; all tibiae brown, yellow at either end; tegulae black..... *fraternus*

Nearly all of scutellum and postscutellum yellow; tegulae brown.

flavoscutellum

Scutellum black; face yellow; punctation of mesonotum nearly obsolete

*flavifrons*Body entirely black; mesonotum with sparse round punctures, a regular row around hind border of scutum..... *immaculatus*Wings dusky; body uniformly purplish black..... *purpureus**Males.*

Entire body black.

A regular row of round punctures bordering hind edge of mesonotum..... *immaculatus*

Mesoscutum with sparse punctures, but without such a regular row.

Tegulae brown; all tibiae and tarsi yellow; hind tibiae occasionally with dusky patch near base..... *flavoscutellum, lecanii*Tegulae black; all tibiae dark brown in middle, whitish at either end..... *fraternus*

Mesoscutellum tipped with yellow.

General color, brown; mesoscutum irregularly but sparsely punctate..... *cognatus*General color, black; punctation nearly obsolete..... *flavifrons*Scutellum black; mesoscutum with terminal yellow bands..... *scutatus*General color honey-yellow..... *ochraceus***Coccophagus lecanii (Fitch.)***Platygaster lecanii* Fitch. Fifth Report Insects of New York (1858), p. 25.*Coccophagus lecanii* E. A. Smith. Amer. Nat., 1878, p. 661; Seventh Rep. State Entomologist Illinois, 1878, p. 130.*Coccophagus lecanii* (Fitch) Howard. Report Entomologist, Annual Report U. S. Dept. Agr., 1880, pp. 357-358; Howard, Report on the Parasitic Hymenoptera, Island St. Vincent, Journ. Linnean Soc., Lond., vol. xxv, 1894, p. 97.*Coccophagus ater* Howard. Report Entomologist, Annual Report U. S. Dept. Agr., 1880, p. 359.

Female.—Length, 1 mm.; wing expanse, 2.25 mm.; greatest width fore-wings, 0.42 mm. Antennae as long as the thorax; head, pronotum, and mesoscutum finely and sparsely punctured and furnished with short bristles, punctures of mesoscutum arranged in longitudinal rows.

Mesoscutum also has a fine shagreening. Mesoscutellum and parapsides of mesoscutum very finely shagreened, without larger punctures; abdomen smooth. General color black, shining, tegulae brown; eyes dark reddish brown; antennae light brown, with darker longitudinal raised lines on flagellar joints. Hairs of thorax whitish, lighter on mesoscutellum. Last half of mesoscutellum and center of postsutellum bright lemon-yellow. Wing veins dark brown. All femora brown or black, somewhat yellowish at either extremity. All tibiae straw-yellow, with the exception of the posterior pair, which have a brown annulus near base; all tarsi straw-yellow, with the fifth joint dark brown.

Male.—Averages about half the size of the female; abdomen small, much narrower than thorax; antennae longer than thorax, scutellum dark.

Described from many male and female specimens. Parasitic upon *Lecanium quercitronis* Fitch, New York; *Pulvinaria innumerabilis*, Illinois, Miss Smith; District of Columbia (Division of Entomology); Cambridge, Mass., W. Trelease; Flatbush, Long Island, New York, J. L. Zabriskie; *Lecanium pruinosum*, Los Angeles, Cal., D. W. Coquillett; *Lecanium persicae*, Ithaca, N. Y. (Department of Agriculture); *Pseudococcus aceris*, Jamaica Plain, Mass., J. G. Jack; *Lecanium hesperidum*, District of Columbia (Department of Agriculture); Los Angeles, Cal. (Department of Agriculture); *Lecanium* on plum, Medina, Ohio, F. M. Webster.

Coccophagus fraternus Howard.

Coccophagus fraternus Howard. Report Entomologist, Annual Rep. U. S. Dept. Agric., 1880, p. 359.

Coccophagus fuscipes Howard. Report Entomologist, Annual Rep. U. S. Dept. Agric., 1880, p. 359.

Female.—Length, 0.78 mm.; expanse, 2 mm.; greatest width forewings, 0.36 mm. Thoracic punctures much as with *C. lecanii*, but mesoscutum is smoother and the larger punctures are not arranged in longitudinal rows. Thoracic bristles black, except those on mesoscutellum, which are white. Tip of mesoscutellum bright yellow, somewhat orange, dividing line between yellow and black very irregular. Center of postsutellum only slightly yellowish. All coxae and femora black, whitish at tips. All tibiae dark brown in middle, whitish at either end.

Male.—Somewhat smaller than female; antennae longer, club proportionately considerably longer, each of the joints as long as each of the immediately preceding funicle joints. Coloration like that of female, except that the yellow tip of mesoscutellum is wanting.

Described from many female and male specimens. Parasitic upon *Lecanium persicae*, District of Columbia (Department of Agriculture); Agricultural College, Michigan (A. J. Cook).

Coccophagus cognatus Howard.

Coccophagus cognatus Howard. Report Entomologist, Ann. Rep. U. S. Dept. Agric., 1880, p. 359.

Female.—Length, 1.2 mm.; wing expanse, 2.1 mm.; greatest width of fore-wing, 0.34 mm. Antennæ not quite so long as thorax. General color dark brown, nearly black; last half of mesoscutellum and tip of metascutellum orange-yellow; anterior coxæ, femora, and tibiæ, fuscous; tarsi whitish, last two joints slightly dusky; middle femora and coxæ nearly black, tibiæ somewhat dusky, tarsi as with fore tarsi; hind coxæ, femora, and tibiæ dark, tibiæ as with others.

Male.—Length of body, 0.6 mm.; expanse of wings, 1.4 mm.; greatest breadth of fore-wing, 0.25 mm. Antennæ nearly as long as head and thorax together. General color brown; scutellum and metascutellum just tipped with light yellow-brown. In all other respects resembles the female.

Described from many specimens. Parasitic upon *Lecanium hesperidum*, District of Columbia (Department of Agriculture); *Lecanium* on plum, Bramley, Ontario (J. Fletcher and T. D. A. Cockerell); *Lecanium persica*, Lake Shore and Mapleville, Md. (Department of Agriculture).

Coccophagus immaculatus Howard.

Coccophagus immaculatus Howard. Report Entomologist, Annual Rep. U. S. Dept. Agric., 1880, p. 358.

Female.—Length, 1.2 mm.; wing expanse 2.35 mm.; greatest width of fore-wings, 0.47 mm. Antennæ slightly longer than thorax. Mesoscutum and mesoscutellum sparsely furnished with round punctures, of which there is a regular row around hind border of mesoscutum. Between the punctures is a faint shagreening. All hairs blackish, metanotum honey-yellow. General color black; eyes reddish brown, with a yellowish border above; ocelli dark red; antennæ light yellowish brown, with dark brown longitudinal carinæ on each joint except scape and pedicel; mesoscutellum shining black, slightly metallic in some lights; wing veins dark brown; front femora black; middle and hind femora black, except at base, which is whitish; front tibiæ dusky, light at knees; middle and hind tibiæ light yellow; all tarsi whitish, last joint fuscous; front coxæ dark brown, middle and hind coxæ and all trochanters yellowish; ovipositor yellow, sheaths brown.

Male.—Length, 0.9 mm.; wing expanse, 2.3 mm.; greatest width of forewing, 0.43 mm. Antennæ as long as thorax; club compact, the lines separating the joints of the club somewhat oblique. Colors as with female, except that metanotum and all coxæ are black.

Described from three males and three females. Parasitic on *Eriococcus azaleæ*, District of Columbia (Department of Agriculture). The punctured scutellum is unique.

Coccophagus purpureus Ashmead.

Coccophagus purpureus Ashmead. Trans. Am. Ent. Soc., vol. XIII, p. 132, 1886.

Female.—Length, 0.10 inch. Robust and of a uniform purplish black color throughout, including abdomen, coxæ and femora; the surface is very finely punctate, and the tibiæ and tarsi are yellow; wings, except at base, brown.

Captured on gall-berry bushes.

I have not seen this species, but Mr. Ashmead tells me that there is no doubt it is a true *Coccophagus*. It differs from all known species in the infuscated wings.

Coccophagus flavifrons Howard.

Coccophagus flavifrons Howard. Bulletin 5, Bureau Entomology, U. S. Dept. Agric., 1885, p. 25.

Coccophagus koebelei Howard. Bulletin 5, Bureau Entomology, U. S. Dept. Agric., 1885, p. 24.

Female.—Length, 1 mm.; expanse, 2 mm.; greatest width fore-wings, 0.35 mm. Punctuation of thorax nearly obsolete. Scutellum perfectly smooth, except for faint shagreening. Hairs black; eyes, clypeus, occiput, abdomen, and dorsum of thorax black, with a bluish metallic luster upon abdomen. Face, antennal scape, all tibiæ, middle femora, honey-yellow; hind femora black at base, yellowish at tip; front femora brownish at base, yellow at tip; tegulæ dark yellow or brown; edge of mesoscutum just above tegulæ, also brown; wing veins fuscous.

Male.—Somewhat smaller; uniform black except tegulæ, which are brownish; antennæ light brown, scape black; all femora black, except at tips; all tibiæ and tarsi yellow; extreme tip of meso- and metascutellum yellowish.

Described from three females and one male. Parasitic upon *Lecanium* sp. on *Pinus australis* (A. Koebele, Department of Agriculture).

Coccophagus flavoscutellum Ashmead.

Coccophagus flavoscutellum Ashmead. Florida Agriculturist, vol. IV (1881), p. 65.

Coccophagus viridus Howard. Bulletin 5, Bureau Entomology, U. S. Dept. Agriculture, 1885, p. 25.

Female.—Length, 1.03 mm.; wing expanse, 1.96 mm.; greatest width of fore-wing, 0.35 mm. General color, shiny black; antennæ light brown, with the customary dark brown longitudinal carinæ; greater part of mesoscutellum and visible portion of metascutellum bright orange-yellow, the line of juncture of the two colors on the mesoscutellum straight and sharp; tegulæ yellow-brown; all coxæ and femora brown, yellow at joints; all tibiæ and tarsi yellow, occasionally a dusky patch near base of hind tibiæ; fifth tarsal joint brown. Entire mesoscutum very finely punctate.

Male.—Length, 0.55 mm.; wing expanse, 1.47 mm.; greatest width of fore-wing, 0.25 mm. Color as in female, except that the tegulæ are brown and the scutellum is black, sometimes yellow at extreme tip.

Redescribed from many male and female specimens. Parasitic upon *Lecanium hesperidum*, Crescent City, Fla., H. G. Hubbard; Jacksonville, Fla., W. H. Ashmead; Los Angeles, Cal., A. Koebele; *Lecanium* sp., New Alameda, Cal., H. W. Turner; *Dactylopius destructor*, District of Columbia, Th. Pergande; *Lecanium* sp., Los Angeles, Cal., D. W. Coquillett; *Lecanium tulipiferae*, Molino, Fla. (Department of Agriculture); *Pulvinaria* on plum, Florence, S. C. (Department of Agriculture); *Pulvinaria* sp. on *Sullengia*, Rôckport, Tex., E. A. Schwarz; *Pulvinaria innumerabilis*, Roslyn, N. Y., L. H. West (Department of Agriculture); *Lecanium* sp. on *Adenostema*, Alameda, Cal., A. Koebele; *Lecanium* sp. on *Arctostaphylos*, Sonoma, Cal., A. Koebele; *Lecanium* sp. on plum, Ottawa County, Ohio, F. M. Webster.

Coccophagus californicus Howard.

Coccophagus californicus Howard. Insect Life, vol. I, p. 269 (March, 1889).

Female.—Length, 1.4 mm.; expanse, 2.1 mm.; greatest width of forewing, 0.39 mm. Abdomen broader than thorax and one-third longer. Pedicel and joints 2 and 3 of funicle subequal in length; joint 1 of funicle one-third longer. Eyes rather more plainly hairy than usual. General color dark brown, nearly black, no punctation visible. Mesoscutellum lighter in color than rest of thorax, except at immediate base, its posterior edge with a narrow band of bright lemon-yellow extending from one lateral angle around the curved border to the opposite lateral angle, of nearly equal width throughout, at its widest portion measuring 0.027 mm.: all coxæ brown; all trochanters yellowish white; all femora brown, yellow at tip; more yellow at tip of front femora, less at tip of middle, and still less at tip of posterior femora; front tibiæ light yellow, very slightly dusky; middle tibiæ entirely light yellow; hind tibiæ yellowish, with a brownish shade near base; all tarsi yellowish white, last joint dusky. Wings hyaline, veins light brown distinct.

Described from one female specimen reared from a female *Icerya purchasi* at Los Angeles, Cal., July 6, 1887, by Mr. D. W. Coquillett.

Coccophagus lunulatus Howard (fig. 11.)

Coccophagus lunulatus Howard. Insect Life, vol. VI, p. 232 (Feb., 1894).

Female.—Length, 0.93 mm.; expanse, 2 mm.; greatest width of forewing, 0.39 mm. Head rather coarsely punctulate, opaque; mesonotum very finely shagreened, somewhat glistening; mesoscutellum with apical bristles very long; abdomen smooth, shining. General color black; apical three-fifths of mesoscutellum bright orange, with an irregular black spot at tip, and with the dividing line between the orange and black irregular; tegulæ black; antennæ with the scape black and the flagellum dark fuscous; front legs, including coxæ, light orange yellow, considerably lighter than the mesoscutellum; middle and hind coxæ and hind femora black; middle and hind trochanters, tibiæ, and tarsi and

middle femora light orange-yellow. Wings hyaline, veins dark brown, marginal cilia very short.

Described from one female reared December 5, 1892, from *Aspidiotus aurantii*, received from D. W. Coquillett, Los Angeles, Cal.

Coccophagus scutatus n. sp.

Female.—Length, 1.6 mm.; expanse, 3.3 mm.; greatest width of fore-wing, 0.58. Punctation of head and mesothorax scaly, more marked on mesoscutum. Thoracic bristles long and sparse, particularly long on hind border of pronotum and border of mesoscutellum. Parapsidal grooves very indistinct. Occiput, metanotum, and abdomen smooth and shining. Wing veins very heavy. General color black, mesoscutellum and postsutellum without a trace of yellow; mesoscutum with broad transverse band of orange extending from tegula to tegula, the anterior border being nearly straight, while posterior border follows the central backward curve of the scutum. Antennae dusky, legs pale fuscous, coxæ dark, femora with a middle brownish band, middle tibia darker in the middle and hind tibia dark brown on basal half. Wings clear, veins dark brown.

Male.—Rather smaller, but closely resembles female. The mesoscutar band is of a pale orange; the antennae are lighter in color; the scape yellowish; front and middle legs, with the exception of basal half of coxæ, entirely light lemon-yellow. All of hind coxæ and femora concolorous with other legs, but basal half of hind tibia is nearly black. Lower half of face also somewhat yellowish, particularly along the borders of the antennal groove.

Described from five females and one male reared by A. Koebele in October from a *Kermes* on *Quercus agrifolia* at Los Angeles, Cal. Also nine specimens reared by D. W. Coquillett from the same host at Los Angeles.

Differs from all other species of *Coccophagus* known to me in the possession of the scutal band.

Coccophagus ochraceus n. sp.

Female.—Length, 0.7 mm.; expanse, 1.53 mm.; greatest width of fore-wing, 0.3 mm. Differs at once from all other species of the genus in having the general color ochraceous or dark honey-yellow instead of black. Head and mesonotum very finely and sparsely punctate, also very delicately shagreened. Normal notal hairs blackish; abdomen smooth. General color, as just stated, dark ochre-yellow. Eyes dusky, ocelli dark red. Antennae yellowish, except pedicel, which is blackish. Mesopleura and terminal segments of abdomen dark brown, nearly black. All legs concolorous with thorax. Wings hyaline, veins uniformly fuscous.

Male.—Punctation of notum a trifle more pronounced than with the female, mesoscutum appearing slightly rugose; antennae slightly dusky.

Described from three males and one female, reared July, 1887, at Alameda, Cal., by A. Koebele, from *Lecanium* on *Adenostema fasciculatum*.

This species interferes with a suggested generalization made by the writer in a paper entitled "The hairy eyes in Hymenoptera" (Proc. Entom. Soc. Wash., vol. 1, p. 195) to the effect that the hairy eyes in the subfamily Aphelininae are associated with a black color. This holds with the typical genus *Aphelinus*, in which all the yellow species have naked eyes, the two black species (*A. mali* and *A. flaviceps*) having hairy eyes. Having a yellow species of *Coccophagus*, we should expect naked eyes; but here hairiness of the eyes seems to be a generic character.

Genus PROSPALTA Howard.

Prospalta Howard. Insect Life, vol. VII, p. 6, 1894.



FIG. 12.—*Prospalta murtfeldtii* Howard—greatly enlarged (from Insect Life).

Female.—Anterior wings with no oblique transverse hairless line below stigma. Antennae 8-jointed; club 3-jointed; all joints subequal in length; first joint of club widest. Head transverse; ocelli at corners of an oblique-angled triangle. Eyes naked. Thorax wider than head; mesoscutar parapsides club-shaped, broadening suddenly on distal side; axillae extending anteriorly to swelling of parapsides; metascutellum broad and short; legs rather stout; all tarsi short; first joint of hind tarsi only as long as second; first joint of middle and front tarsi longer than second. Ovipositor slightly extruded. Wings broad; submarginal vein reaching nearly to middle of wing; marginal much shorter than submarginal; stigmal very short, its anterior border nearly parallel with costa, its posterior border extending into disk of wing at an angle of 45° with costa; outer margin of fore-wing with rather short cilia; hind margin of hind-wings with somewhat longer cilia. First abdominal joint much the longest; abdomen as a whole equaling thorax in length; whole body tapering gradually from tegulae to tip of abdomen.

Anterior wings with two fuscous patches; joint 1 of funicle wider than pedicel.

murtfeldtii

Anterior wings perfectly hyaline; joint 1 of funicle narrower than pedicel. *aurantii*

Prospalta murtfeldtii Howard (fig. 12).

Prospalta murtfeldtii Howard. Insect Life, vol. VII, p. 6, 1894.

Female.—Length, 0.69 mm.; expanse, 1.7 mm.; greatest width of fore-wing, 0.3 mm. Joint 1 of funicle wider than pedicel; flagellum gradually widening from base of pedicel to base of club. Surface of body nearly smooth; scutellum slightly shagreened. General color light yellow; mesoscutum with brownish patch covering entire disk; mesoscutellum with two large brown patches, one each side of middle line; axillæ each with a brown patch; metanotum brownish; base of abdomen brown; tip of abdomen also brown; antennæ brown, with the exception of joints 2 and 3 of the funicle, which are whitish; all coxæ and femora light honey-yellow, except that hind femora are dusky at base; front tibiæ with a dusky ring near middle; first and second tarsal joints of forelegs dusky; middle and hind tibiæ each with two dusky bands; first tarsal joint of middle and hind legs dusky; wings hyaline with a fuscous basal patch, and a triangular median fuscous patch with its apex at stigmal vein and its base reaching somewhat less than half of outer hind margin; entire disk of wing densely, finely, and uniformly ciliate; apical spur of tibiæ rather short. Hind-wings with two rows of discal cilia and an interrupted third row on outer third. Hind marginal cilia somewhat longer than wing width.

Described from five balsam-mounted female specimens reared by Miss Mary E. Murtfeldt, at Kirkwood, Mo., from *Aspidiotus urvæ*. Received November 4, 1888.

Since the original description was published I have received a series of thirteen specimens of this insect from Mr. W. G. Johnson, of the State Laboratory of Natural History, at Champaign, Ill. Eleven of this series Mr. Johnson reared from a new species of *Aspidiotus* on cherry twigs, and the other two from a new species of *Aspidiotus* on currant canes, both at Champaign, Ill. The specimens received from Mr. Johnson were all mounted dry, on tags, while the type specimens from Miss Murtfeldt were mounted in balsam. It becomes apparent that Miss Murtfeldt's specimens must have been mounted very soon after they issued from the host insect. The colors are lighter, in general, than those of the matured and dried specimens. The second funicle joint of the antennæ is dusky, like the first funicle joint, and not white, like the third. The general color of the thorax, instead of being yellow, is dark brown. The basal joints of the abdomen are yellowish, with the tip brown. The obvious conclusion is that all these parasites should be allowed to mature in color before being mounted in balsam.

Prospalta aurantii (Howard) (fig.13).

Coccophagnus aurantii Howard. Insect Life, vol. vi, p. 231, 1894.

Female.—Length, 0.7 mm.; expanse, 1.16 mm.; greatest width of fore-wing, 0.18 mm. Joint 1 of funicle shorter and narrower than pedicel and than joint 2, which is subequal to pedicel in length and width, joint 3 shorter than joint 2. Surface of thorax smooth. General color, light brownish yellow; occipital line, margin of pronotum and a median stripe on mesoscutum, scapulae, outer edge of metanotum, abdomen, especially lateral margin, darker; antennae and legs light fuscous; eyes black, ocelli red; wings hyaline, veins slightly dusky. Fore-wings with disk densely, finely, and uniformly ciliate, costal margin with very short marginal cilia beginning at stigma, growing gradually longer at tip of wing and on lower outer margin becoming half the width of wing; broadest portion of wing beyond stigma; hind-wings as with preceding species.

Described from two female specimens reared May 9, 1887, by D. W. Coquillett from *Aspidiotus aurantii*, var. *citrinus*, from San Gabriel, Cal.



FIG. 13.—*Prospalta aurantii* (Howard)—greatly enlarged (from Insect Life).

Specimens of this species occur in the collection of the Department of Agriculture, reared from the following species of Coccida: *Aspidiotus ancylus* Putn. var., on linden, District of Columbia; *Mytilaspis citricola* Pack. on orange, Florida; *Aspidiotus pinii* Comst. on *Pinus rigida*, Ithaca, N. Y.; *Mytilaspis albus*, var. *concolor* Ckll., Cockerell, Las Cruces, N. Mex.; *Mytilaspis eucalypti* Crawford MS., Adelaide, South Australia, October 5.

Mr. W. G. Johnson has also sent me from the collection of the Illinois State Laboratory of Natural History at Champaign, Ill., a large series of this species reared from a species of *Chionaspis* on an undetermined food-plant (probably introduced) growing on the university campus. Professor Berlese has also sent me specimens of this species reared in Italy from *Aspidiotus ederae* and from *Leucaspis pinifoliae* on *Pinus canariensis*.

The figure of this insect in Insect Life (reproduced above) is not colorational.

The extraordinary geographical range, as indicated by this summary of the specimens at hand, would seem to indicate the possibility that this species is originally an inhabitant of Europe, and that it has been introduced into the United States and Australia. It is evidently a very important species. It is the so-called "golden chalcid" referred to in California reports.

Genus *ABLERUS* Howard.

Ablerus Howard. *Insect Life*, vol. VII, p. 7, 1894.

Female.—Fore-wings with no transverse hairless streak below stigma. Antennæ apparently only 7-jointed, club appearing unjointed; antennæ simple, slightly clavate; scape slender; pedicel as long as, or slightly longer than, funicle joint 1; funicle joints 1, 2, and 4 subequal in length, 3 rather shorter; club as long as three last funicle joints together, furnished with two minute papillar projections at tip; mesoscutar parapsides clavate, but not broadening suddenly into a club; mesoscutellum transverse; abdomen semiovate; ovipositor extruded for more than half the length of abdomen. Wings short, narrow; marginal vein nearly as long as submarginal; stigmal long, slender, one-third length of marginal, squarely truncate at tip, extending at a very slight angle into disk of wing; marginal vein with three principal bristles, submarginal with one; cilia of border of wings as with

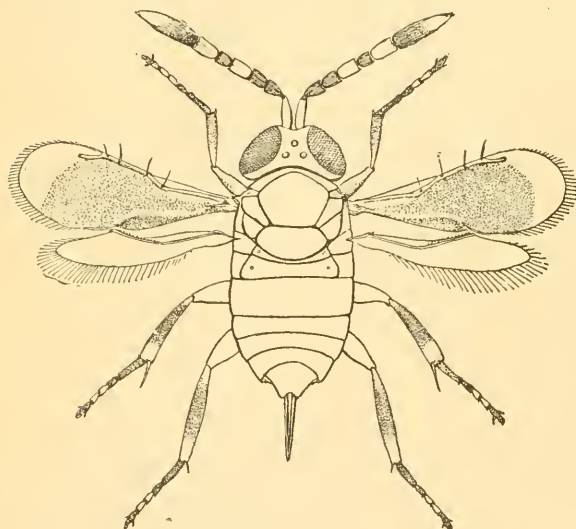


FIG. 14.—*Ablerus clisiocampæ* (Ashmead)—greatly enlarged (from: *Insect Life*).

Prospalta; hind border of fore-wings with a longitudinal hairless streak and a slight fold extending from base of wing nearly to middle; thickening of anal margin opposite tip of marginal vein of hind-wings seems to extend forward into this fold; marginal vein of hind-wings with closely set row of minute bristles. First tarsal joint of all legs as long as two succeeding joints together. Middle tibial spur as long as corresponding first tarsal joint.

Ablerus clisiocampæ (Ashmead) (fig. 14).

Centrodora clisiocampæ Ashm., *Proc. Entom. Soc. Washington*, vol. III, p. 10 (1894).

Female.—Length, exclusive of ovipositor, 0.7 mm.; ovipositor, 0.18 mm.; expanse, 1.5 mm.; greatest width of fore-wing, 0.19 mm. Hairs of

anal spiracle nearly as long as ovipositor. General color black, somewhat metallic, notal sclerites of thorax having a greenish luster, while abdomen appears bluish; antennæ black, with funicle joints 2 and 4 silvery white, and apical three-fourths of club light brown, with a somewhat silvery tinge. Head in life, and shortly after the insect has issued, whitish, with occiput yellow-brown and occipital line black; brown patch including ocelli. Eyes bright red. In dry mounts the head shrivels considerably and becomes light brown in color. Legs dark brown; all tibiæ with a silvery white distal apex. Spurs of middle tibiæ black; tarsal joints 1, 2 and 5 dark brown or black; 3 and 4 whitish. Fore-wings with proximal three-fourths deeply and uniformly infuscated, except two light longitudinal streaks near base; apical one-fourth hyaline; discal cilia very minute, but closely placed; sparse, however, toward distal anal portion and toward base of wing.

Redescribed from ten freshly issued females reared July 6 and 7, 1894, from female specimens of *Chionaspis furfurus*, District of Columbia. Mr. W. G. Johnson has also reared two females from a species of *Aspidiotus* on pear and apple at Champaign, Ill.

In view of these rearings, as well as from the well-known and quite uniform host habit of the group, it becomes probable that Mr. Ashmead's type came from a scale insect in the near vicinity of or perhaps hidden by the *Clisiocampa* eggs from which he thought he reared it.

PHYSCUS new genus.

Type: *Coccophagus varicornis* Howard.

Female.—Antennæ 7-jointed; inserted at border of clypeus; scape slender; pedicel as long as first funicle joint; second and third funicle joints subequal and each longer than joint 1; club long, ovate, acute, 2-jointed; joint of division before middle. Eyes hairy. Mesoscutar parapsides very narrow; axillæ also narrow; scutellum nearly as long as broad. Discal cilia of fore-wings uniform in distribution, but those proximad of stigma shorter and considerably more delicate than those distad; marginal vein about as long as submarginal; stigmal short, but with a well-defined neck and with a rounded knob; radial angle narrow. Marginal cilia rather short; discal cilia of hind-wing very delicate and rather sparse. First tarsal joint of front and hind legs as long as two following joints; first tarsal joint of middle legs as long as three following joints; middle tibial spur long. Ovipositor slightly extruded.

Male.—No fresh or balsam-mounted males are at hand, and characters can not be studied from the poor material which we have.

Physcus varicornis (Howard).

Coccophagus varicornis Howard. Ann. Rept. Dept. Agr. 1880, p. 360.

Female.—Length, 0.7 mm.; expanse, 1.4 mm.; greatest width of fore-wing, 0.25 mm. Mesonotum very faintly longitudinally shagreened,

nearly smooth, shining; tegulae, pleura, and abdomen smooth. Wings hyaline. General color glistening black; antennal scape dusky; pedicel nearly white; first funicle joint dark brown; joints 2 and 3 nearly white, somewhat yellowish; club light brown; mesopostscutellum nearly white; all coxae black; trochanters nearly white; all femora and tibiae black or dark brown, lighter at extremities; tarsi all nearly white, including terminal joints; pile on sides of abdomen and hind femora white, showing distinctly against the black surface.

Described from one female specimen, reared March 1, from *Aspidiotus ancylus* on linden, District of Columbia. There is also a large series of specimens of this species in the National Museum collection reared from *Chionaspis quercus*, at Alameda, Cal., by A. Koebele, in August. Among the series is a number of males, but none are in condition for description. Such antennal fragments as remain, however, show that the antennae are probably of a uniform brown color. Mr. W. G. Johnson has also sent me from the State Laboratory of Natural History at Champaign, Ill., a series of five specimens reared from his manuscript *Chionaspis americana* on elm.