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PROCEEDINGS OF THE
ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 33 JANUARY, 1931 No. 1

THE ENVIRONMENT AND BEHAVIOR OF SOME BRAZILIAN MOSQUITOES.[1]

By RAYMOND C. SHANNON.
(*From the Yellow Fever Laboratory of the International Health Division of the Rockefeller Foundation, Bahia, Brazil.*)

OUTLINE.

[1]The studies and observations on which this paper is based were conducted with the support and under the auspices of the International Health Division of the Rockefeller Foundation.
The laboratory building was furnished by the State of Bahia, through the kindness of Dr. Barros Barreto, Secretary of Health.

INTRODUCTION.

The object of the present communication is to draw attention to certain facts relating to the environment and biology of mosquitoes, which were learned in the course of investigations on the mosquito fauna of the middle coast states of Brazil, recently conducted by the Rockefeller Foundation Yellow Fever Staff.

Part I contains a general account of the mosquito fauna of Brazil, with special reference to that of the middle coast states. The species of this region are listed together with their larval habitats, which are more fully treated in the remainder of the paper.

In Part II an attempt is made to classify the larval habitats on a natural basis, and it is shown that this classification is in accord with the natural (phylogenetic) classification of the family. Consideration is given to mosquito environment as affected by man. The habits of *Aëdes* (*Stegomyia*) *aegypti* (Linnaeus)[1] are treated in detail, and by means of this species we are able to show to some extent how the choice of larval habitat probably evolved among the mosquitoes as a whole.

PART I.

THE MOSQUITO FAUNA OF THE MIDDLE COAST STATES OF BRAZIL.

A COMPARISON OF THE FAUNAS OF DIFFERENT AMERICAN COUNTRIES.

Our investigations have been chiefly concerned with the mosquito fauna of the middle coast states of Brazil, namely, Bahia, Sergipe, Alagôas, Pernambuco, Parahyba, and Rio Grande do Norte. However, in order better to orient this fauna in relation to the known mosquito fauna of Brazil as a whole, and also to show the relation of the Brazilian fauna to the American fauna as a whole, a brief summary has been made of the number of species belonging to the different genera as found in various countries. This is presented in tabular form on page 4.

The earliest comprehensive paper prepared on the Culicidae of Brazil was published by Bourroul in 1904. Incidentally, his work was based primarily on the mosquito fauna of the section of Brazil covered by our investigations. He records twenty-six species from the state of Bahia and four additional ones from the states of Alagôas, Pernambuco, and Parahyba. All but four of these species are represented in our collection of approxi-

[1]Throughout the present paper "stegomyia" is used as the common name for *Aë.* (S.) *aegypti*, and "culex" for the common tropical house mosquito: *Culex* (*Culex*) *quinquefasciatus* Say (=fatigans, Wiedemann).

mately ninety species. The four not found by us have been reported from southern Brazil.

The subsequent studies on Brazilian Culicidae, with but few exceptions, centered about the faunas of the northern states, principally Pará, and certain of the southeastern states, namely, Minas Geraes, Rio de Janeiro, and São Paulo. It thus happens that our knowledge of the mosquitoes of Brazil has been practically limited to those of the northern and southeastern sections of the country. The real interior of the country is practically unexplored, and but three species (*Anopheles mattagrossensis*, *cuyabensis*, and *triannulatus*) are known to occur there, which have not been found in the coastal and adjacent regions.

The most recent comprehensive treatment of the mosquitoes of Brazil is that by Dyar (1928) in "Mosquitoes of the Americas," in which approximately 170 species are recorded. The locality for most of these species is listed simply as "Brazil." It can not be assumed, however, that these species are actually present even in all the better known parts of the country.

Our present classified material, consisting of a small collection from Pará and a fairly complete one from the middle coast states, contains sixteen species not recorded by Dyar. Of these, only three are new to science, although probably the majority of the, as yet, unclassified species (about fifteen, chiefly Sabethines and species of *Culex*) are new.

It has proved impossible to identify absolutely all of our Sabethine material by means of Dyar's keys and descriptions alone. Moreover, it has become evident in the course of the work, that the generic and subgeneric classification of this group is far from settled and also that many of the species are imperfectly known. It should be admitted that this has not been avoidable, owing to the rarity of most of the species, the slight differences in external structure and coloration between species, and the sometimes considerable degree of variation existing within certain species. Moreover, numerous generic and subgeneric names have been proposed, and in some cases their type species are imperfectly described. It is thus evident that the group is in need of a thorough revision, based upon extensive collections. I have therefore refrained from making any changes in the system as proposed by Dyar, and also from adopting the proposed change of Costa Lima (1930), namely, that *Wyeomyia* (*Pentamyia*) *bromeliarum* Dyar and Knab be regarded as synonymous with *Dendromyia leuteoventralis* Theobald. This would necessitate an extensive regrouping of species, which no doubt would lead to still further, and at the present time haphazard, alterations. Also, for similar reasons, I have made little attempt to classify the species of *Culex*, particularly of the subgenus *Mochlostyrax*. For final identification in this group, recourse to type material which is at present unavailable is absolutely essential.

The fact that fully 90 per cent of our material from Pará and the middle coast states, most of which also occurs in the southern coast states, has already been described, indicates that the majority of the species of the coastal region are now known to science. In this connection it might be stated that one of the outstanding features of the South American mosquito fauna is the great distribution north and south of the majority of the species, many of which occur well beyond the equator on both sides.

COMPARATIVE TABLE OF MOSQUITO FAUNAS OF VARIOUS AMERICAN COUNTRIES.[1]

	All America.	Canada and United States.	Panama	British and Dutch Guianas.	Brazil	Amazon region.[2]	Middle Coast States of Brazil.[3]	South-eastern States of Brazil.[4]	Argen-tina.
Sabethes	14	0	3	6	8	7	1	4	2
Sabethoides	9	0	3	3	5	2	2	4	1
Limatus	3	0	2	2	2	2	2	1	1
Wyeomyia	30	3	7	7	12	3+	9+	9	4
Miamyia	14	0	5	3	2	1	0	2	1
Dendromyia	26	0	14	8	7	2	3	5	1
Menolepis	1	0	0	0	1	0	0	1	1
Isostomyia	4	0	2	1	1	0	0	1	1
Goeldia	12	0	4	2	7	3	1	6	2
Joblotia	3	0	2	1	3	2	1	2	1
Psorophora	29	11	9	5	9	5	7	9	11
Haemagogus	13	0	4	2	2	1	2	1	2
Aëdes	108	75	15	13	13	9	11	11	11
Culicella	8	8	0	0	0	0	0	0	0
Mansonia	13	2	5	4	10	9	7	7	4
Deinocerites	4	1	4	1	0	0	0	0	0
Lutzia	4	0	1	0	2	1	0	1	2
Culex	162	22	45	47	58	26+	15+	35	11+
Aedeomyia	1	0	1	1	1	1	1	1	1
Orthopodomyia	4	1	2	1	2	1	1	1	0
Megarhinus	22	2	3	4	11	5	2	7	3
Uranotàenia	15	5	8	6	7	5	6	3	5
Chagasia	3	0	1	1	1	0	1	1	1
Anopheles	47	9	12	10	25	10	14	20	10
Totals	550	137	152	128	188	95	86	130	76

[1]The records for the countries north of Brazil are compiled from Dyar (1928). The Brazilian records are from Dyar, Peryassú (1908), and our collection. The Argentine records are from Dyar, and from Shannon and Del Ponte (1928).

[2]Amazon region: States of Pará and Amazonas.

[3]Middle coast states: Bahia, Sergipe, Alagôas, Pernambuco, Parahyba, and Rio Grande do Norte.

[4]Southeastern states: Minas Geraes, Rio de Janeiro, São Paulo, Santa Catharina, Paraná and Rio Grande do Sul.

+Indicates the author has additional unclassified material which contains species as yet unrecorded for the country.

The tabulation on page 4 shows a number of facts of interest.

(1) The tribe Sabethini (*Sabethes* to *Joblotia*) contains 116 species, chiefly tropical. Only three species occur in the United States; fifteen are recorded from the subtropic regions of Argentina, chiefly from the heavily forested state of Misiones.

(2) The tribe Culicini (*Psorophora* to *Orthopodomyia*) is the largest, containing 346 species. One genus, *Culicella*, is strictly of the North Temperate Zone, as are also most of the species of Aëdes; the majority of the *Culex* are tropical. The species of *Deinocerites* occur only in the Caribbean region; three other small genera, *Haemagogus*, *Lutzia*, and *Aëdeomyia*, occur from Mexico south to Argentina; while the *Mansonia* are chiefly represented in Brazil.

(3) Two tribes, Megarhinini and Uranotaeniini, with but one genus each, are chiefly tropical.

(4) The Anophelines (*Chagasia* and *Anopheles*) are chiefly tropical.

(5) Panama, by far the smallest of the regions, has proportionally much the largest recorded fauna.

(6) All of the American genera, save *Culicella* (restricted to the north temperate zone) and *Orthopodomyia*, have representatives in Argentina, while the *Psorophora* are as numerous here as in North America.

(7) An analysis of the Brazilian fauna shows that, at least along the coastal states, the fauna varies (principally as to the number of species) according to the character of the region. It also becomes evident that the faunas of the three regions here treated have been unequally studied. The Amazon fauna, undoubtedly one of the richest in the world, appears to be proportionately the least known of those of the three sections. A recent collection made by N. C. Davis in the city of Pará during two weeks' time contains approximately forty-five species, of which thirty-three have been identified. The fact that ten of these, or 33 per cent, and probably half of the unidentified species (Sabethines and species of *Culex*) are unrepresented in our collection from the middle coast states, accumulated during the course of eighteen months, clearly indicates the Pará fauna to be much the richest. Moreover, seven of the classified species have not hitherto been reported from Brazil, and two are new to science. Probably the majority of the unidentified species have not been described.

The southeastern states, owing to heavy rainfall and varied topography, probably have a fauna more or less equal to that of Pará. More species are recorded from the former region, but this undoubtedly is due to the fact that more intensive studies have been made there.

In the middle coast states the fauna is limited by the prolonged dry periods during the warmer months of the year, while during the rainy season (late summer and winter months) the temperature is sufficiently cool to produce a marked retarding effect on mosquito development. Consequently the different species vary in point of numbers according to season. Those *Psorophora* and species of the Aëdine subgenus (*Ochlerotatus*) which utilize the temporary ground pools formed by rains are most abundant at the beginning of the rainy season, which occurs towards the end of summer. As the weather becomes cooler they largely disappear. Species breeding in tree holes, bamboo joints, etc., are more abundant in individuals at the end of the wet season, at which time the warm weather begins. As the dry season advances they tend to disappear. The topography and plant life are also somewhat unfavorable for extensive mosquito life. Only a few species are numerous to the point of being very troublesome, and these have a comparatively short season. Stegomyia and Culex, because of their intimate association with man, are largely independent of rainfall for their propagation and therefore are an exception to the statement made regarding the seasonal abundance and the number of individuals per species.

In the coastal states of Ceará and Piauhy (intermediate between the middle states and Pará) it is to be expected that, owing to the comparatively dry climate throughout the year, the fauna is still more limited than in the middle coastal states.

List of Mosquito Species of the Middle Coast States and their Larval Habitats.

Eighty-six species are listed. The unclassified species of Sabethines and of the subgenus *Mochlostyrax* (*Culex*) would probably bring the total to 100. Names of doubtful status are indicated by an interrogation point (?). An asterisk (*) indicates the species of which the larvae have not as yet been found. In the case of the latter species the authority giving the habitat, where known, is cited.

Tribe Sabethini.

(The Sabethines.)

Genus **SABETHES.**

albiprivus Theobald . . . . Tree-holes?

Genus **SABETHOIDES.**

?*purpureus* Th. . . . . Bamboo
chloropterus (Humboldt) . . . . Tree-holes (Dyar)

Genus **LIMATUS.**

durhami Th. . . . . Tree-holes, bamboo, nut husks, fruit rinds, fallen leaves, artificial containers
asulleptus Th. . . . . As above

Genus WYEOMYIA.

oblita Th.	Bromeliads, rare in bamboo
bromeliarum Dyar & Knab	Bamboos, occasionally in artificial containers
tripartita Bonne-Wepster and Bonne	Bromeliads
pallidoventer Th.	Bromeliads (Dyar)
?*guasapata* Dyar	Bromeliads?
quasilongirostris Th.	Bromeliads
?*pilicauda* Root	Bromeliads
?*flavifacies* Edwards	Bromeliads?
incaudata Root	Bromeliads

Genus DENDROMYIA.

?*mystes* Dyar	Bromeliads
?*complosa* Dyar	Swamp aroids?
personata Bourroul	Tree-holes

Genus GOELDIA.

**trichopus* Dyar	Colocasia?

Genus JOBLOTIA.

digitata Rondani	Coconut husks, tree-holes

Tribe Culicini.

(The Culicines.)

Genus PSOROPHORA.

Subgenus PSOROPHORA.

cilipes (Fabr.)	Rain-pools
genumaculata Cruz.	Rain-pools
ciliata Fabr.	Rain-pools

Subgenus JANTHINOSOMA.

lutzi Th.	Rain-pools
ferox Humb.	Rain-pools
varipes coq.	Rain-pools (Dyar)

Subgenus GRABHAMIA.

cingulata (Fabr.)	Woodland pools, hoof-prints, xetremely rare in artificial containers

Genus AËDES.

Subgenus OCHLEROTATUS.

fulvus Wiedemann	Rain-pools (Dyar)
serratus Th.	Grassy rain-pools
?*nubilus*	Woodland rain-pools
scapularis Rond.	Grassy rain-pools
?*hastatus* Dyar	Grassy rain-pools

Subgenus **TAENIORHYNCHUS.**

fluviatilis Lutz . . . . Stream-bed rock pools
taeniorhynchus Wiedemann . . . . . . Marshes, rock and ground pools

Subgenus **FINLAYA.**

terrens Lutz . . . . Tree-holes, bamboo
argyrothorax B. W. & B. . . . . Tree-holes

Subgenus **HOWARDINA.**

fulvithorax Lutz . . . . Tree-holes, bamboo

Subgenus **STEGOMYIA.**

aegypti Linnaeus . . . . Artificial and natural containers, rock pools, exceedingly rare in ground pools

Genus **HAEMAGOGUS.**

equinus Th. . . . . Tree-holes
?*janthinomys* Dyar . . . . Tree-holes

Genus **MANSONIA.**

Subgenus **MANSONIA.**

titillans Walker . . . . Pistia and floating grass ponds
**indubitans* Dyar & Shannon . . . . . . As above (?)
**humeralis* D. & K. . . . . Pistia ponds (Dyar)

Subgenus **RHYNCHOTAENIA.**

fasciolata L. Arribalzaga . . . . . . Equisetum pools
**justamansonia* Chagas . . . . Sedge or equisetum pools (?)
**chrysonotum* Peryassú . . . . As above (?)
**albicosta* Perry . . . . As above (?)

Genus **CULEX.**

Subgenus **CARROLLELIA.**

iridescens Lutz . . . . Artificial containers, tree-holes?

Subgenus **MOCHLOSTYRAX.**

theobaldia Lutz . . . . Permanent ground pools

Subgenus **MELANOCONION.**

conservator D. & K. . . . . Tree-holes

Subgenus **MICROCULEX.**

pleuristriatus Th. . . . . Bromeliads
gairus Root . . . . Bromeliads
inimitabilis D. & K. . . . . Bromeliads
imitator Th. . . . . Bromeliads
albipes Lutz . . . . Bromeliads

Subgenus **CULEX.**

quinquefasciatus Say	Artificial containers, tree-holes, ground pools (usually foul)
corniger Th.	Ground pools, stream-bed rock pools, tree-holes, bamboo, barrels, etc.
nigripalpis Th.	Ground pools
mollis D. & K.	Tree-holes
declarator D. & K.	Ground pools, frequently foul; artificial containers
coronator D. & K.	Ground pools
surinamensis Dyar	Stream-bed rock pools

Genus **AËDEOMYIA.**

squamipennis, L. A.	Vegetated, more or less permanent pools

Genus **ORTHOPODOMYIA.**

fascipes Coquillet	Tree-holes

TRIBE MEGARHININI.

(Megarhines.)

Genus **MEGARHINUS.**

trinidadensis D. & K.	Tree-holes, occasionally bamboo and artificial containers
violaceus Wd.	Bromeliads, occasionally bamboo

TRIBE URANOTAENIINI.

(Uranotaenines.)

Genus **URANOTAENIA.**

geometrica Th.	Ground and rock pools containing algae
lowii Th.	Marshes, permanent and temporary ground pools, hoof-prints, crab-holes
calosomata D. & K.	Ground pools, occasionally artificial containers
leucoptera Th.	Ground pools
pulcherrima L. A.	Ground pools
nataliae L. A.	Ground pools (Dyar)

TRIBE ANOPHELINI.

(Anophelines.)

Genus **CHAGASIA.**

fajardoi Lutz	Upland streams, chiefly in forested regions

Genus ANOPHELES.

Subgenus STETHOMYIA.

?*nimbus* Th.	Woodland pools and streams

Subgenus ANOPHOLES.

Group ARRIBALZAGA.

peryassui D. & K.	Woodland pools and streams
minor Costa Lima	Rocky streams, rarely ground pools
intermedius Peryassú	Woodland pools and marshes
mediopunctatus	Woodland pools

Subgenus KERTESZIA.

cruzii D. & K.	Bromeliads

Subgenus NYSSORHYNCHUS.

parvus Chagas	Upland, sunlit pools and streams (Root)
argyritarsis R. D.	Sunlit streams, ground and rock pools, marshes, hoof-prints, artificial containers
albitarsis L. A.	Sides of sunlit streams, ponds, ground pools
darlingi Root	Sides of sunlit streams, ponds, ground pools (Root)
bachmanni Petrocchi	Sunlit vegetated ground pools and marshes
tarsimaculatus Goeldi	Sunlit marshes, ground pools, ditches, etc.
strodei Root	Sunlit marshes, edges of streams

Subgenus MYZOMYIA.

gambiae Giles	Sunlit, over-flowed grassy fields. In Africa, also recorded from swamps, temporary pools, drains, wells, ditches, weedy streams, crab-holes, roof gutters, tree-holes, brackish pools, bilge water, water tanks, etc.

Part II.

ENVIRONMENT AND BEHAVIOR.

General Considerations of Mosquito Environment Under Natural Conditions and as Affected by Man.

Environment, as related to mosquito life as a whole, is a highly confusing complex, owing to (1) the aquatic life of the larva and the aerial life of the adult, (2) the influence of man and his environment, (3) the large variety of species, and (4) the great adaptability of certain species, both in the larval and adult stages.

Accurate knowledge relating to the environment of mosquito larvae dates from the time of Hooke, Swammerdam, and others, who published their observations on *Culex pipiens* in the Seventeenth Century. In 1738, Réamur published an extended account of the life history and structure of *Culex pipiens*. His observations "were so full, and his authority was accepted as so all-satisfying, that the publication of this memoir practically put a stop, for a hundred and fifty years, to further studies of the aspects of mosquito life." The only noteworthy additions were made by Joblot, who described the larva of *Anopheles* in 1754, and DeGeer, who recorded the occurrence of *Aëdes* larvae in snow-water ground pools (*vide* Howard, Dyar, and Knab, 1912). Since 1900, intensive studies have been made on the group as a whole. Increase in knowledge of mosquito biology was so rapid that, by 1912, Howard, Dyar, and Knab were able to state in their monograph on mosquitoes: "Each species, and even groups of species, has its own very definite larval habitat."

The purpose of the present article is to show that this statement of Howard, Dyar, and Knab's in reality consists of a fundamental principle in mosquito biology, namely: *The larvae of each species are more or less restricted to a special type of habitat; and further, the natural classification of the habitats is in accord with the natural classifications of the family as based on larval and adult characters.* Even in association with man's environment, the essential elements of this principle are maintained.

The presence of man, however, especially on a large scale, alters the normal environment and, to a varying extent, the mode of life of the mosquitoes. It will be useful, therefore, to treat the environment of mosquitoes from two different viewpoints, each giving a different alignment of species, both of which yield results of value:

(A) From the standpoint of the biology of mosquitoes (a natural classification).

(B) From the standpoint of the relation of mosquitoes to man (giving a highly artificial grouping of species).

(A) Mosquito Environment from the Standpoint of the Biology of Mosquitoes.

The allotment of the various species to the three classes under "(B) Mosquito Environment as Influenced by Man," is largely dependent upon the location of the preferred type of larval habitats. The present discussion will therefore serve as an introduction to the following section.

The need of water for the larval and pupal stages is universal for all species of Culicidae and accordingly is regarded as a family characteristic. Secondary requirements are that the body of water be of comparatively small size and more or less in a state of rest. The larvae are never found in large bodies having free wave action (unless there is the shelter of floating plants, etc.) or in those having a swift, evenly distributed current. They may, however, be found along the shallow, plant-grown shores of quiet lakes and large ponds.

With regard to the tribes, genera, subgenera, and species, the location and condition of the water appear to be the primary factors which lead to the choice of habitat. The location, manifestly, is of greater importance for the majority of species; while condition appears to be of first importance only in the case of a few species of the subgenus *Culex*.

Larval habitats may therefore be classified according to (I) location, and (II) condition.

I. *Classification of larval habitats based on location.*

A. In depressions in the ground.
  1. Natural: lakes, ponds, streams, marshes (tidal and fresh), springs, rock pools, etc.
  2. Artificial: resevoirs, ditches, wells, excavations (e.g. borrow pits), road ruts, etc.

A minor class produced by animals, may be noted, e.g., hoof-prints, crab-holes, wallows, etc. The importance of these from the standpoint of mosquito biology is indicated by the fact that one genus, *Deinocerites*, and several species of *Culex* breed exclusively in crab-holes.

B. In containers on or above ground.
  1. Natural: water-holding plants (tree-holes, bromeliads, etc.), fallen leaves and nuts, etc.
  2. Artificial: Tanks, barrels, tins, bottles, unused boats, etc.

A minor class, consisting of animal remains, may also be noted: Egg-shells and sea-shells, skulls and horns of cattle, etc. An accumulation of these is at times an important source of stegomyia production.

Although it would appear from the foregoing classification that there are sharp distinctions between the four main groups of habitats, in the final analysis such do not exist. Numerous types of man-made containers, especially when abandoned in natural surroundings, partake of the characteristics of the natural ones; also artificial conditions may be imposed upon natural ones or vice versa. The interrelations of the two may be so complete at times that even the mosquitoes are unable to decide correctly. This should be taken into consideration when there are apparent discrepancies in the source of mosquito larvae. Nevertheless, the distinctions made are essentially real, as shown by the great consistency on the part of the mosquitoes under natural conditions, and especially by stegomyiae under artificial conditions (see following section). The most notable exception to the system is furnished by the common house culex which utilizes indiscriminately both the container and the ground deposits of water. But this appears to be an exception which helps prove the rule. Its choice of habitat appears to be more influenced by the condition of the water (foul water is preferred) than by location.

An examination of the list of habitats given with the list of species (part I) shows that certain natural groups of species are addicted to the natural and artificial containers, while other equally natural groups utilize the ground collections of water. Furthermore, the records given by Dyar (1928) for the mosquitoes of all the Americas, show that this system is applicable to the entire mosquito fauna of the New World.

A brief summary, based on the records given by Dyar (1928) and supplemented by our observations, is presented to show this essential relation existing between mosquito and larval habitat.

Species occurring in ground water.

Natural and artifical deposits.

Most probably ground collections of water were the original, or primitive, habitats of mosquito larvae, and the great majority of the species belonging to the tribes Culicini, Anophelini, and Uranotaeniini still retain this type of habitat. The exceptions are given below. Providing the artificial ground collections approximate natural conditions sufficiently, the ground-water species utilize them about as freely as the natural collections.

Species occurring in natural containers.

Two entire tribes, the Sabethini and Megarhinini, are restricted to the container type of habitat. We have but one record, and that a doubtful one, of a species of Sabethine occurring in ground pools, namely *Wyeomyia oblita* (Parahyba, Brazil).

The species belonging to the Culicine and Anopheline tribes which are habituated to natural containers consist of several small, natural groups of species (subgenera or genera containing but a few species), some of which are phylogenetically widely separated from each other. These are the genera *Orthopodomyia* and *Haemagogus;* the *Aëdine* subgenera *Conopstegus*, *Finlaya*, and *Howardina;* two subgenera of *Culex: Carrollelia* and *Microculex;* and the Anopheline subgenus *Kerteszia*. In addition, certain species of the *Culex* subgenera *Melanoconion* and *Culex* are consistent breeders in natural containers; while several other species of the subgenus *Culex*, notably *quinquefasciatus* and *corniger*, are sometimes found in tree-holes, especially those containing decaying fruits, etc.

Larvae of *Uranotaenia pulcherrima* have been recorded by Dyar as occurring in bromeliads (Panama), but as this species is usually found in ground pools (in common with its congeners) this probably constitutes an accidental occurrence.

Species occurring in artificial containers.

Only the two domestic species, stegomyia and culex, breed more or less habitually in artificial receptacles. The former no doubt originated from a tree-hole-breeding group, and it still utilizes the natural containers to some extent. The other species sometimes found in artificial containers may be regarded as facultative in this respect, and are the ones treated under section (B), class III. Those occurring with the greatest frequency are: *Limatus durhami* (Sabethine), *Aëdes taeniorhynchus* and *Culex corniger* (Culicines); and *Anopheles argyritarsis*. *Anopheles gambiae* is known to utilize artificial containers with great frequency in Africa, its native home.

II. *Classification of habitats based on condition.*

Factors which affect the condition of water.

The condition of water is dependent upon both physical and chemical factors and upon the presence or absence of plant or animal life. Some of the factors which may be noted are size; temperature; whether flowing or stagnant, shaded or sunlit, fresh or foul; presence or absence of salt or other inorganic compounds and dissolved gases; whether with or without plant life; presence or absence of enemies.

Owing to the great variety and variability of the chemical, physical and biological factors which may be present in the larval habitats, it is impossible to devise a simple and satisfactory classification of larval habitats based on the condition of the water. However, certain states of condition are obvious and these evidently are of significance for certain species. As a general rule, stegomyia larvae prefer fairly clean water, while culex larvae prefer foul water; the Anophelines of the subgenera *Nyssorhynchus* and *Myzomyia* prefer sunlit bodies of water, while those of *Arribalzagia* and *Stethomyia* are usually found in shaded pools.

B. Mosquito Environment as Influenced by Man.

The influence of man on mosquito life may be classified, according to degree, as dominant, partial, and non-existent. Three classes of environment corresponding to the three types of influence, may be recognized: human (urban), intermediate (suburban), and natural (sylvan); and, according to the degree of adaptability of the different species, they may be placed rather consistently in one or another of the three classes: Class 1 contains only the two essentially domestic species, stegomyia and culex. These have become so thoroughly adapted to the human environment that they may be considered almost as obligate parasites of man. The second class contains a number of less adaptable species, which can readily exist, however, under suburban conditions both in the larval and adult stages (the facultative suburban breeders), while those of the third or strictly sylvan class are so completely unadaptable that as man encroaches upon their territory they rapidly disappear.

Class I. The essentially domestic (urban) species.

But two species, namely, stegomyia and culex, occurring in Brazil, appear to be primarily dependent upon an environment afforded by man wherein usually the entire life cycle is passed.

The habitats of stegomyia larvae.

Aëdes (Stegomyia) aegypti, the sole representative of the Old World subgenus *Stegomyia* and itself likewise of Old World origin, has, despite its rather complete domestication, maintained its ancestral behavior to a high degree. In fact, by means of this species we are able to show to some extent how the choice between the container and the ground types of larval habitats probably evolved among the mosquitoes as a whole.

Undoubtedly the original larval habitat (which is still utilized by the other species of the subgenus *Stegomyia* and allied subgenera and also to some extent by stegomyia itself) consisted of rot holes in tree trunks and other natural containers. However, the stegomyia is now so thoroughly adapted to domestic conditions, both in the larval and adult stages, that, of all insects requiring an aquatic environment in the larval state, it is the easiest to breed under laboratory conditions.

An investigation made in the city of São Salvador (Shannon, 1930) on stegomyia breeding in natural and abandoned artificial containers in the vacant lands, strongly indicated that even under seminatural conditions the species prefer artificial containers to natural ones. During the same period of time and in the same general region, an average of 26 larvae were found in the water-containing artificial receptacles, as compared with an average of 0.64 larvae in bamboos, one of their favorite natural habitats. It might be thought that if stegomyia breeding were controlled in artificial containers, the species might gradually eliminate itself from the natural ones. However, in spite of the intensive antistegomyia campaign going on throughout the city, although the number of larvae in the bamboos was greatly reduced, a certain amount of breeding persisted in these plants, thereby showing that the ancestral instinct of the stegomyia to oviposit in natural containers is sufficiently strong to give the natural containers a certain degree of significance.

The decided preference which stegomyia exhibit for the container type of habitat has been widely known since the time of Gorgas' antistegomyia campaign in Havana, Cuba. Any exceptions to this rule are worthy of special notice. Carter (1924), during his long association with the yellow fever campaigns in Central America and Peru, became so impressed by the general absence of stegomyia larvae in natural or earth-lined ground pools, that he expounded the following formula: We have not found this mosquito in nature breeding completely, that is from oviposition to imago, in any collection of water, where, at the water's edge, there was nothing but mud. Later, in view of the claim that stegomyia larvae were found breeding in great abundance in mud puddles, etc., in Africa, he modified his statement (ibid.) thus: "In the Americas we have not found, etc." It may be seriously doubted whether the African observations are correct as to the identity of the species. The only observations similar to this, to be reported from Africa in recent years, are those made by Dunn (1928) and by Riqueau (1929), both of whom found stegomyia larvae in crab-holes.

As far as the writer is aware, there is in America no clear-cut exception to Carter's formula; and it may be added, it is extremely rare to find stegomyia larvae in natural deposits of ground water of any type. They do, however, utilize cement and brick-lined excavations in the ground (cisterns, wells, etc.), even when the water-level is well below the ground surface. We have but two records of the occurrence of stegomyia larvae in natural ground deposits. On one occasion, Doyle, while at Parahyba, found larvae and pupae in a small straight and clean-sided hole that had been formed in clay soil by a temporary stream of water coming down an adjoining hillside. On several occasions in Bahia we have found larvae in rock pools, but it may be noted that rock pools are only a step removed from cement-lined cisterns. However, larvae of *Aëdes* (*Ochlerotatus*) *scapularis* and *Aë.* (*Taeniorhynchus*) *taeniorhynchus* were likewise present, and it is an extremely rare exception for stegomyia larvae to be found associated with typical ground-pool species of *Aëdes*.

Carter does not offer any explanation as to why stegomyia does not breed in mud-lined pools. We have found that laboratory-bred mosquitoes oviposit as freely on wet mud as they do on damp filter paper or on the surface of water. Under certain conditions, which are noted below, the larvae will develop and pupate in mud puddles. However, the explanation probably can be based on the retention of the ancestral instinct of the females, which causes them to continue to choose the container-type of habitat to the practical exclusion of ground deposits.

Furthermore, an analysis of the behavior of stegomyia larvae in relation to their environment apparently affords an indication as to how the difference between the choice of the container and the ground type of habitat arose among the mosquitoes.

The behavior of stegomyia larvae.

The behavior of stegomyia larvae is very characteristic, and it is so well marked that they may be distinguished at sight from all other Brazilian species of Culicidae by their movements alone, save for one known exception, *Aëdes fulvithorax*, a sylvan tree-hole-breeding species. Their behavior is based on two factors: (1) their extreme sensitiveness to vibration and light (being strongly negatively phototropic) and (2) their method of seeking food. In addition, they are extremely restless, nearly always on the move, even when undisturbed and in moderate light. Their motions, epecially when they are disturbed, consist of intense looping movements which result in but little actual progression. Another important fact is that upon coming in contact with the bottom of the container after being disturbed, they do not remain there quietly for more than a few seconds, and it requires a long time for them to work their way gradually to the surface. In their search for food, they roam throughout the container, feeding from the surface, the sides, the bottom, and on the particles of food suspended in the water.

In contrast to their behavior the other Culicines and the Anophelines, under quiet conditions, evince but comparatively little phototropism, and when disturbed their movements have a distinctly less looping motion, and progress is rapid. *Anopheles* and *Culex* are strongly disinclined to descend to the bottom; but when sufficiently disturbed they will do so, and upon reaching the bottom they usually remain there motionless until the disturbance has ceased. Their return to the surface is usually very rapid. The Anophelines remain quiet for long periods of time at the surface of the water, and are surface feeders. All the species of *Culex* hang suspended from the water surface and feed upon the suspended food material. Most of the Aëdines (sens. lat.) are mainly bottom feeders. The Sabethines are extremely sluggish in behavior, distinctly more so than stegomyia. They remain for long periods of time on the bottom or against the sides of the container, usually ventral side up or out, and feed from the sides and bottom and on suspended food particles. Only when there is a scarcity of food will they roam about freely in the container. At such times the larvae slowly skim along just under the water surface, ventral side up, searching for food.

Susceptibility to predacious enemies.

The restless roaming of stegomyia larvae throughout all parts of the container, especially when food is scarce, combined with their slow movements, render them easy victims of predators if these chance to be present. In our experiments made to test the susceptibility of various species of mosquitoes as prey, we have placed numbers of larvae of *Wyeomyia bromeliarum* (*Sabethine*), *Stegomyia*, *Culex quinquefasciatus*, *Aëdes scapularis*, and *Anopheles argyritarsis* in jars, each containing different species of insect predators, namely, Belostomatids, Corixids, dragon-fly nymphs, and various types of predacious Culicid larvae, *Corethrella*, *Megarhinus trinidadensis*, and *M. violaceus*. Invariably, the stegomyia larvae were the first to disappear completely, and they were, in time, followed by the Sabethine larvae.

Compared with the ground collections of water, the natural containers have very few predators; while for the artificial containers we have very few records: two records of *Chaoborus*(?) *brasilensis* (subfamily Chaobarinae, Culicidae) in barrels; a few of *Corixa* sp. (Hemiptera) in large cement tanks; and two records of *Megarhinus trinidadensis* in earthenware jars in woodlands. In natural containers we find *Corethrella* spp. (tree-holes and bromeliads); *Megarhinus trinidadensis* (tree-holes); *M. violaceus* (bromeliads); *Sabethoides purpureus* (in bamboos); and a species of Tipulid, *Sigmatomera* sp. (in tree-holes).

In the ground collections, in addition to numerous insect predators, there may also occur various species of larvivorous fish.

Certain other experiments indicate very clearly that at least one reason why we do not normally find stegomyia larvae in ground pools is because if the eggs of this mosquito should be deposited in such collections the resultant larvae would not long survive, providing predators were present.

Experiment No. 1.—Two artificial mud-lined pools were made and stegomyia eggs were immediately added. The larvae completed development.

Experiment 2.—The pools were then allowed to stand until they had assumed a natural aspect by becoming more or less overgrown with vegetation. Meanwhile dragon-flies, *Culex quinquefasciatus*, and *Anopheles argyritarsis* adopted them as habitats. During the course of the five tests, over 1,000 stegomyia eggs were placed in the pools, 100 to a pool each time. Five days after each placement of the eggs, at which time the stegomyia larvae should have been full grown, the pools were thoroughly searched, but although we obtained numerous *culex*, *anopheline*, and occasionally *Aëdes scapularis* larvae, there were no stegomyia larvae to be found.

Experiment No. 3.—Some of the dragon-fly nymphs were placed in a jar with numerous culex and stegomyia larvae. The first lot of stegomyia larva disappeared overnight, and subsequent lots disappeared with equal rapidity; the culex larvae, meanwhile, appeared to be undiminished in numbers. Finally, when no more stegomyia larva were added, the culex gradually disappeared.

Considering the behavior of the three organisms, the explanation is obvious. The dragon-fly nymphs remain at the bottom and, as they are able in clear water to detect full-grown larvae at a distance more than equal to their own length, they rapidly make away with the restless stegomyia; while the culex, being at the surface, remain unmolested. When the dragon-fly nymphs are sufficiently driven by hunger, they come to the surface and feed on the larvae located there.

Experiment No. 4.—One of the pools was then freed of enemies by the use of iodine (highly insecticidal, but very transient in nature) and more stegomyia eggs were added. These passed through a normal development.

Similar observations have been reported by Gordon (1922) from Manáos, Brazil. He noted that stegomyia larvae were not to be found in ground pools and attempted to learn whether this was due to the water's being of such character as to prevent the females from ovipositing, or whether, if oviposition did occur, the larvae would develop. Using ground-pool water, he found that oviposition occurred as readily as in the domestic waters; and providing enemies were not present, the larvae developed normally. With enemies present, the larvae disappeared in the course of 24 hours, but culex larvae persisted for 8 days under the same conditions.

We may conclude from the foregoing that one of the main reasons for the choice by the stegomyia of the container type of habitat is that, because of their peculiar susceptibility as prey, they are forced to choose habitats which are relatively free of predators. Possibly their instincts guide them still further, leading them to choose artificial containers, which are practically free of enemies. It may be noted that the number of stegomyia larvae found in natural containers is more or less inversely proportional to the number of predators present. This observation is based on hundreds of collections made from these sources in the vicinity of São Salvador. Bamboos, which have the fewest predators, have had the highest number of stegomyia larvae; tree-holes rank second, while the bromeliads, favorite haunts of *Megarhinus violaceus*, rarely contain stegomyia larvae.

The environment of stegomyia in relation to that of man.

In the city of São Salvador (Bahia), 80 per cent of the stegomyia larvae collected from the "bamboo traps" were obtained from bamboos located within 25 meters of houses; approximately 20 per cent were found between 25 and 100 meters of houses; while beyond this distance they were extremely rare. The tree-hole collections show that 85 per cent occurred in trees within 40 meters of houses, 13 per cent in those between 40 and 80 meters of houses, and less than 2 per cent in those between 80 and 160 meters of houses. It is of considerable interest to note, however, that on a few occasions adult stegomyia have been found in wooded areas within from 200 to 500 meters of houses, and also that in a series of investigations on this species in Africa, Dunn (1928) found that at 500 yards from houses the larvae were more abundant in his bamboo traps than at shorter distances.

However, the following experiments tend to show that stegomyia will not propagate under truly natural conditions in woodlands which are well isolated from houses. An approximate total of 3,000 eggs, full-grown larvae, and pupae were placed in bamboo joints, tree-holes, tin cans, and small earthenware jars in wooded areas 3 kilometers distant from houses. Only on two of the weekly inspections made during the four months following the "plantings" were there second-brood larvae in the containers, and these were found on the first and second weeks following one of the plantings. The adults always disappeared from the localities in the course of two weeks' time.

Under normal conditions, stegomyiae probably rarely fly far from their places of birth. Flight experiments made on this species show that they fly from house to house to some extent, as specimens were recovered in many different houses, sometimes at a distance of 300 meters from the one of release. Also they are able to fly for at least a kilometer over open water, as was shown by the recovery of specimens which had been released on a boat (Shannon and Davis, 1930).

Similar detailed observations have not been made on *Culex quinquefasciatus*. Its larvae are usually found in foul water, both in containers and in ground collections. They are sometimes found in fresh water deposits, in which stegomyia larvae also occur. In Brazil they are rarely found associated with wild species habituated to the plant-grown ground pools of fresh water.

The fact that stegomyia and culex are never found in unbroken virgin territory indicates that they are unable to exist without some more or less direct influence of man. Probably a better criterion for showing that these species are essentially domestic is that they are the only ones which can habitually reproduce indoors and are the only species to be found with regularity in the centers of large cities, far removed from any more or less natural larval habitats. In fact, in uncontrolled towns stegomyia, at least, may occur far more abundantly in the more densely populated sections than in the outskirts.

Among other species, notably certain Anophelines, it is apparent that the adults deliberately seek the habitations of man, and to this extent may be regarded as domestic species. However, their occurrence in the central parts of large cities is extremely rare and probably entirely accidental, while their larvae are never found indoors, except when accidentally conveyed there from the outside water-supplies. This is true even in the case of the recently introduced African species, *Anopheles gambiae*, probably the most domestic of all Anophelines; for although its larvae have been found outdoors in all manner of domestic receptacles as well as in natural collections of water, they do not normally occur indoors. No doubt this is due to the fact that they do not thrive in completely shaded situations. Various other species are known to utilize artificial containers to some extent as larval habitats, but these are treated under Class II, the "facultative suburban breeders."

Finally, it is of interest to note that the four species of mosquito most intimately associated with man, *Aëdes* (*Stegomyia*) *aegypti*, *Anopheles* (*Myzomyia*) *gambiae*, *Culex* (*Culex*) *quinquefasciatus*, and *C.* (*Culex*) *pipians* (the latter found in temperate latitudes), are all transmitters of disease and are cosmopolitan in distribution, and that the first two species, and presumably both species of *Culex* as well, are of Old World origin. This indicates a high degree of adaptability and long association with man.

Class II. The facultative suburban species.

In all the cities in the particular Brazilian states wherein our investigations have been made, there are to be found areas which still possess some of the original natural conditions, such as woodlands, valleys, marshes, ponds, ground depressions wherein temporary rain pools are formed, and streams. Usually these, as well as the ditches, reservoirs, etc., are in a favorable state for mosquito production. We find a rather large group of species which thrive under these seminatural conditions as well as they would under strictly sylvan conditions; possibly in some cases they thrive better. These species may be termed the "facultative suburban breeders." As a rule, they seldom penetrate beyond the suburban areas, as only rarely are they found, even in the adult stage, in the center of large cities.

This group contains a large number of strictly harmless species; the most important of the obnoxious ones, some of which have been shown capable of transmitting yellow fever under laboratory conditions; and the malaria vectors.

The following are the species most frequently observed. An asterisk (*) indicates that the species sometimes enter houses to feed; but as they rarely remain indoors during the day, they are considered only as transient visitors. *Limatus durhami*, *Wyeomyia oblita*, *W. bromeliarum*, *W. tripartita*, **Aëdes scapularis*, *Aë. fluviatilis*, **Aë. taeniorhynchus*, **Mansonia titillans*, **M. justamansonia*, **M. fasciolata*, *M. chrysonotum*, *Culex corniger*, *C. nigripalpis*, *C. declarator*, *C.* (*Mochlostyrax*) spp., *C.* (*Microculex*) spp., *Megarhinus trinidadensis*, *M. violaceus*, *Uranotaenia geometrica*, *U. lowii*, *U. pulcherrima*, **Anopheles albitarsis*, **An. argyritarsis*, **An. darlingi*, **An. bachmanni*, **An. tarsimaculatus*, **An. gambiae*.

Although all the species of this group are, or can be, quite independent of man for their existence, a number of them, especially certain Anophelines, have become more or less domesticated, particularly in the adult stage. It is highly improbable, however, that any of these species will remain indoors more than 24 to 48 hours at a time. More extensive investigations are needed to really prove this point. Cesar Pinto (1930) records that in Rincão, São Paulo, *Anopheles argyritarsis* and *albitarsis*, while common in houses at night, are rarely found there during the day. Davis (1926) has shown that in the state of Rio de Janeiro, only 3.1 per cent of the Anophelines resting in certain houses on a given day during warm weather are to be found there the following day; also it is apparent, according to his observations on *Anopheles gambiae* in Natal, that comparatively few adults of this species remain indoors during the day.

Aëdes taeniorhynchus and *scapularis* and several species of *Mansonia* are at times the cause of considerable annoyance about houses in suburban and rural districts. They enter houses with some frequency, and occasionally they remain throughout the following day.

Generally, the adults of these species remain more or less in the immediate vicinity of the larval habitats, but this depends largely upon their powers of flight and the proximity of food. *Aëdes taeniorhynchus* and *Mansonia titillans* sometimes fly from ten to thirty kilometers. Le Prince (1912) and later Zetek (1915), working in Panama during the construction days of the Canal, demonstrated that every evening there was a flight of *Anopheles tarsimaculatus* (an extremely abundant species in the Canal Zone at that time) from their larval habitats to the towns, in some instances two kilometers distant. The following morning there would be a return flight. Observations made on other species of Anophelines in other countries show that at least some species of this genus have a flight range of eight kilometers.

However, it is extremely rare to find mosquitoes other than the essentially domestic stegomyia and culex in houses in the center of large cities. *A. taeniorhynchus* and *M. titillans* may be exceptions to this rule, and on one occasion Dr. Frobisher captured a female *Mansonia justamansonia* in the Hotel Nova Cintra in the center of the city of São Salvador, a site obviously far removed from any breeding source.

Class III. The essentially sylvan species

A large number of species, especially the so-called "rare species," owing to the peculiarity of their larval habitats and the short flight range of the adults, are never found in the immediate vicinity of dwellings, save on occasions when new land is being opened up to settlement. Others (e. g. certain tree-hole and bromeliad species) have been found only under strictly natural conditions, even though the suburban sections of a city may closely approximate natural surroundings. Thus, in São Salvador, although hundreds of collections have been made from tree-holes in more or less natural areas rather well removed from houses, no specimens of *Aëdes fulvithorax*, *Aëdes terrens*, or *Culex mollis* have yet been obtained; while in woodlands, some miles distant from the city, these species have frequently been found. Conversely, we have collected hundreds of larvae of a certain species of tree-hole-breeding *Culex*, *C.* (*Melanonoconion*) *conservator* (an innocuous species) from the suburban tree-holes, but up to the present we have not found them in unbroken woodlands.

Most of the species belonging to Class III disappear upon the development of a human environment. Owing to their limited and usually haphazard contact with man, they are all probably entirely innocuous. In their native haunts many of the species will readily attack man, but they apparently never deliberately enter houses for the purpose of obtaining food. Their occasional presence there may be regarded as purely accidental and probably due to their having been attracted by light, or having entered accidentally during flight.

NOTES ON THE FOOD HABITS OF ADULT MOSQUITOES.

Probably all mosquitoes, save those of the genus *Megarhinus*, feed to a greater or less extent on blood. It is believed, on the basis of a very few observations, that a large number of Sabethines and certain species of the genus *Culex* feed primarily on cold-blooded animals (frogs, lizards, etc.), but possibly even the majority of these will attack warm-booded animals if given a perfect opportunity. We have collected specimens of all the species of Sabethines recorded in the list (part I) while they were in the act of attacking man.

Stegomyia apparently has a decided preference for human blood. However, under laboratory conditions, Stegomyia two weeks old, previously unfed on blood, will freely attack toads, geckos, and snakes.

The Uranotaeniini apparently have very little predilection for blood, at least for mammalian blood. We have never observed species of this tribe feeding, and only on one occasion have we found a female engorged with blood (*U. lowii*).

Time of Activity of the Adults.

Practically all of the container-breeding species of mosquitoes: the *Sabethines*, *Megarhines*, *Haemagogus*, the *Aëdine* subgenera *Conopstegus*, *Finlays*, *Howardina*, and *Stegomyia* are day fliers. The other *Aëdine* subgenera and the genus *Psorophora* fly and attack readily by day but preferably at twilight, the Anophelines more especially at twilight, and those of *Culex* during twilight and night hours. *Mansonia titillans*, and probably the other species of *Mansonia* as well, are apparently on the wing at all hours of the day and night, providing the weather is favorable. There are exceptions to these generalizations, in that stegomyia sometimes attack at night and various species of Anophelines (subgenera *Stethomyia* and *Nyssorhynchus*) will occasionally bite in direct sunlight.

Indoors, the time of mosquito attacks is of importance in helping to determine the species concerned. Stegomyia attack during the day, culex at night; but during twilight hours these, as well as the suburban species of *Aëdes*, *Mansonia* and *Anophelines*, may all join forces.

SUMMARY.

Approximately ninety species of mosquito have been found in the middle coast states of Brazil. Owng to the comparatively less favorable climate of this area, the fauna is not as rich in species or as prolific in individuals as in the more humid regions of the Amazon and of several southern coast states. The larval habitat is definitely known for all but seven of the species, and in these cases the habitat may easily be inferred from the group relation of the species.

Mosquito environment is treated (A) according to the biology of the mosquitoes and (B) as affected by the environment of man. Under (A) it is shown that the larvae of each species are more or less restricted to a special type of habitat and, further, that the natural classification of the habitats is in accord with the natural (phylogenetic) classification of the family. The larval

habitats are classified according to location and condition. For the majority of the species, the location, whether in ground deposits or in containers (natural or artificial) on or above ground, is of primary importance; while the condition of the water appears to be of primary importance only in the case of a few species of the subgenus *Culex*. The majority of the species belonging to the tribes Culicini, Uranotaeniini, and Anophelini are addicted to ground deposits of water, while the tribes Sabethini and Megarhinini, and the Culicine groups *Orthopodomyia*, *Haemagogus*, *Cenopstegus*, *Finlaya*, *Howardina*, *Stegomyia*, *Microculex*, and *Kerteszia* are addicted to the container type of larval habitat.

Under (B) the mosquitoes are grouped in accordance with their ability to adapt themselves to man's environment. Class I contains the essentially domestic species, stegomyia and culex. They are the only species which occur in the centers of large cities, breed more or less habitually in and around human habitations, and are rarely found under sylvan conditions. When they do occur under the latter conditions, it is never more than a few hundred yards from houses. Certain experiments, in fact, in which approximately 3,000 eggs, larvae, and pupae of stegomyia were placed in woodlands three kilometers from houses, show that the adults do not remain to propagate under truly natural conditions.

The behavior of stegomyia larvae renders them easy prey to enemies. The relative absence of predators in the container type of habitat, as compared with the usually numerous enemies present in ground-water deposits, suggests that the container type was adopted by the stegomyia as a means of escape from predators; or it may be that the behavior of the larvae results from the general absence of enemies in their habitats.

Class II consists of a group of less adaptable species, which can, however, easily exist under suburban conditions. The obnoxious wild species and the malarial vectors belong here.

Class III contains the strictly sylvan species, which, because of the peculiarity of their larval habitats, quickly disappear as man encroaches upon their territory.

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A NEW SCELIONID EGG PARASITE OF THE BLACK WIDOW SPIDER.

By HERBERT L. DOZIER, *Service Technique, Port-au-Prince, Haiti.*

It is very interesting to describe a reared species of *Bæus*, from the egg mass of a specifically identified spider, and especially as its host is the generally feared, very poisonous *Latrodectus mactans*. The egg masses were placed in glass tubes for observation. Young spiders hatching at the same time did not seem to take any notice of the wingless females and these remained alive in the tube as long as eight days. Numbers of winged males, however, were found dead in four days time but were apparently not eaten by the spiders.

Bæus latrodecti, new species.

This species is nearest in coloration to *Bæus americanus* Howard but differs in the general more yellowish-orange color, particularly the head, and is slightly longer in body length.

Male.—Length, .86 mm. General color distinctly darker than the female, dark honey-orange with the dorsum of thorax and abdomen infuscated; legs honey-yellow. Antennae pale yellow, composed of eleven joints, the scape very long, much thicker and wider than the other joints, the club constricted near middle, making the club appear almost as being two-jointed. Wings hyaline, fringed, venation pale brown, marginal nervure very short, basal nervure distinct, the stigmal long and oblique, no post marginal nervure present.

Female.—Length .717 mm. Length of antennal club .115 mm.; width of club .046 mm. General color of head and body medium to dark honey-yellow, the abdomen a decidedly deeper or rusty color; eyes black; antennae honey-yellow, the basal half of pedicel fuscous; legs concolorous with the head, the last joint of tarsi blackish. Head large and broad, decidedly wider than the thorax. Pro- and mesonotum and abdomen with dark prominent setae when observed under microscope, less prominent on abdomen on account of the darker color of the latter. Antennae seven-jointed, the club very large, being slightly longer than the combined pedicel and funicle joints; funicle joints very narrow, short, transverse and subequal. Abdomen robust, rounded, distinctly wider than the thorax.

Allotype wingless female mounted in balsam on slide, U. S. National Museum Cat. No. 43327. Holotype winged male on slide with four other males and four females.

Described from two females reared October 30, 1930, and a large series of females and males reared Nov. 12-14, 1930, by the writer from egg sacs of the "cul rouge" or "black widow" spider, *Latrodectus mactans* Fab. collected from beneath bee hives at Damien, Haiti.

Ashmead in the description of the winged male of *Bæus americanus* How. and characterization of the genus, states that the male antenna is 12-jointed but with the male of *B. latrodecti* there are only eleven joints, the last being constricted somewhat to suggest a twelfth joint.

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PROCEEDINGS OF THE
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BIOLOGICAL OBSERVATIONS ON AGRIOTYPUS (HYMENOPTERA).

By CURTIS P. CLAUSEN,
Bureau of Entomology, United States Department of Agriculture.

The ichneumonoid family Agriotypidae, of which only a single species (*Agriotypus armatus* Curtis) has heretofore been known, has engaged the interest of insect parasitologists for many years owing to its aquatic habit as a parasite in the cases of caddis-flies. The species was described by Curtis, who, in 1832, noted its aquatic habit, and in 1858 von Siebold called attention to its rôle in relation to the caddis-fly cases. In 1889 and 1893, Klapálek (*2, 3*) published accounts of the general habits of the species and described and figured the mature larva, the "subnymph," the pupa, and also the peculiar ribbon formed at the end of the parasitized cases. This species is found in many of the countries of Europe and is recorded as having been reared from the cases of the genera *Silo*, *Geora*, *Odontocerum*, *Aspatherium*, and *Trichostoma*.

In Japan, Ota observed a species of the genus parasitic in caddis-fly cases in Lake Hakone, and in 1917–1918 (*4, 5*) published accounts of his observations. The data and figures given are in all essential respects similar to those of Klapálek, and no additional information was presented. Ota believed this species to be distinct from *armatus*, but did not describe it.

In the early spring of 1929 the writer made a collection of caddis-fly cases at Lake Hakone, bearing the filament indicative of Agriotypus attack, and reared out the adults. A series of these was sent to Dr. J. Waterston at the British Musem for examination and comparison with the types of *armatus*, and he has recently described the species as new under the name of *Agriotypus gracilis* (*6*).

This paper deals with the habits of the adult, the manner of oviposition, the egg, and the first larval stages, with notes on the mature larva as interpreted from an examination of the cast skins. Regrettably, the writer's departure from Japan prevented the completion of the study of the life history of this most interesting parasite.

On March 25, 1929, a search was made for parasitized cases and a total of 21 of these secured. They were found largely in the crevices of the stone embankment bordering the lake along the village front, usually from 6 to 15 inches beneath the water level prevailing at that time, and were readily distinguished by the long ribbon-like appendage extending out into the water from the anterior end of the case. The collections were made between 10 and 11 o'clock in the morning, and 13 females and 6 males of *A. gracilis* emerged from these cases within two hours after collection. The remaining two cases were already empty. The immediate emergence of these adults was probably induced by the higher temperature of the water in the glass jar in which the cases were placed, and under normal conditions in the lake this might have been delayed for a considerable time.

Mating of the reared individuals occurred very readily on the surface of the water and in vials, immediately after emergence. The females were then set aside for a week or more to permit of the maturing of the eggs, though this may not have been necessary, as the dissection of one female on the day of emergence revealed from 30 to 35 apparently mature eggs in the ovaries. For experimentation in the manner of oviposition a glass bowl 12 inches in diameter and 5 inches deep was used, a layer of sand and gravel being placed in the bottom with a few tufts of grass at one side, and filled with water for a depth of 4 inches. About 50 caddis-fly cases containing active larvae, prepupae, and pupae were then placed in the bowl.

Under proper conditions the females would descend into the water by means of the grass stems and leaves provided for that purpose, and no instance of unaided direct entry was observed. Under the conditions as they exist in the collection locality at Lake Hakone the only means of getting beneath the surface is by crawling down the face of the stone embankment or the sides of occasional partially submerged rocks. In the laboratory this was most easily induced by dropping the females upon the surface of the water and then forcing them beneath it by the use of a small brush. Once submerged and brought into contact with pebbles or other objects which could be grasped with the feet, they would remain there and soon begin the search for host cases.

Upon entrance into the water, the entire body is enveloped by a bubble of air which conforms in general to the body outline, and the formation of this is probably due to a considerable extent to the fine, dense pubescence with which the body is clothed. The antennae are usually laid back over the thorax and held there by the air bubble, while the wings remain folded in the normal resting position. The respiratory requirements of the female during the period of submergence are partially met by the bubble contents, and this supplemented by oxygen entering the bubble from the surrounding water. In no instance has any activity with the antennae been noted under water, and they are evidently functionless in so far as the detection and examination of the host is concerned.

The maximum period during which a female was observed to remain under water continuously was 14 minutes, though the average was considerably less. In emerging from the water the foothold upon the object beneath is first loosened and the body then quickly floats to the surface, there being no movement of either the legs or wings at this time. Ota states that they swim obliquely to the surface, with the wings folded. Upon reaching the surface of the water the film is broken without difficulty, and the parasite may take flight immediately. Other individuals will coast on the water for several inches or more in gaining speed before taking wing. During this preliminary coasting, the wings beat rapidly as in flight; the middle and hind legs trail on the surface of the water, and the anterior pair is held sharply raised, with the tarsi directed downwards.

In the examination of caddis-fly cases preparatory to oviposition the female is evidently guided by the tactile sense, the stimuli being transmitted through the feet or by movements of the host transmitted through the water to the sense organs. She may walk about over a case for a considerable time or may immediately insert the ovipositor. While able to distinguish readily whether or not a case is inhabited, she can not recognize the stage of caddis-fly contained therein. Provided the host case is inhabited, the female parasite lowers the tip of the abdomen and feels about with it until a suitable crevice is found between the bits of sand or gravel covering the outside of the case, following which its perforation with the ovipositor is attempted. This may happen a number of times and at different points before actual penetration is accomplished, and the point finally chosen is usually in the mid-dorsal region somewhat to one side of the median line.

Should the case contain an active caddis-fly larva the first jab of the ovipositor of the parasite causes it quickly to extrude the head and the thoracic segments from the anterior opening of the case. As a result of this response the parasite immediately withdraws the ovipositor and leaves the case without oviposition. Not a single egg was deposited in the one hundred or more instances in which the perforation of the cases of active larvae was observed.

The attempt to effect oviposition upon mature larvae having failed, attention was turned to the prepupae and newly-formed pupae. The former is entirely immobile in the case and the latter capable of moving the abdomen to only a limited extent. The anterior opening of the case is closed and it is firmly attached to stones or in crevices in embankments. Penetration of these cases was effected in exactly the same manner as with the larvae, and the egg laid externally upon either stage. The entire process of oviposition usually covers a period of from 3 to 5 minutes.

The establishment of the fact that oviposition occurs externally upon the prepupa and the pupa, rather than internally in the mature larva, was an unexpected development. Klapálek in the case of *armatus*, and Ota in *gracilis*, have both stated that the mature larval stage is attacked. While Klapálik does not state definitely that *armatus* is an internal parasite, yet various writers have assumed such to be the case.

The ovarian egg is 0.9 mm. in length and 0.18 mm. in maximum width, this being near the anterior end; the ventral surface is nearly straight and the dorsal slightly convex, with the anterior end smoothly rounded and the posterior somewhat tapering. There is no indication of any structure corresponding to a pedicel. Over the anterior end is a marked increase in the thickness of the egg covering, which appears to be distinct from the chorion proper.

The laid egg is of approximately the same dimensions and form as the ovarian egg but, strangely enough, is found with a distinct stalk 0.20–0.25 mm. in length, by means of which it is anchored to the host derm. This stalk differs from that of the eggs of other Ichneumonoidea which are attached to the host body in a similar manner in that it is of inconstant form and is not an extension of the egg chorion. Both the stalk and its enlarged tip, which is inserted beneath the host derm, become almost black and have a shrivelled, twisted appearance shortly after the egg is laid, an effect not seen in other stalked ichneumonoid eggs. It appears that this stalk must be formed at the time of oviposition, from the sheath of material which closely envelops the anterior pole of the ovarian egg. The chorion of the egg is of a very light amber color and is exceedingly tough, being difficult of penetration even with a sharp dissecting needle.

The position of the egg on the host body is usually lateral or dorso-lateral, either on the thorax or on the anterior half of the abdomen of the prepupa or pupa, and often in one of the intersegmental grooves. Several instances were noted of eggs attached to the wing pads of pupae.

During the latter part of the incubation period the form of the developing larva within the egg can be readily distinguished. The large bifurcate caudal process lies ventral of the body, the prongs being contiguous, and extends forward to the posterior margin of the head.

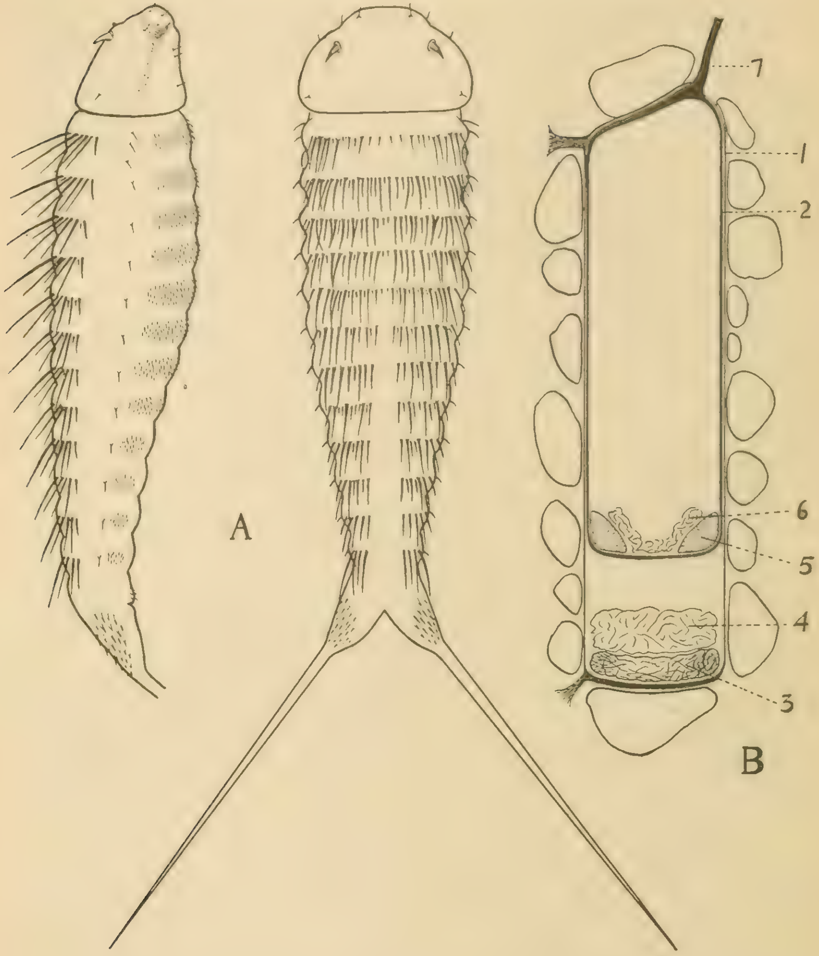
At the time of hatching there first appears a small break in the chorion beneath the posterior half of the head and the first thoracic segment. Whether this is effected by the use of the mandibles of the larva is not known. The enlargement of the aperture is accomplished by a slow but steady distension of the thoracic region of the body and the consequent bringing forward of the posterior portions. This continued outward pressure results gradually in a broadening of the aperture until the thoracic segments are forced through it, the head at this time being still within the egg and bent back over the dorsum. Further enlargement of the circular opening frees the head, following which the entire body slowly emerges. The opening through which emergence is effected is about two-thirds the width of the egg, circular in outline, and with the edges curled back. There is no splitting of the chorion such as is seen in the hatching of other ichneumonoid eggs. The time elapsing from the first indication of a break in the chorion to complete emergence of the larva is five to eight hours.

Agriotypus gracilis Waterston: A, dorsal and lateral views of first stage larva; B, longitudinal section of parasitized case showing (1) the caddis-fly case, (2) the Agriotypus cocoon, (3) the cast larval skin of the caddis-fly, (4) the pupal remains of same, (5) the meconial ring of Agriotypus, (6) the cast larval skin of same and (7) the basal portion of the silken ribbon extending outwards from the anterior end.

The first stage larva (A) is 1.2 mm. in length to the base of the bifurcate caudal process, 0.35 mm. in width in the thoracic region, with 13 body segments and translucent white. There is no trace of open spiracles.

The head is as broad as the thoracic segments, the length being slightly less than the width. Dorsolaterally, and slightly forward of the transverse median line, is a pair of heavy horn-like processes similar to those seen on a *Perilampus* planidium. There are 7 pairs of fine setae, situated as shown in the illustrations. The pharyngeal skeleton is irregularly U-shaped, with the heavy mandibles simple.

Each of the body segments, except the last, bears dorsally a median transverse row of heavy spines extending nearly to the lateral margins. On the first five segments the row is continuous across the dorsum, while on the following segments it is interrupted along the median line. These spines are of very unequal length, the largest being slightly longer than the segment itself, and situated near the ends of the row. At the lateral margin of the first segment are two small spines, and one only on the following eleven segments. The first eight segments each bear ventrally a broad band of closely set setae extending nearly to the lateral margins. The anterior and posterior margins of each segment are bare. On segments 9 to 12 this band is broken medially. The caudal segment is bifurcate, with its 2 prongs 0.9 mm. in length, very slender, heavily chitinized and sharply pointed, diverging at an angle of about 80 degrees and borne at an angle of approximately 45 degrees with the horizontal plane of the body. The dorso-lateral area at the expanded base of the process bears numerous short, robust setae. Ventrally, there is an indication of the anal opening.



The bifurcate caudal process reveals a considerable similarity to that of the primary larva of *Anastatus albitarsis* (*1*), which develops in the egg of *Dictyoploca japonica*. In the latter case the transverse rows of heavy spines on the body segments are borne ventrally rather than dorsally, and these, in conjunction with the caudal process, permit of some degree of movement in the semifluid contents of the egg through a flexing and straightening out of the body.

The above type of larva, unique among the ichneumonoid Hymenoptera, is exceptionally well adapted to the conditions under which it lives. The dorsal rows of heavy spines, which normally lie flat on the body, can be raised to a nearly vertical position, and these, in conjunction with the ventrally directed caudal process, permit of ready movement between two curved surfaces such as exist in the caddis-fly case between the body of the prepupa or pupa and the wall of the case. The larva has three points of contact with the surface upon which it rests, these being the head and the tips of the two caudal prongs. In movement the posterior portions of the body are raised and the tips of the prongs brought forward. The dorsal rows of spines, in contact with the cocoon wall, serve to prevent backward movement through any cause. Being thus braced, the head is then moved forward and the action repeated.

At first sight, it would appear surprising in a highly specialized larva such as this, and of aquatic habit, that none of the morphological modifications has any relation to respiration. They are solely locomotory in function, and no open tracheal system exists. However, in its life in flowing water, the environment is really more comparable to that of a normal internal parasite floating in the body fluids of its host than to an external one in the open air. It is probable that the supply of oxygen required is secured partially by osmotic action from the surrounding water and to a lesser extent from the body fluids of the host which are imbibed. In an open Petri dish several of these larvae lived in ordinary tap water for 3 to 5 days, a period much longer than has been found possible even in normal saline solution with other primary larvae of internal habit.

The final larval stage differs very little from the ordinary ichneumonoid form. Living or preserved specimens have not been available for examination, and the few details given are based upon the cast skins found in cocoons from which the adults had already emerged.

The head capsule is relatively large and is quite heavily pigmented in irregular areas. The segmentation of the body is distinct, and nine pairs of open spiracles are present. The caudal segment bears a broadly bifurcate process, approximately equal in length to the last two segments, the ends of the prongs being curved slightly inward toward the median line and the tips somewhat dilated and rounded rather than sharply pointed.

In the empty host cocoons there were found no cast skins corresponding to the "subnymphal" described and figured by Klapálek, and Ota does not mention having seen such a form in *A. gracilis*.

The most interesting point in the life history of Agriotypus is the formation and function of the elongate, whitish, ribbonlike band which extends outwards, at times to a length of 2 inches or more, from the anterior end of the cocoon and floats freely about in the water. Ota surmises that it serves as a warning signal to enemies or as a scaffolding for use at the time of emergence, but there is little to support either idea.

This ribbon is unquestionably a component part of the Agriotypus cocoon, and is presumably formed by the mature larva at about the same time. It appears to consist of a bundle of silken strands rather loosely bound together, and attached to the cocoon dorsally at the anterior end. In the material examined there was no indication that this ribbon represented a hollow tube, as was at first supposed.

A consideration of the conditions under which the mature larva and pupa live in the cocoon indicates that this ribbon is associated with the respiratory function of these stages. The living larva and pupa of the host maintain a continuous flow of water through the case, and thus the first larval stage of the parasite, and presumably the intermediate also, derive their oxygen supply from the water in the same manner as does the host. In the final larval stage, however, the host is destroyed, and the parasite is equipped with a fully developed and open tracheal system, necessitating existence in air rather than in water. The Agriotypus cocoon, spun inside that of the host, is quite heavy, completely closed, and impervious to water. Thus the supply of oxygen, previously derived direct from the water, is shut off. An examination of the previously mentioned ribbon indicates that between the silken strands may be numerous minute air channels extending into the cocoon, and that the oxygen in the surrounding water might be drawn into these channels and into the cocoon owing to a lower air pressure within.

In Fig. B is shown a longitudinal section of a caddis-fly pupal case containing the cocoon of Agriotypus. The case of the host is relatively light in texture and is closed at both ends. At its posterior end is seen the cast skin of the caddis-fly larva (3) and the remains of the pupa (4), each as an irregular pad. The cocoon of Agriotypus is considerably heavier and occupies only about three-fourths of the space available, the posterior region containing the host remains being partitioned off. The ends of the Agriotypus case are considerably heavier than the sides, and from the anterior dorsal edge extends the long silken ribbon (1) of nearly the same width as the cocoon, which identifies all parasitized caddis-fly cases. At the base of the cocoon the larval meconium (5) is found as a ring encircling the tip of the abdomen of the pupa, while the larval exuvium (6) forms a conical sheath about it.

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BRUCHIDAE INFESTING SEEDS OF COMPOSITAE, WITH DESCRIPTIONS OF NEW GENERA AND SPECIES (COLEOPTERA.)

By John Colburn Bridwell, *Washington, D. C.*

For some thirty-two years a major task of our Department of Agriculture has been the exploration of all parts of the world for new plants adaptable to our agriculture. Up to the present time some ninety thousand lots of seeds and plants have been handled by the Office of Plant Introduction. This work has established the cultivation in this country of durum wheat and of the soybean, to mention two strikingly beneficial results. Nearly half of these lots consisted of seeds of which samples have been preserved in a seed collection in charge of H. C. Skeels. This seed collection now contains samples of seeds of more than twelve thousand species of plants and it is safe to say constitutes the greatest collection of seeds of economic plants in existence.

The infestation of these seeds by insects was early noted by the men in charge of this work and the insects noticed began to accumulate in the National Museum and in the Chittenden collection in the Bureau of Entomology (now in the Museum). After the establishment of the Federal Horticultural Board in 1912, all the material imported by the Office of Plant Introduction was subjected to rigorous inspection by the Port Quarantine Division of the Board and the insects intercepted sent by the Bureau of Entomology to the Museum for identification by the specialists of the Bureau.

On account of their agricultural importance, the legumes make up one-fourth of the seed collection and the Bruchidae which infest seeds of this family have formed a large proportion of the insects intercepted. Some fifty museum drawers of these insects are now present in the Museum, many of them from material intercepted by the Federal Horticultural Board in seeds imported by the Office of Plant Introduction. Much of this material is accompanied by notes indicating the host seeds affected and is in many instances accompanied by the seeds from which they had emerged and constitutes the most important source of recorded but unpublished information on the habits of Bruchidae in existence. While a great majority of the Bruchidae of which the larval habits are known live in the seeds of legumes—Viciaceae, Cassiaceae, and Mimosaceae—many other plants are utilized. Whole genera of Bruchidae devote their attention to plants of other families. The palm bruchids have been the subject of a recent paper. In another, attention has been directed to the genus *Megacerus* with its species attached to plants of the family Convolvulaceae. In the Old World most of the species of *Spermophagus* use seeds of the same family; a few attack Malvaceae, while only a single species is known to affect the seeds of a legume—a species of *Cassia*. In the New World several species in different genera devote themselves to the Malvaceae. Besides these, material in the National Museum ndicates the use of seeds of these plant families: Lauraceae, Rhamnaceae, Tiliaceae, Bixaceae, Epilobiaceae (Onagraceae), Anacardiaceae, and Dioscoriaceae. In Europe one of the bruchids lives as a larva in the stems of an Umbellifer. To these varied host plants we may now add the Compositae.

The only published indication that bruchid larvae can live in the seeds of composites which I have encountered is found in the description of *Bruchus lapsanae* Motschulsky 1874 Bull. Soc. Nat. Moscou 46^2 : 235 where the species is said to be from "Panama in sem. [inibus] *Lapsanae*." Since the cichoriaceous genus *Lapsana* (sometimes written *Lampsana*) is native to the Palaearctic region with its described species ranging from Europe and the Mediterranean region to Japan, there must be some error of host plant or locality. Cichoriaceae seem to be almost absent from Central America. The description of this species, which has not since been recognized, shows that it is not similar to the other species here discussed.

H. Y. Gouldman, of the Federal Horticultural Board, found a pair (♀ and ♂) of a peculiar bruchid among the seeds of the tree Dahlia (*Dahlia maxonii* Safford) on March 23, 1920, in quarantine at Washington, D. C., collected by Wilson Popenoe at Antigua, Guatemala, on February 20, 1920 (S. P. I. 49757; F. H. B. 29942). These insects were examined by the writer in 1921 and were recognized as representing an undescribed genus of Bruchidae, but were not determined specifically. On March 16, 1923, Mr. Gouldman collected from seeds of the same host plant a series of the same insect which the late Dr. E. A. Schwarz determined as *Bruchus longulus* Sharp 1885 (described from Nicaragua). These seeds were sent to the Office of Seed and Plant Introduction by W. Cameron Townsend from Chimaltenango, Guatemala (S. P. I. 56665; F. H. B. 345288). Recent examination of the seed of this sending preserved in the Seed Collection revealed an additional adult loose in the containing vial, another within a seed, a crushed pupa in a seed, and a number of the achenes showed emergence holes from which adults had escaped. These were not quite so neatly cut as is usual with Bruchidae, doubtless because of the fibrous nature of the covering of the seed. No trace of eggs could be found. We may then be sure that these seeds nourished the larvae from which the adult bruchids had developed. I have seen the types of *Bruchus longulus* and am convinced that Dr. Schwarz's determination is correct, but unfortunately the specific name is preoccupied in *Bruchus* and must be replaced. Dr. Sharp's figure of the species gives an impression of greater narrowing of the prothorax anteriorly than is really found.

A lot of seeds of an undetermined *Dahlia* resembling the horticultural *Dahlia*, from the Federal District of Mexico sent by William Brockway and received in Washington on September 22, 1913 (S. P. I. 36257) showed similar emergence holes in the achenes and indicate the presence of a *Dahlia* bruchid in that locality, but it still remains to be determined if it is the species described below or the Nicaraguan species or some other species still unknown.

There is in the United States National Museum a single male bruchid collected by Leopold Conradt in the Federal District of Mexico so closely related to the Nicaraguan *Dahlia* bruchid as to suggest that it may be the Mexican *Dahlia* bruchid but no accompanying notes are present to confirm this. It is congeneric with the Nicaraguan species and is described below.

Paul G. Russell of the Office of Foreign Plant Introduction collected a pair of a peculiar bruchid upon the flowers of *Cosmos* sp. at Oaxaca, Mexico, on September 29, 1930, which, from its affinity to the *Dahlia* bruchids, may be expected to breed in the seeds of the *Cosmos* upon which it was found. *Cosmos* belongs in the same tribe of the Asteraceae as *Dahlia*, *Coreopsis*, and *Bidens*. The seeds of the garden *Cosmos* seem to be too small and narrow to support a bruchid larva, but other species of possible horticultural value have seeds large enough to serve this use. This bruchid is closely allied to the other two here discussed, but differs so much in important characters as to make it desirable to place it in a genus distinct from them.

DAHLIBRUCHUS, new genus.

Genotype *Dahlibruchus sharpianus* new name *Bruchus longulus* Sharp 1885, Biologia Centrali Americana Col. 5: 482, not Kraatz 1868.

Body elongate, about twice as long as broad and twice as broad as deep; head short, eyes emarginate more than one half, separated by the width of the eye or more, head strongly contracted beneath and on the sides but not above behind the eyes, temples abruptly declivous to the contraction; antennae short, compressed, perfoliate-clavate, joints 1–4 narrow, 5 and 6 gradually broader, 7–10 expanded, as broad as long or broader, 11 ovate; pronotum subquadrate with anterior angles rounded, dorsum little convex, surface even, median lobe slightly impressed medially, posterior angles a little acute, lateral margin acute, carinate posteriorly to the middle, ampliate in the middle, obsolete anteriorly, flanks broadly concave posteriorly; prosternum acute at apex, separating the coxae for about one half their length; mesepimeron lanceovate, acuminate toward the coxa but remote from it; mesosternum oblique, narrowy truncate at apex, overlapping the apex of the metasternum; scutellum small, subquadrate, emarginately bidentate at apex; elytra conjointly much longer than broad, nearly three times as long as the pronotum, slightly broader at base than the prothorax, gradually broader posteriorly to beyond the middle, surface even, without tubercles at base, not much convex (not at all longitudinally), striae fine, impressed, without visible punctures, free at apex, 5 and 6 abbreviate at apex, intervals flat, humeral callus and humeral lobe feeble, apices covering the pygidium at base; legs with all the femora somewhat incrassate; hind femur as wide as the coxa, nearly straight beneath, widest in the middle, lower side somewhat flattened, without carinae, teeth or denticles, condylar plates small and rounded, hind tibia straight except at base, gradually widened to apex, truncate at apex with apical teeth or spines, hind tarsus about as long as hind tibia, basitarsus about half as long, slightly arcuately arched, not produced at apex beneath, ungues appendiculate with the basal lobe a little acute, abdomen about as long as the thorax, longer than broad, first sternite behind the coxa longer than the coxal width and longer than sternite 2, but not as long as 2 and 3 together, intermediate sternites longer than usual, sternite 5 in ♂ very slighty broadly emarginate and longer in the middle than sternite 4, in the ♀ about as long as 3 and 4 together; pygidium subhorizontal, about as broad as long, broadly rounded at apex, subplane more convex and deflected at apex in the ♂.

I have seen no species of Bruchidae approaching in form the two species placed in *Dahlibruchus* excepting the species described below as *Cosmobruchus russelli*, which is still more elongate and more nearly cylindrical with the hind femur dentate beneath and hind tibia unarmed at apex. *Bruchidius longulus* Schilsky 1905 (Kafer Europa's 41: no. 79) described from France, Spain, Greece, and Asia Minor, must approach the species of this genus in form but has the hind femur with a fine denticle near apex beneath and the antennae serrate in the ♂ and subserrate in the ♀. Nothing is recorded as to the host-plant of this species.

The two species of Dahlibruchus may be distinguished thus:

Front finely carinate; sides of pronotum slightly convergent anteriorly; front tibiae ♂ with an erect acute tooth at middle beneath ♀ unknown *conradti*, new species.

Front flat, without any indication of a carina; sides of pronotum not at all convergent; front tibiae unarmed in both sexes. *sharpianus*, new name. *Bruchus longulus* Sharp 1885.

Dahlibruchus conradti, new species.

Black, antennal joints 1–4 (1 and 2 blackish above) and legs red, the hind femora suffused with black to about the middle; with appressed cinereous pubescence somewhat concealing the surface scuplture (much abraded in the type); pronotum somewhat longer than in *sharpianus* with moderate punctures separated by the width of one to three punctures, antennae longer than in *sharpianus*, third joint much longer than 2 or 4, 7–10 about as broad as long; front tibia with a strong acute erect tooth in the middle, and somewhat sinuately narrowed beyond the tooth; hind tibia with the apical armature made up of triangular teeth rather than spines (spiniform in *sharpianus*), the ventral tooth (mucro) not longer than the lateral tooth, pygidium less oblique and less convex than in *sharpianus* ♂, but suddenly bent down near apex. Length (apex of pronotum to apex of elytra) 2.5 mm.; width of elytra 1.25 mm.; depth .75 mm.

Described from a single ♂ type collected in the Federal District of Mexico by Leopold Conradt. The female is unknown.

COSMOBRUCHUS, new genus.

Genotype *Cosmobruchus russelli*, new species.

Closely related to *Dahlibruchus* and similar to it in many of its characters, but still more elongate in form, nearly or quite three times as long as broad, subcylindrical instead of flattened, the depth being as great as the width instead of only half as great; elytra with striae 4 and 5 abbreviate at apex (instead of 5 and 6); hind femur with a strong flattened triangular tooth near apex beneath within, from which a fine carina extends forward for some distance; hind tibiae without apical teeth or spines; pygidium and hypopygium alike in the sexes, pygidium three-fourths as broad as long, abdomen longer than the thorax.

The species described below is the only known species.

Cosmobruchus russelli, new species.

Black, antennal joints 1–5 and legs yellow-testaceous, femora blackish from base nearly to middle in ♀, beyond the middle in ♂; covered with appressed pubescence, white on the body beneath and but little concealing the surface but more condensed on the sides, above yellowish cinereous, somewhat concealing the sculpture; clypeus, front and neck rugosely and subconfluently punctured with punctures finer than those of pronotum, front subtectiform with a median longitudinal impunctate shining line; pronotum closely punctured with coarse shallow punctures often separated by less than the width of a puncture, intervals of elytra without punctures except for the usual microscopic punctulation of the surface in general; punctures of pygidium very shallow.

Length ♀ (apex of pronotum to apex of elytra) 2 mm.; width of elytra 1 mm.; depth 1 mm. Male about five-sixths as large.

Described from 1 ♀ type and 1 ♂ allotype collected by P. G. Russell, at Oaxaca, Oaxaca, Mexico, September 29, 1930, on the flowers of *Cosmos* sp.

The two genera here described belong in the subfamily Bruchinae, the largest complex within the family. Only a small number of genera in which they have differentiated are as yet distinguished. Their affinities are with American forms.

The form in these interesting species is with little doubt due to the shape of the achenes in which they pass their immature stages. The *Dahlia* achenes are flattened and elongate while those of *Cosmos* are nearly circular in cross section. I believe this principle governs the shape of many Bruchidae. Those species which are limited to hosts with flattened seeds tend to a flattened form while those which breed exclusively in seeds more nearly spherical assume a more compact form. Those not confined to seeds of the same form do not seem to be much affected by the shape of the host seed, but even here there is some reason to believe that some individuals are actually more depressed in form than others of the same species from pressure upon them during development.

A NEW LEAF MINING BUPRESTID FROM THE CANAL ZONE (COLEOPTERA).

By W. S. Fisher,
Bureau of Entomology, United States Department of Agriculture.

Pachyschelus psychotriae, new species.

Male.—Broadly ovate, slightly longer than wide, more strongly narrowed behind than in front, strongly shining, sparsely pubescent, the pubescence forming more or less distinct fasciae on the elytra; head and pronotum aureo-aeneous; scutellum piceous, with a feeble violaceous tinge in certain lights; elytra cyaneous, with a distinct violaceous tinge; beneath piceous, except the tarsal lamellae, which are brownish white.

Head strongly convex, with a distinct, narrow, longitudinal groove on the front; surface finely, densely granulose, with a few coarse, irregularly distributed punctures intermixed, and sparsely clothed on the occiput with short, inconspicuous hairs.

Pronotum slightly convex, four and one-half times as wide as long at middle, much narrower at apex than at base, and widest at base; sides feebly, arcuately rounded from base to anterior angles, which are rather acute; hind angles acute, projecting slightly beyond the humeral angles of the elytra and fitting closely to them; anterior margin deeply, arcuately emarginate; base transversely sinuate, and broadly, transversely truncate in front of scutellum; surface even, not depressed toward the sides, densely, finely granulose, sparsely, vaguely ocellate-punctate, and sparsely clothed with short, inconspicuous, semierect, cinereous hairs. Scutellum broadly triangular, twice as wide as long, and the surface nearly smooth.

Elytra as wide as pronotum at base, and widest at basal fourth; humeral angles broadly rounded; sides broadly rounded from base to near middle, then strongly, arcuately narrowed to the tips, which are conjointly broadly rounded, the lateral margins smooth, and when viewed from the side are nearly straight from base to apex, except for a broad, arcuate sinuation for the posterior legs; each elytron with a deep depression between the humerus and lateral margin, extending along the margin from humeral angle to middle, becoming deeper and broadly expanded behind the humerus, but without a distinct basal depression; surface coarsely, irregularly punctate, somewhat rugose, sparsely irregularly clothed with moderately long, recumbent, cinereous hairs, which form a more or less distinct, broad, transverse fascia at middle, a similar fascia covering the apical fourth, and with numerous, irregularly distributed, cinereous hairs on basal third.

Abdomen beneath feebly convex, finely, densely granulose, sparsely, coarsely, irregularly punctate, and very sparsely clothed with short, inconspicuous hairs; last segment acutely rounded at apex, the portion in front of marginal groove acutely rounded, with a rounded tubercle at apex. Metasternum very broadly emarginate in front. Prosternum feebly, broadly, arcuately emarginate in front; prosternal process very broad, the sides nearly parallel, and very broadly subtruncate at apex. Prothoracic epipleura broad and nearly flat. Antennal groove deep, wider internally, and parallel with the lateral margin.

Length, 2.6 mm.; width, 2 mm.

Type locality.—Barro Colorado Island, Canal Zone.

Type.—Cat. No. 43329, United States National Museum.

Described from a unique male cut from a larval mine in *Psychotria carthaginensis* Jacq., collected at the type locality, April 10, 1929, by S. W. Frost.

This species resembles *festivus* Fisher, but that species differs from *psychotriae* in being more slender, the pronotum more shining and not granulose, and *festivus* should be placed in the genus *Hylaeogena* Obenberger.

LIST OF MOSQUITOES COLLECTED IN NIGERIA, WEST AFRICA, INCIDENTAL TO RESEARCH ON YELLOW FEVER.[1]

By Cornelius B. Philip

Certain investigations in connection with the study of endemic yellow fever in West Africa necessitated the collection of various species of mosquitoes in the immature and adult stages. Adult insects were captured from a number of environments, during studies of local mosquito prevalence, usually by means of a "sucker" operated by sharp intake of the breath through a rubber tube connecting with a catching-chamber as described elsewhere (Phillip, 1931). This method facilitated capture and preservation of specimens for identification with a minimum of damage. Crab-holes, tree-holes, native and European quarters, undergrowth either near the compounds or bordering various aquatic environments, and the dense "bush" itself furnished the chief sources for adult mosquito collections.

Larvae and pupae were taken particularly for use in the attempted transmission of the virus of yellow fever in the laboratory. A summary of this work was recently published in Science (Philip, 1930). As a matter of interest, the species in the following table, which have been experimentally implicated in the transmission of yellow fever, have been printed in small capital type. Most of the collections of the immature stages were taken either from such natural sources as crab-holes, tree-holes, brackish water along the lagoons, various types of ponds and borrow-pits, and a few streams, or from several kinds of artificial "aquaria" such as domestic utensils, ceremonial pots, and canoes.

The exigencies of other laboratory investigations and routine precluded any more thorough investigation of the ecological phases of local mosquito prevalence than a qualitative sampling of conditions most likely to be of importance in connection with the major problem in hand. Considerable work has already been done in recording the Nigerian mosquito fauna (Graham, Dalziel, Connal and others), but a number of new records for that colony and even for West Africa, produced under other methods of sampling than were previously employed, as well as the large variety of species encountered during the writer's tour of a year and a half, appeared to indicate an advantage in recording the species taken.

A few species were taken only in the hinterland incidental to certain surveys by Drs. Kumm and Hayne of the West African Yellow Fever staff. The localities in which these were taken

[1]The studies and observations on which this paper is based were conducted in Lagos, Nigeria, with the support and under the auspices of the International Health Division of the Rockefeller Foundation.

have been marked with asterisks. All of the others were taken in and about Lagos or as far inland as Oshogbo and Shaki, by the writer. It should be added that quantitative notes in the list ("a" signifying abundant, "m," moderate, "s," scarce and "r," rare) refer only to the frequency with which the species came to the writer's attention and probably relate to the actual abundance only in a general way, i. e., *Taeniorhynchus uniformis* was seen by the writer only twice, and yet it is probably fairly prevalent, especially inland. Again, two species of *Banksinella*, of *Ingramia*, and *Uranotaenia philonuxia* are recorded as moderately abundant, but this would hold only under very localized conditions to which the writer paid special attention. However, this condition is true of most lists of mosquitoes in which the observer records relative abundance; insects considered by that author as common in one locality may be scarce under environmental conditions fifty feet away, while the reverse may be true of a different species which he has observed to be scarce. The crab-holes, for example, afford very restricted types of adult shelter, those in an exposed part of the same yard yielding considerably fewer mosquitoes than those in a shaded area nearby. More detailed observations of this type will be presented at another time.

Identifications were made in Lagos, supplemented, where the literature was inadequate, by shipment of specimens to London or Liverpool for study by Mr. F. W. Edwards or Miss A. M. Evans. Determinations by these workers have been listed after the appropriate species except in a few instances in which the writer's identification was confirmed. Thanks are also due Dr. S. L. M. S. Connal. The taxonomic arrangement is in accord with the latest tabulation of African species by Mr. Edwards as published by Schwetz (1927) with one exception: the genus *Mansonia* Blanch. has been substituted for *Taeniorhynchus* Arrh. The latter has been shown to be synonymous by tautonomy with *Aedes* and is accepted as such by being given subgeneric rank under *Aedes*, viz., *Aedes* (*Taeniorhynchus*) *taeniorhynchus* Wied. *Mansonia* therefore takes precedence for inclusion of the species of the subgenera *Coquilletidea* and *Mansonioides*.

The species in the following list were taken as adults unless indicated as "reared," in which case they were secured in the larval stage and the adults obtained later in the aboratory.

ANOPHELES.

Anopheles s. str.—1. *mauritianus*, Grp. (s), 2. *obscurus*, Grunb. (r).

Myzomyia—3. *pharoensis*, Theo. (m), 4. *squamosus*, Theo. (Afuga*), 5. *rufipes*, Gough (Kano*), 6. *theileri*, Edw. (Afuga*, s), 7. *gambiae*, Giles (=*costalis*, Lw.) (a), 8. *nili*, Theo. (s), 9. *funestus*, Giles (a), 10. *marshalli*, Theo. n. var. near *moucheti* [by Evans] (r).

MEGARHINUS.

1. *aeneus*, Evans (reared, s), 2. *vrevipalpis*, Theo. (reared, m).

URANOTAENIA.

Uranotaenia s. str.—1. *bilineata* var. *fraseri*, Edw. (r), 2. *coeruleocephala*, Theo. (m), 3. *balfouri*, Theo. (reared, s), 4. *philonuxia*, Philip, n. sp. (m), 5. *caliginosa*, Philip, n. sp. (m).

Pseudoficalbia—6. *annulata*, Theo. (a), 7. *mashonaenisis*, Theo. (m), 8. *ornata*, Theo. (m.)

HODGESIA.

1. *sanguinea*, Theo. (s), 2. *nigeriae*, Edw. n. sp. (r).

HARPAGOMYIA.

1. *taeniarostris*, Theo. (r).

ERETMOPODITES.

1. CHRYSOGASTER, Graham, (m), 2. *grahami*, Edw. [by Evans from larvae] (r).

MUCIDUS.

1. *mucidus*, Karsch, (reared, r).

AEDES.

Dunnius—1. *argenteoventralis*, var. *dunni* Evans, 2. *kummi*, Edw. n. sp. [both by Edw. from reared adults, m].

Stegomyia—3. AEGYPTI, Linn. (a), 4. SIMPSONI, Theo. (Ibadan, Oshogbo, Shaki, reared, m), 5. *metallicus*, Edw. (Kano*, reared, m), 6. *apicoargenteus*, Edw. (a), 7. *dendrophilus*, Edw. [by Edw.] (reared, m), 8. *unilineatus*, Theo. (Ibadan, reared, r), 9. AFRICANUS, Theo. (m), 10. LUTEOCEPHALUS, Newst. (m), 11. VITTATUS, Big. (=*sugens*, Theo.) (Abeokuta, Ibadan, Shaki, a).

Aedimorphus—12. *simulans*, N. and C. (s), 13. STOKESI, Evans (=*apicoannulatus*, in several publications on Nigerian mosquitoes as corrected by Evans) (a), 14. *domesticus*, Theo. (s), 15. *punctothoracis*, Theo. (s), 16. *furcifer*, Edw. (Kano*) [by Edw.], 17. *rhecter*, Dyar (Kano*, recorded by Schwetz as restricted to East Africa) [by Edw.], 16. *nigricephalus*, Theo. (a), 18. *irritans*, Theo. (a), 19. *hirsutus*, Theo. (Kano* reared, m) 20. *albocephalus*, Theo. [by Edw.] (reared, s).

Banksinella—21. *punctocostalis*, Theo. (m), 22. *lineatopensus*, Ludl. (r), 23, *palpalis*, newst. (m).

Finlaya—24. *longipalpis*, Grunb. (reared, a), 25. ingrami, Edw. (reared, s).

MANSONIA.

Coquillettidea—1. *metallicus*, Theo. (s), 2. *aurites*, Theo. (s), 3. *annetti*, Theo. (m).

Mansonioides—4, AFRICANUS, Theo. (a), 5. *uniformis*, Theo. (r).

AEDOMYIA.

1. *africana*, N. L. (Ibi*, 1).

MIMOMYIA.

1. *splendens*, Theo. (s), 2. *hispida*, Theo. (r), 3. *pallida*, Edw. [by Edw., reported by Schwetz as restricted to East Africa] (1 ♀), 4. *plumosa*, Theo. (s), 5. *mimomyiaformis*, Newst. (m).

THEOBALDIA.

1. *fraseri*, Edw. (by Edw.) (larvae, Ibadan*).

FICALBIA.

Etorleptiomyia—1. *mediolineata*, Theo. [by Edw.]
Ingramia—2. *malfeyti*, Newst. (m), 3. *nigra*, Theo. (a).

LUTZIA.

1. *tigripes* var. *fusca*, Grp. (a).

CULEX.

s. str.—1. *quasigelidus*, Theo. (m) 2. *annulioris* var. *consimilis*, Newst. (m), 3. *thalassius*, Theo. (larvae, m), 4. *duttoni*, Theo. (a), 5. *pruina*, Theo. (a), 6. *univittatus*, Theo. (s), 6a. *univittalus* var. *neavi* Theo. [by Edw.] (s), 7. *fatigaus*, Wied. (s), 8. *decens*, Theo. (a), 8a. *decens* var. *unvidiosus*, Theo. (a), 8b. *decens*, n. var. [by Edw.] (r), 9. *grahami*, Theo. (s), 10. *perfidiosus*, Edw. [by Edw.] (s), 11. *perfuscous*, Edw. [by Edw.] (s), 12. *guiarti*, Blanch. [by Edw.] (s), 13. *tritaeniorhynchus*, Giles [by Edw.] (s), 14. *laurenti*, Newst. (s), 15. *philipi*, Edw. n sp. (s).
Neoculex—16. *rima*, Theo. (=*insignis*, Carter) (a), 17. *andreanus*, Edw. [by Edw.] (a).
Protomelanoconion—18. *horridus*, Edw. (=fusca, Theo.) (m).
Mochthogenes—19. *inconspicuosus*, Theo. (s).
Eumelanomyia—20. *albiventris*, Edw. (=*inconspicuosa*, Theo.) (m).
Culiciomyia—21. *nebulosus*, Theo. (a), 22. *cinerellus*, Edw. (m), 23. *cinereus*, Theo. [by Edw.] (s).

Citations.

Philip, C. B. 1930. The experimental transmission of yellow fever by mosquitoes. Science, **71**: 614–615.

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Schwetz, J. 1927. Synopsis des moustiques connus du Congo Belge. Revue Zoologique Africaine, **15**: 271—fascicule no. 3.

MINUTES OF THE 425TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 425th regular meeting of the Entomological Society of Washington was held at 8 p. m., Thursday, January 8, in Room 43 of the new building of the National Museum. Dr. A. C. Baker, President, presided. There were present 44 members and 32 visitors. The minutes of the 424th meeting were read, corrected, and approved. There were no reports of committees or other preliminary business.

The first communication on the regular program was given by H. S. Peters and was entitled, "Collecting Insects Affecting Man and Animals in the West Indies." He accompanied Dr. Paul Bartsch of the National Museum on a four-months trip to the West Indies this past summer. He was sent by the Bureau of Entomology to investigate and collect insects affecting man and animals. They left Miami, Florida, on June 10, in a chartered boat, visiting the smaller islands in the southern Bahamas, then to Cuba and islands lying off the south coast. The route included the islands of the Cay Sal bank, Ragged Islands, Crooked Islands, Plana Cays, Mariguana, Caicos Islands, Turks Islands, Inagua, the south coast of Cuba from Guantanamo to Isle of Pines and islands adjacent and the Cayman Islands. They returned to Key West, Florida, on September 30 after making large collections of mosquitoes, sandflies and examining 1096 birds for ectoparasites. (Author's abstract.) A number of maps were shown and the itinerary indicated. This paper was discussed by Hyslop, Howard, Bishopp, Greene and Ewing.

The second paper on the program was presented by J. A. Hyslop, entitled "Report on the Entomological Sections of the meetings of the American Association for the Advancement of Science Held in Cleveland, Ohio, Dec. 29, 1930, to Jan. 2, 1931." The entomological meetings were held in the engineering building of the Case School of Applied Science and were extremely well attended, both the American Association of Economic Entomologists and the Entomological Society of America giving their programs before large audiences. The entomological banquet was held on the campus and was attended by approximately 300 entomologists. Dr. W. E. Britton of Connecticut was toastmaster of the evening and the guest of honor was Dr. W. J. Holland of the Carnegie Museum, Pittsburgh. Dr. Holland told of his early life and entomological experiences, and particularly stressed the importance of the place of the taxonomist in our entomological structure. The programs of the two societies were heavily crowded, totaling 114 papers, of which 72 were presented before the Economic Association. This does not include 14 papers that were presented at an evening session of the Extension Section of the American Association of Economic Entomologists, and which included a symposium on the effect of the drought of 1930 on insect populations. The attendance of American entomologists at the International Congress to be held in Paris in 1932 was stressed at the meeting and a committee on transportation and accommodations in Paris was appointed. The extreme dissatisfaction with the crowded program and the lack of opportunity for adequate discussion led to the appointment of a committee with power to prepare a modified program for the next meeting, which is to be held in New Orleans, La., during the Christmas Season of 1931. (Author's abstract.) This communication was discussed by Morrison, Howard and Rohwer.

Remarks were made on invitation of Mr. Ernesto Sanchez Estiada, of Havana, in charge of the plant quarantine work of Cuba, who expressed pleasure in being with us but referred apologetically to his poor speaking due to inadequate knowledge of the English language. He briefly discussed the communication by Mr. Peters, and also took occasion to express his thanks to various individuals for courtesies extended to him during his visit to Washington. Dr. P. N. Annand, a visitor of the U. S. Entomological Laboratory, Twin Falls, Idaho, on invitation also greeted the society. Dr. R. R. Parker, U. S. Public Health Service, Hamilton, Mont., a visitor, also on invitation discussed briefly recent work with ticks in Montana, particularly in the Bitter Root Valley and with special reference to localities in which parasites had been liberated. These remarks were commented on by Dr. Howard. Dr. T. S. Palmer, of the U. S. Biological Survey, another visitor, also on invitation made a brief address in which he referred humorously to the comparative ages of entomologists and ornithologists. His remarks were discussed by Dr. Howard.

The chair announced the recent death of Dr. J. S. Hine, of Ohio State University, Columbus, Ohio.

The meeting adjourned at 10 P. M.

J. S. WADE, *Recording Secretary.*

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THE PHOTOPERIODISM OF THE FIREFLY PHOTINUS PYRALIS LINN.; ITS RELATION TO THE EVENING TWILIGHT AND OTHER CONDITIONS.

By H. A. Allard, *U. S. Department of Agriculture, Washington, D. C.*

The light emitting specializations evolved by the fireflies have not failed to excite keen attention on the part of many biologists in the past. It is indeed a most striking endowment of the living mechanism to generate light whatever the subsequent utility of the function has become. There has been a weird trend of spontaneity in it all that baffles explanation, for there is no evidence at hand to lead one to believe that the individual or even the race was ever consciously, intentionally concerned with the evolution of photogenic accomplishments. In the fireflies' light we have, so far as known, an extremely high radiant efficiency, for there is little attendant heat produced, in contrast with our own wasteful efforts expended in light production.

Aside from the properties of this organic light, there is a variable behavior shown in its production and periodism that, with some fireflies at least, is so consistently related to certain phases of their evening activities throughout the season, as to merit some consideration.

I have long been interested in the behavior of fireflies, and several years[1] ago published a note on some peculiarities of their flight movements and flashing. The present paper is a further consideration of the same interesting behavior.

During the summer of 1930, a renewed interest led me to investigate the behavior of the common firefly, *Photinus pyralis* Linn.) rather critically, more especially to determine its relation to light intensity, temperature, and other conditions. Each day, with few exceptions, observations of the first evening appearance of the fireflies were made from June 13 to August 7, when they no longer appeared. To gain some idea of the weather conditions during this period, a standard U. S. Weather Bureau sling psychrometer was used, giving dry bulb or air

[1]"The Flight of Fireflies and the Flashing Impulse." Science, N. S., December 3, 1920.

temperature readings, and wet bulb readings for determination of relative humidities. The wet bulb readings were obtained by fastening a piece of muslin to the thermometer bulb, connecting it with a wick and wetting it with distilled water. The psychrometer was placed on a level with the grass about one-half foot from the ground. Without whirling, readings were made at the time the first fireflies appeared. A small portable Tycos Biram's Anemometer (sold by the Taylor Instrument Company of Rochester, N. Y.), was borrowed to determine wind velocity readings. This, however, was found unnecessary, since with few exceptions there was too little air movement at dusk in the protected situation where observations were made, to record. During the period of these observations wind velocity appeared to be such a negligible factor that the use of the instrument was soon abandoned.

Air temperatures and relative humidities alone were determined at the grass level, in the open, as soon as the first fireflies appeared here.

Observations were made at Lyon Park, Virginia. An area of open, exposed, unused roadway covered with a dense growth of grass, weeds and other herbage was selected, which lay just southward of an area heavily shaded by trees. A dense hedge of climbing roses bounded the area on the west.

The first appearance of the firefly is marked by a flash almost as soon as it takes wing from the herbage. The initial flight of the evening is very distinctive, being a slow, weak, uncertain drift or hovering close to the herbage from which the insect has arisen. From time to time, the insect settles downward in its seemingly aimless aerial drifting as if it were too weak to sustain its initial flight, and were going to alight. Just at this critical point when it seems that it must touch the herbage there is a lively flash, sometimes more or less prolonged, and coincident with this, a sudden sharp upward propulsion of the insect from a few inches to as much as 18 inches or more, takes place. The insect does not long remain at this higher level attained, however, but again begins the same uncertain drifting, usually losing the altitude previously gained, until the stratum of herbage is once more almost reached in its descent. There is once more a flash and the insect rises precipitately again. This is the usual behavior of these marvellous light emitting insects over all the area when the first evening flight movements have begun. As the dusk of evening deepens, there is a gradual increase in the average elevation attained above the herbage, and a noticeable tendency to depart from the slowly drifting, aimless hovering flight to a straight-forward, active flight in the direction of the higher shrubbery and trees, which is the characteristic flight-behavior of the night time. The flash, likewise, becomes more sharp, incisive, regular and frequent. During cool evenings, with the temperature above the grass around 60° to 65° F., the insects, being cold blooded, and forced to have their own bodies take on the prevailing air temperatures, become sluggish in their movements. At such times they arise more slowly and with more difficulty, and their upward propulsion with each incident, somewhat lingering flash, is of much less magnitude. When high temperatures around 72° to 75° or higher obtain, their movements are more vigorous and swift, the upward propulsion at every flash attaining its greatest magnitude, amounting even to 18 inches or more at times. The conditions of air temperature in the early evenings are markedly reflected in the general behavior of the insects whose aerial movements pass from slow drifting here and there, to flight that is rapid, direct and apparently nicely controlled.

Since this peculiar early evening behavior is only temporary and is consistently abandoned later when the dusk has intensified, it must be looked upon as a transitional behavior arising in response to some special condition of the environment. As a matter of fact, the fireflies arise earlier in shade than in the open, and appear earlier on very cloudy evenings than on clear evenings. These accidental displacements merely advance or delay this transitional period. It has seemed to me, too, that there is less of the slow, dilatory rising and falling behavior when the fireflies arise in the deep shadows of trees. In other words, they arise here more directly, sustain their flight with more mechanized assurance, and develop the direct horizontal component more quickly.

Regardless of markedly varying temperatures and humidities at the time the beetles appear, the same distinctive behavior obtains until near the beginning of civil twilight, about half hour after sunset. As a matter of fact it begins at a higher level of temperature, as a rule, than obtained when rapid direct horizontal flight has finally become established 20 to 30 minutes later, so that it can not be looked upon as a sluggishness due to low temperatures.

There is good circumstantial evidence leading one to believe that this preliminary weak hovering flight is a response to light intensities too high to sustain normal flight activities. As the insects arise from the deeper shadows of the ground and low herbage, and a flash is followed by the sharp upward propulsion, they are likely to be exposed to a higher and more direct intensity of light from the western skies. It would appear that this condition of brightness unfavorable to active flight is followed by a gradual fall in the altitude gained until a reaction to the deeper ground shadows or other conditions causes them to emit another flash accompanied by a vertical ascension.

Preliminary tests made with a powerful 3-cell battery, spot, flash light capable of throwing a concentrated beam near 500 feet, have given some results of interest. In a number of tests, carefully directing the beam vertically down upon the hovering firefly, caused it to cease its upward propulsions and actually to descend and finally alight upon the grass. At other times the hovering insect made very weak efforts to flash and propel itself upward, and if it succeeded, it seemed to do so in response to a very weak impulse. When the beam of light was directed against the sluggish insect vertically from below, the reaction was usually sharp and sudden, the insect being oftentimes driven precipitately high into the air and away in an oblique trend as the beam struck it more or less from an angle. Oftentimes when the insect had assumed the sluggishly hovering position and the beam struck full upon it from the side, the reaction was as sharp as if the insect were in a state of fright, and it might fly away precipitately as if to escape. In a few instances the beam of light has caused the insect to fly toward its source, but this has occurred only when the flash light was held very close to the insect, apparently causing it to appear as a localized point of light.

There are some features of this distinctive early twilight behavior of the fireflies that are rather puzzling. Following a flash with its incident upward propulsion, the insect in its subsequent hovering and downward drift, somehow appears keenly aware of a near approach to herbage or leafage, to a highly sensitive degree. Normally it rarely alights, but at the critical instant, just prior to contact, emits a flash and makes a sudden sharp trajectory flight upward. Again and again, this behavior is repeated until the dusk has deepened.

I have made several tests centering around this behavior, which, although more or less preliminary, indicate a proximity sense of some sort. In one test I cut a long slender green branch from a tree, and very carefully brought it beneath the descending insect. The creature, as before, checked its descent when almost in contact with the green leafage and shot upward on its flash. Before it could descend to its former level I very carefully raised the branch above this level so that the descent of the insect would be blocked at a higher point. The flash and upward propulsion occurred as before, bringing the insect ever higher until it had mounted far beyond my reach. These tests indicated that little could be definitely learned by using a green branch. I now obtained a good-sized piece of fine chicken wire with a two-inch mesh and folded it once to decrease the size of the interspaces. A piece of this, about two feet square, was fastened horizontally to the end of a long, slender handle. It is evident that this equipment would more nearly assume the true air temperature than cool, transpiring green leafage. On the whole, the insects reacted differently to this wire when placed beneath them, for sometimes they came in contact with it in their descents, or even passed through its mesh spaces as if quite unaware of its presence. Strangely enough when held above the insect, its upward propulsion often caused it to bump into the wire, a behavior which was also shown when the green branch was held above it. This would indicate that the insects are more positively sensitive to objects below them than to objects above them.

In other tests a piece of two-inch mesh chicken-wire about four feet wide and ten feet long was fastened in a horizontal position about a foot above the herbage, in an open area frequented by them each evening. As the insects arose following sunset, their sallies of ascent and descent were noted within the area embraced by the wire. This test indicated that their reactions to the thin strands of wire were not as positive as their reactions to green herbage. While it would seem that a temperature factor is involved here, the matter can not be considered definitely settled without further intensive study. As the problem at present stands, my own observations would indicate that the distinctive, seemingly aimless hovering flight of the fireflies with alternations of upward propulsion and slow downward driftings, as they first arise from the herbage, is a response to decreasing light intensities to which they are slowly adjusting themselves until the critical levels have been passed, and their true night has begun. During this period of adjustment it would appear that the checking of the descent, with a flash and sudden upward propulsion just as the herbage is nearly reached, is dependent upon some nicety of sense perception which may prove to be a matter of fine temperature discrimination. To say the least the behaviors probably fall into some definite reaction-category, quite independent of any specific psychic manifestations on the part of the insect.

One point here is still not clear to my mind, viz: What is the reason for the upward propulsion following the flash, which is abandoned for direct horizontal flight later in the evening? Why at this transition period are the wing movements of such an order that the vertical component alone is favored? Is it due to an excessive, unbalanced expenditure of energy thrown into the wing-strokes? There is something weirdly mechanical in it all, simulating the longer, more sustained vertical drive stimulated by a flash-light beam directed upward upon the insect from below. It would almost appear that the insect is driven upward by its own light, and I am inclined to believe that if its own light were not momentary, this upward propulsion would be more sustained. In other words the momentary flash affords an efficient stimulus to a momentary expenditure of violent energy, which is of assistance in enabling the insects to gain altitude for subsequent continuous flight when the evening twilight has fallen to certain favorable levels.

In addition to these peculiarities of photoperiodism in the behavior of the fireflies, a study was at the same time made of those conditions responsible for the first appearance of the insects each day. These observations are presented in table I together with other data bearing on conditions at the time. In figure 1, graphs have been constructed showing the relation of the time of first appearance at sunset, to temperature, relative humidity and the time of sunset.

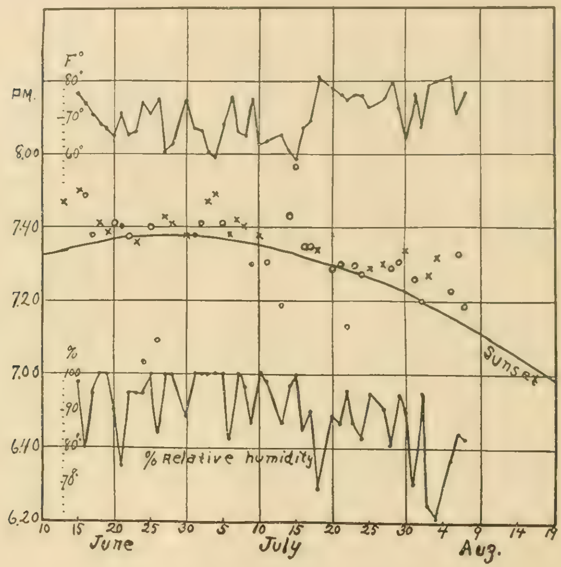


Fig. 1. Time of arising of fireflies from the grass in the open at Lyon Park, Va., 1930, in relation to temperature and relative humidity at the time. Crosses represent clear skies; circles represent hazy or partly cloudy skies; dots represent very cloudy or stormy skies.

On the whole, mean changes in the time of sunset have been rather closely followed both by the fireflies arising in the open, and by those arising earlier in heavily shaded situations. It would appear that the fireflies are quite sensitive in their perceptions of the changes of light intensity taking place as the sunset becomes progressively earlier each day after June.

TABLE I.

Time of appearance of the first fireflies in the evening from an open grass and weed plot at Lyon Park, Virginia, and from the heavy shade of a hedge and trees nearby.

Date	Skies	First fireflies arise in open	First fireflies arise in shade	Wind velocity per minute	Ground conditions	Sunset E. S. T.	Air temperature at grass level. F.°	Wet bulb at grass level	Relative humidity	Appearance before or after sunset in open
June 13	clear	7.45 P. M.	....	none	very dry	7.34	....	....	....	13 minutes after
15	clear	7.50 P. M.	....	none	very dry	7.35	77°	76.5°	98%	15 minutes after
16	partly cloudy	7.49 P. M.	....	2–3 ft.	very dry	7.35	74°	69.5°	80%	14 minutes after
17	very cloudy, rain	7.38 P. M.	....	none	rain soaked; raining	7.36	71°	70°	95%	2 minutes after
18	clear	7.41 P. M.	....	none	heavy dew	7.36	68°	68°	100%	5 minutes after
19	clear; black clouds, west	7.39 P. M.	7.35	none	heavy dew grass wet at 7.30	7.37	67°	67°	100%	2 minutes after
20	slight haze	7.41 P. M.	7.38	none	....	7.37	65°	63°	90%	4 minutes after
21	very hazy and clouds Southwest and North	7.40 P. M.	7.36	slight air drift only	....	7.37	71°	65.5°	75%	3 minutes after
22	slight haze	7.38 P. M.	7.36	slight air drift only	....	7.37	65°	64°	95%	1 minute after
23	clear	7.46 P. M.	....	slight air drift only	....	7.37	66°	65°	95%	9 minutes after
24	very cloudy	7.03 P. M.	....	slight air drift only	sudden thunder-storm, very dark at 7.00	7.37	74°	73°	95%	34 minutes before
25	slight haze	7.40 P. M.	7.32	slight air drift only	....	7.38	71.5°	71.5°	100%	2 minutes after
26	very cloudy, thunder-storms in S. W. and N.	7.09 P. M.	6.45	slight air drift only	very dark with heavy clouds	7.38	71.5°	71.5°	84%	29 minutes before
27	clear, some brilliant reflecting clouds, west	7.43 P. M.	7.35	slight air drift only	....	7.38	60°	60°	100%	5 minutes after
28	clear, some brilliant reflecting clouds west	7.41 P. M.	....	slight air drift	....	7.38	62.5°	62.5°	100%	3 minutes after
30	clear, bright crescent moon	7.38 P. M.	....	slight air drift	....	7.38	72.5°	72.5°	89%	at sunset
July 1	very cloudy, clear areas west	7.38 P. M.	7.35	none	rain soaked, heavy dew	7.38	66.75°	66.75°	100%	at sunset
2	heavy detached clouds	7.41 P. M.	7.32	none	rain soaked, heavy dew	7.38	66°	66°	100%	3 minutes after
3	clear, half moon	7.47 P. M.	7.35	none	rainsoaked, heavy dew	7.37	60°	60°	100%	10 minutes after

Date	Skies	First fireflies arise in open	First fireflies arise in shade	Wind velocity per minute	Ground conditions	Sunset E. S. T.	Air temperature at grass level F.°	Wet bulb at grass level	Relative humidity	Appearance before or after sunset in open
July 4	clear, half moon..	7.49 P. M.	7.42	none	rain soaked, heavy dew	7.37	59.25°	59.25°	100%	12 minutes after
5	hazy, bright moon..........	7.41 P. M.	7.37	none	rain soaked, heavy dew	7.37	68°	68°	100%	4 minutes after
6	detached clouds..............	7.38 P. M.	7.23; again 7.34	none	....	7.37	75.5°	71.5°	82%	1 minute after
7	clear, brilliant moon......	7.42 P. M.	7.32	none	heavy dew	7.37	66	66°	100%	5 minutes after
8	slight haze; brilliant moon	7.40 P. M.	7.34	none	....	7.36	65°	64.5°	97%	4 minutes after
9	very cloudy to zenith....	7.30 P. M.	7.30	none	no dew	7.36	75.5°	72.5°	86.5%	6 minutes before
10	slight haze.....................	7.38 P. M.	7.19	none	heavy dew	7.36	62.5°	62.5°	100%	2 minutes after
11	very hazy; dusk early....	7.31 P. M.	7.28	none	no dew	7.35	73.5°	71°	88.5%	4 minutes before
13	very dark, cloudy..........	7.19 P. M.	....	none	no dew	7.35	75.5°	72.5°	86.5%	15 minutes before
14	detached clouds..............	7.43 P. M.	7.34	none	heavy dew	7.34	61°	60.5°	97%	9 minutes after
15	very hazy.........................	7.57 P. M.	....	none	no dew	7.33	58	58	100%	27 minutes after
16	very hazy.........................	7.35 P. M.	7.34	none	no dew	7.33	67°	64	85%	2 minutes after
17	very hazy.........................	7.35 P. M.	7.26	none	no dew	7.32	69°	67	90%	3 minutes after
18	clear..................................	7.34 P. M.	....	7–8 ft.	no dew	7.31	81°	73°	68.5%	3 minutes after
20	very hazy.........................	7.29 P. M.	7.20	none	no dew	7.31	78	75.5°	89%	2 minutes before
21	very hazy with detached clouds	7.30 P. M.	7.13	none	no dew	7.29	76.5°	73.5°	87%	1 minute after
22	very dark, cloudy..........	7.13 P. M.	6.51	slight	rain soaked	7.29	75°	74°	96%	16 minutes before
23	detached clouds	7.30 P. M.	7.25	none	no dew	7.28	76.5°	73.5°	87%	2 minutes after
24	some detached clouds....	7.27 P. M.	7.16	none	no dew	7.28	76.5°	72.5	82.5%	1 minute before
25	very slight haze..............	7.29 P. M.	7.29	none	no dew	7.27	73°	72°	95%	2 minutes after
27	very slight haze	7.30 P. M.	7.29	slight	no dew	7.25	75°	73°	91%	5 minutes after
28	slight haze	7.29 P. M.	7.15	slight	no dew	7.24	79.5°	75°	81%	5 minutes after
29	slight haze......................	7.31 P. M.	7.23	none	rain wet	7.24	72.5°	71.5°	95%	6 minutes after
30	clear, bright moon	7.34 P. M.	7.26	none	no dew	7.23	64.5	62.5°	90%	11 minutes after
31	hazy; detached clouds ..	7.26 P. M.	....	slight	no dew	7.22	76	69°	70%	4 minutes after
Aug. 1	very hazy.........................	7.20 P. M.	7.18	none	no dew	7.20	67.5°	66.5°	95%	at sunset
2	clear, bright moon..........	7.27 P. M.	7.23	slight	no dew	7.19	79°	70°	64%	8 minutes after
3	clear, bright moon..........	7.32 P. M.	7.30	slight	no dew	7.18	80°	70°	61%	14 minutes after
5	hazy..................................	7.23 P. M.	7.22	none	no dew	7.17	81°	75	77.5%	6 minutes after
6	hazy detached clouds....	7.33 P. M.	....	none	no dew	7.16	71.5°	68°	84%	17 minutes after
7	very hazy and cloudy....	7.19 P. M.	....	none	no dew	7.15	77°	73°	83%	4 minutes after

TABLE II

The following relations together with changes in the time of sunset have been determined from the data in table I.

For fireflies arising in the open, unshaded area.

Mean time of sunset June 13 to June 30, inclusive = 7.36;	Mean time of first appearance in same period = 7.37
Mean time of sunset July 1 to July 10, inclusive = 7.36;	Mean time of first appearance in same period = 7.40
Difference = 0;	Difference = 3 minutes
*Divide by 19 days giving mean change per day = 0;	Divide by 19 days giving mean change per day = .157 minutes
Mean time of sunset July 11 to July 20, inclusive = 7.33;	Mean time of first appearance in same period = 7.35
Mean time of sunset July 21 to Aug. 7, inclusive = 7.22;	Mean time of first appearance in same period = 7.27
Difference = 11 minutes;	Difference = 8 minutes
*Divide by 16 days giving mean change per day = .7;	Divide by 16 days giving mean change per day = .5 minutes

For fireflies arising in the shade of a rose hedge and beneath the heavy shade of trees.

Mean time of sunset June 13 to June 30, inclusive = 7.37;	Mean time of first appearance in same period = 7.36
Mean time of sunset July 1 to July 10, inclusive = 7.37;	Mean time of first appearance in same period = 7.32
Difference = 0;	Difference = 4 minutes
*Divide by 14 days giving mean change per day = 0;	Divide by 14 days giving mean change per day = .285 minutes
Mean time of sunset July 11 to July 20, inclusive = 7.31;	Mean time of first appearance in same period = 7.28
Mean time of sunset July 21 to Aug. 7, inclusive = 7.22;	Mean time of first appearance in same period = 7.20
Difference = 8 minutes;	Difference = 8 minutes
*Divide by 11 days giving mean change per day = .7;	Divide by 11 days giving mean change per day = .7 minutes

*The mean change per day has been found by dividing the entire mean change in sunrise taking place between the first and second periods of time by the number of days elapsing to produce these mean changes.

Mean time before or after sunset when the fireflies appeared from the grass and herbage, both in the open and in shaded situations.

June 13 to June 30, inclusive, in open	= .937	minutes after sunset
June 13 to June 30, inclusive, in shade	=9.2	minutes before sunset
July 1 to July 10, inclusive, in open	=3.5	minutes after sunset
July 1 to July 10, inclusive, in shade	=5.0	minutes before sunset
July 11 to July 20, inclusive, in open	=6.6	minutes after sunset
July 11 to July 20, inclusive, in shade	=4.6	minutes before sunset
July 21 to Aug. 7, inclusive, in open	=4.2	minutes after sunset
July 21 to Aug 7, inclusive, in shade	=3.9	minutes before sunset

Mean time, before or after sunset of first appearance of fireflies in open and in shaded situation, for clear, cloudless, hazy or partly cloudy, and cloudy or stormy evenings.

Time of arising in open.

Clear, cloudless evenings, June 13 to Aug. 7, inclusive = 8.7 minutes after sunset.

Hazy or partly cloudy (detached clouds) June 13 to Aug. 7, inclusive = 3.6 minutes after sunset.

Very cloudy, dark evenings or rainy, June 13 to Aug. 7, inclusive = 11.2 minutes before sunset.

Time of arising in shaded situations.

Clear, cloudless evenings June 13 to Aug. 7, inclusive = 2.8 minutes before sunset.

Hazy or partly cloudy (detached clouds) June 13 to Aug. 7, inclusive = 7.0 minutes before sunset.

Very cloudy, or rainy evenings June 13 to Aug. 7, inclusive = 32.3 minutes before sunset.

The time of appearance on clear, hazy and partly cloudy, and dark cloudy evenings is additional confirmation that the fireflies appreciate rather nice gradations in light intensity more or less comparable to the visual discriminations of birds and humans.

As indicated in the graphs of figure 1, there is some evidence of a seeming positive correlation with conditions of humidity as well as with sunset. However, the relations of the first evening appearance of the fireflies to shade and to differences in the clearness of the skies, and the fact that some of the earliest appearances have occurred when the relative humidities have been very high, would indicate that the general trend of the curve of the relative humidity has been only accidentally associated with that of the sunset curve. In other words the curve of humidity is a result of an abnormally hot and dry season which prevailed in July as the evening temperatures steadily mounted until late in the month.

The more direct relation of the fireflies' first evening appearance appears to be with the time of sunset, the time of appearance on clear cloudless evenings following soon after the setting of the sun. It would appear that their movements in the field are activated by a more or less specific level of light intensity operating through the visual sense, comparable to the birds that are stimulated to sing their dawn and twilight songs at certain specific levels.

TWO NEW PERUVIAN MICROLEPIDOPTERA OF ECONOMIC IMPORTANCE (GELECHIIDAE AND OECOPHORIDAE).

By August Busck, *U. S. Bureau of Entomology.*

Gnorimoschema tuberosella, new species. (Pl. 1, Figs. 3, 5.)

Second joint of labial palpi whitish ochreous, sprinkled with fuscous; terminal joint ochreous with a broad incomplete black annulation at base and an even broader, likewise incomplete, black annulation just before the tip; extreme apex yellow. Maxillary palpi short but plainly discernible, appressed to base of the spiraled tongue. Antennae ochreous, with narrow black annulation, basal joint long, shaded with dark fuscous. Face iridescent, ochreous white; head and thorax light ochreous, sprinkled with dark fuscous. Fore wing whitish ochreous overlaid with darker ochreous and fuscous scales, especially on dorsal half; a broad, dark brownish-black, oblique streak from basal fourth of costa reaches beyond the cell; it is more strongly emphasized on the cell in an elongate ovate spot of deeper black and fades gradually out in the fuscous scaling on upper half of the wing to apical fourth; at apical fourth is an ill-defined, unmottled costal spot of the ground color; a similar dorsal spot somewhat nearer apex; at the end of the cell a short black streak; a similar black streak before apex is preceded and surrounded by brown scales; cilia light ochreous, dotted with dark fuscous scales. Hind wings broader than fore wings, dark fuscous with ochreous fuscous cilia. Venation typical; fore wing with 12 veins; 1 *b* furcate at base, 1 *c* present on basal half, fading out toward the edge; 2, 3, and 4 equidistant; 5 slightly approximate to 4; 6 free; 7 and 8 stalked to costa; 9 free; 11 from before the middle of cell. Hind wing with 8 veins; 3 and 4 connate; 5 distant but bent toward 4 at base; 6 and 7 parallel; no costal tuft in either sex. Abdomen light ochreous sparsely sprinkled with fuscous; dorsum of first, second, and third joints with the usual velvety, short, yellow scaling common in the genus; first joint sprinkled with black scales. Legs silvery ochreous; tibiae strongly mottled with black exteriorly; front and middle tarsi with black annulations; posterior tibia with long hairs on upper side.

Male genitalia (Pl. 1, Fig. 5) typical of genus; tegumen elongate, with two short, strongly chitinized lateral processes; vinculum, with long, slender anterior process, is fused with the anellus, which is very large and broad and terminates in three processes, a central, very long, strongly chitinized, spike and two lateral shorter, less chitinized, pointed lobes; the aedoeagus is very long, slightly bulbous at base, deeply cleft at apex into two nearly equal forks with the penis opening laterally on the larger fork. Eighth segment strongly developed into a dorsal and a ventral cover for the genitalia when at rest.

Female genitalia (Pl. 1, Fig. 3) with genital plate large and fused with the penultimate joint and its supporting internal rods; ductus bursa a strongly chitinized tube from ostium to the end of the rods, there broadening out into a small, soft, heart-shaped bulb, with a short chitinized center and continued unchitinized to the bursa, which contains a short, stout, spinelike signum.

Alar expanse 15–17 mm.

Type.—U. S. National Museum No. 43309.
Type locality.—Lima, Peru.
Foodplant.—*Solanum tuberosum.*

Received from Dr. Johannes Wille, who reports that the larvae feed not only in the tubers but also in the stalks of cultivated potatoes. The species was previously received from Dr. C. H. T. Townsend, who reported it injurious to potato at Callao, Peru, in 1927.

The species is close to *Gnorimoschema* (*Phthorimaea*) *aquilina* Meyrick, also described from Peru, but is smaller and differs in details of ornamentation as well as in genitalia. This species was described under the generic name *Phthorimaea* Meyrick, but was subsequently placed in *Gnorimoschema* by him in the text of his Revision of the *Gelechiidae,* though his colored figure is named *Phthorimaea. Phthorimaea* was originally established on the costal hairtuft in the hind wings of the male of the genotype *P. operculella,* but this character is not found in most of the species now included in the genus, and Meyrick has attempted to differentiate between this genus and *Gnorimoschema* Busck on slight differences in the length and scaling of the terminal joint of the labial palpi, differences, however, which do not hold, but appear in gradual modification in all the species included in both genera. In all important characters of the oral parts, the venation, and the genitalia, *opercullela* and most of the species placed with it conform with *Gnorimoschema,* and the writer, therefore, reluctantly abandons the well-known name *Phthorimaea* for the other "well-known form" *Gnorimoschema* Busck, which has two years' priority. A few of the species placed in *Phthorimaea,* like *glochinella* Zeller and *lycopersicella* Busck, differ from the types and the bulk of the species in possessing a strong hook-like uncus, instead of the normal hoodlike uncus characteristic of the genus, and these may eventually require a new generic name. (See Busck, Proc. Haw. Ent. Soc., vol. 7, p. 173, 1928.)

Eucleodora cocae, new species. (Pl. 1, Figs. 1, 2, 4, and 6.)

Labial palpi long, recurved; second joint thickened, with smoothly appressed scales, slightly serrated below and at apex; light ochreous brown on inner side, darker brown exteriorly, with the scales white tipped, so as to form an ill-defined transverse striation; terminal joint as long as second, thickened, with long loose scales on posterior edge, smooth anteriorly (Pl. 1, Fig. 2), reddish brown with posterior tuft dark fuscous, extreme apex acute, light whitish ochreous. Antennae slightly longer than fore wing, serrate, especially toward the tip, brown with light ochreous underside; no pecten on basal joint. Face smooth, light ochreous; head brown with spreading side tufts extending over the basal joint of the antennae. Thorax light brown, smooth. Fore wing elongate, costa slightly arched; apex falcate, termen deeply and abruptly excavated below apex, thence broadly rounded at tornus; dorsum straight; on costal base a light ochreous patch extended in an oblique streak to middle of dorsum; dorsal base dark brown; at costal third a broad, trapezoidal, bluish patch terminated on the middle of costa by two outwardly oblique, light yellow streaks; these reach nearly to the end of the cell and are separated by a narrow bluish metallic streak and edged exteriorly with white scales on the costa; beyond these streaks the wing is rich brown with a blackish brown, longitudinal, central line before apex and mottled with light ochreous; below the trapezoidal costal patch is an elongate, oval, deep brown spot; cilia brown, with a yellow tuft below the falcate apex, and with base yellow edged by a perpendicular black line. Hind wing with costa and dorsum nearly straight, termen obliquely rounded, apex blunt; dark lead-colored; cilia dark fuscous, light ochreous at the tip of the wing; in male with a strong expansible, light ochreous hair-pencil from base of costa, reaching beyond the middle of costa.

Venation typical (Pl. 1, Fig. 4); fore wing with 12 veins, 1 *b* single at base, the upper fork being obsolete; 1 *c* present at outer half to edge of wing; 2 from just before the end of the cell; 3 and 4 closely approximate from the end of the cell; 5 and 6 parallel, widely separated; 7 and 8 stalked to costa; 11 from middle of cell.

Hind wing with 8 veins; 3 and 4 shortstalked; 5, 6, and 7 parallel; 5 nearer to 6 than to 4 and 6 nearer to 5 than to 7.

Abdomen dark fuscous above, with light ochreous underside. Legs whitish ochreous on their inner sides; anterior tarsi thickened exteriorly, with light brown scales; middle and hind tarsi dark fuscous exteriorly with narrow bars of white; tarsi dark fuscous, whitish ochreous annulations.

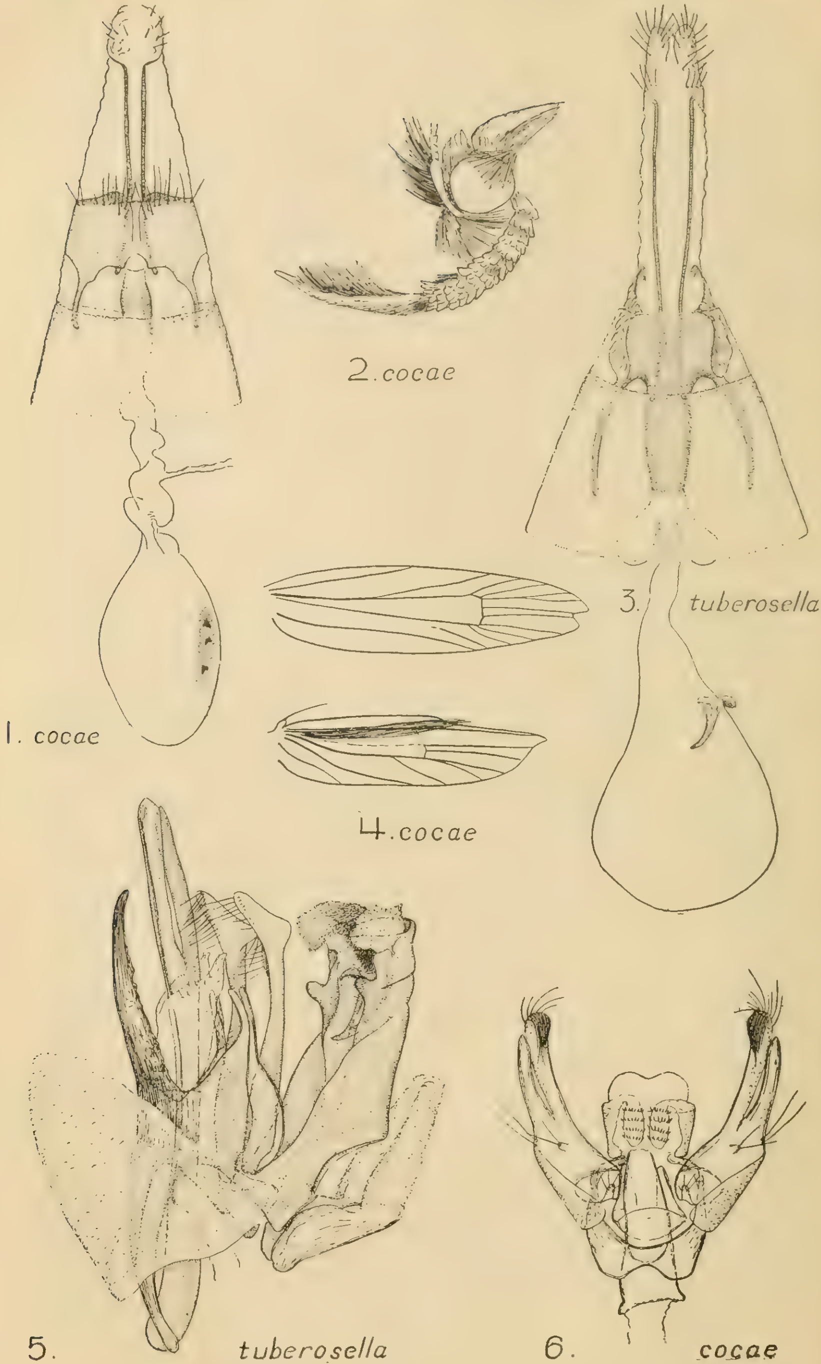
Male genitalia (Pl. 1, Fig. 6) with tegumen rectangular, ending in two shallow soft lobes hardly differentiated enough to be termed uncus; socii absent; gnathos divided into two shortstalked, elongate, egg-shaped tassels from the corners of the tegumen, curiously ornamented with large rough scales, arranged in a close spiral; it may be argued that these organs are the socii and not the gnathos, but I judge that they correspond to the similar scaled, unpaired, knobbed tip of the gnathos typical of many Oecophorids, and which in many forms tend to become divided; harpes narrow and divided on their outer half into two short, hairy lateral lobes; aedoeagus straight, bulky, with very large oval opening for the penis, extending more than half the length of the whole aedoeagus.

Female genitalia (Pl. 1, Fig. 1) with ostium simple; ductus rather long, spiraled on itself in two close loops and with a short chitinized ring near ostium; bursa elongate ovate; signum an elongate oval plate with two (or three?) short but heavy double spines.

Alar expanse.—11–12.5 mm.

Type.—U. S. National Museum No. 43310.
Type locality.—Otuzco, Peru.
Foodplant.—*Erytroxylon coca* (Johannes Wille).

Doctor Wille reports that the larvae feed on the leaves of the coca plant and that the damage caused by them amounts to about 60 per cent of the harvest in the height of the season and to about 20 per cent in the winter months.


1. cocae
2. cocae
3. tuberosella
4. cocae
5. tuberosella
6. cocae

Meyrick has erected the genus *Psittacastis* for the American representatives of the African genus *Eucleodora* Walsingham, on the smooth terminal joint of the labial palpi (versus the posteriorly tufted third joints of *Eucleodora*). The genotypes of both *Psitticastis* and its synonym, *Necedes* Walsingham, have truly smooth terminal labial joints at once distinguishable from those of the present species, which perforce must go in *Eucleodora*. The several described and undescribed species of this immediate group, characterized by the falcate fore wing with the striking involved color-ornamentation, are very similar in all the other characters and especially in the genitalia, though amply differentiated specifically, both in genitalia and in details of coloration of wings, palpi, and legs.

Explanation of Plate

Drawings made by Mrs. Eleanor A. Carlin under the direction of the author.

1. *Eucleodora cocae* Busck. Female genitalia.
2. *Eucleodora cocae* Busck. Head and labial palpi.
3. *Gnorimoschema tuberosella* Busck. Female genitalia.
4. *Eucleodora cocae* Busck. Wing venation.
5. *Gnorimoschema tuberosella* Busck. Male genitalia.
6. *Eucleodora cocae* Busck. Male genitalia

THOMAS SAY, EARLY AMERICAN NATURALIST, By Harry B. Weiss and Grace M. Ziegler. Charles C. Thomas, Springfield, Ill., 260 pages, 27 illustrations.

A delightful, authentic biography; entirely uncolored by personal opinion.

Here the reader may see the personality of Thomas Say emerge from the dust and cobwebs of a century, as the gentle, amiable, steadfast naturalist that he was. No dashing lusty giant such as Audubon was he. Rather poorly endowed with physical stamina, through sheer love of his calling and the exercise of a dogged continuity of purpose throughout his short lifetime of 47 years, he accomplished more than do many stronger men who attain to twice that span.

Surmounting the respect which his ability as a naturalist evoked from his intimates, there is in plain view the fact that he possessed their warmest affection and confidence in a degree which is the infallible index to an unselfish soul. Say's letters breathe consistently a spirit of honesty and mutual aid and reveal, at the age of 29, a store of wisdom and caution which is most admirable in the descriptive naturalist. Evidently realizing that he faced a vast and but slightly worked field for descriptive writing, he deliberately refused to run amok in it, as is shown by the following excerpt from a letter addressed to his friend Melshimer:

"It is certainly of the first importance to a naturalist to know what has been done by others in his particular science in order that his researches may be directed to proper objects that he may not do over again what has been better done by his predecessors—I am determined to be as cautious as possible in this respect."

That he acted in accordance with this resolve is obvious from the permanence of his work. Were one to interpret too literally the "Foreword" to this book he might easily gain the impression that here, at last, was one naturalist who was fortunate in all things. At the end of the story, however, the reader lays the book aside with the feeling that Thomas Say trod the boards of this "earthly stage" amid the trials and disappointments common to a vast majority of mankind, from failure in his first business venture and the loss of all the notes of his first extensive exploration, to recurrent and increasing physical illness and early death. The truth appears to be that with the aid of a few good friends, not the least of whom was a lovely and clever wife, but largely in spite of "hell and high water," he managed to live the life of a naturalist and do the work that his heart craved, to the glorification of manhood and the advancement of Natural Science in America.

This book is of chief importance to those interested in the history of the natural sciences in America but it would grace the shelves of any man's library. —*W. R. Walton.*

THE MALE OF MESOVELOIDEA WILLIAMSI HUNGERFORD (HEMIPTERA: HETEROPTERA).

By Dr. T. Jaczewski, *Polish Museum of Zoology, Warsaw, Poland.*

Prof. H. B. Hungerford has described recently (Bull. Brooklyn Ent. Soc., XXIV, 1929, pp. 288–291) a new genus and species of semi-aquatic Hemiptera, *Mesoveloidea williamsi* Hung. which should be referred with all probability to the family *Mesoveliidae*. The original description is based upon two female specimens from Mera in Ecuador.

In material of *Mesoveliidae* received for study from the U. S. National Museum, I was glad to discover three male specimens which belong beyond any doubt to the same species. I take this opportunity to give in the following, some supplementary details concerning the morphology of the males of this interesting waterbug.

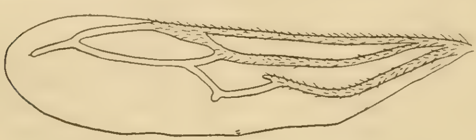


Fig. 1

Fig. 2

Color and general structural characters strictly as described for females by Prof. Hungerford. On the membrane of the hemelytra the veins form a longitudinal outer cell (Fig. 1) which is not found in *Mesovelia* Mulsant and Rey. The male genital segments show the same type of structure as in *Mesovelia.* The eighth abdominal segment is subcylindric in shape, its posterior margin being rounded dorsally and quadrangularly emarginated ventrally. The terminal abdominal segments are covered with fine hairs, but no tufts or fringes of modified hairs or spines are present; the postero-exterior angles of the seventh segment, as well as the caudal end of the eighth segment dorsally, bear longer and more bristle-like hairs. Ninth segment basket-like as in *Mesovelia.* Parameres hook-like, blunt at the end, rather wide at their curvature (Fig. 2). Penis in state of non-extension about equal in length with the parameres, slightly curved. Anal cone as in *Mesovelia.*

Length 2, 5–2, 75 mm.

Three macropterous males, Cachali, Ecuador, coll. Rosenberg (U. S. N. M.).

Explanation of Figures

Fig. 1. *Mesoveloidea williamsi* Hung., ♂. Hemelytron, x33.
Fig. 2. *Mesoveloidea williamsi* Hung., ♂. Paramere, x185.

FURTHER NOTES ON THE AMERICAN SPECIES OF MESOVELIA MULSANT AND REY.

Just a few days after the publication of my last paper on the American species of *Mesovelia*[1] a copy of Dr. Horvath's excellent Catalogue of the Mesoveliidae[2] came to my hands. As, unfortunately, some incongruency will be noticed in these two publications I venture to take this opportunity to make some additional remarks on the subject.

In my paper I have treated the American *Mesovelia mulsanti* B. White as a single, although variable species with the following four subspecies: the typical *M. m. mulsanti* B. White from the Amazonas (males unknown hitherto), the South American *M. m. meridionalis* Jacz., the North American *M. m. bisignata* Uhl. and the Central American and Caribbean *M. m. caraiba* Jacz.

Dr. Horvath lists in his Catalogue *M. mulsanti* B. White and *M. bisignata* Uhl. as two distinct species, the other two subspecies having not yet been established when he was writing his Catalogue. Personally I do not feel that the South and North American specimens of *M. mulsanti* B. White should be looked upon as clearly distinct specifically, the morphological differences between them being rather insignificant and, as I am inclined to think, of, at most, subspecific rank. But this is more a matter of opinion in ascribing greater or smaller

[1]Notes on the American Species of the Genus *Mesovelia* Muls. Ann. Mus. Zool. Pol., Warszawa, IX, 1930, No. 1.

[2]General Catalogue of the Hemiptera, Fasc. II. Northampton, Mass., 1929.

importance to certain differences which can be found between closely allied forms.

The chief correction which I would like to make in connection with Dr. Horvath's Catalogue concerns another point. In giving the distribution of the two species, Dr. Horvath lists all Central American localities under *M. mulsanti* B. White, leaving with *M. bisignata* Uhl. only the localities lying within the political limits of the United States. From the results of my studies it can be seen, however, that the Central American and Caribbean subspecies *M. m. caraiba* Jacz. seems to be particularly closely allied with the North American *M. m. bisignata* Uhl., being linked with it even by transitory forms. If we consider, therefore, *M. bisignata* Uhl. and *M. mulsanti* B. White as two distinct species we should refer *M. m. caraiba* Jacz. doubtlessly to the former and not to the latter. In consequence we should cancel in Dr. Horvath's Catalogue, from the distribution of *M. mulsanti* B. White, the localities: Panama, Guatemala, Cuba, S. Domingo, Guadeloupe, Grenada, St. Vincent and Mexico, and transfer them under his *M. bisignata* Uhl.

MINUTES OF THE 426TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 426th regular meeting of the Entomological Society of Washington was held at 8 p. m., Thursday, February 5, in Room 43 of the new building of the National Museum. Dr. A. C. Baker, President, presided. There were present 34 members and 38 visitors. The minutes of the 425th meeting were read and approved. Mrs. Nancy Harper Wheeler, of the Bureau of Entomology, and Prof. Paul N. Musgrave, Principal of the Junior High School, Fairmont, W. Va., were admitted to membership. The corersponding Secretary-Treasurer announced that a new program committee had been appointed, consisting of S. B. Fracker, B. A. Porter, and R. A. Cushman.

The first communication on the regular program was given by E. J. Newcomer, of the Bureau of Entomology, and was entitled "Fruit Insect Problems in the Northwest." The most important fruit insects economically in the irrigated regions of Washington are the codling moth, San Jose Scale, fruit-tree aphids, and red spiders. The tarnished plant bug at times causes severe injury. The most interesting minor pests are certain apple mites which seem to be distinct from *Eriophyes* pyri (Pgst.), a rust mite (*Phyllocoptes schlechtendali* Nal.), a tree hopper (*Heliria rubidella* Ball) which differs from other tree hoppers in that the nymphal stages live on the trees, and an œcophorid moth (*Schiffermuelleria coloradella* Wlsm.) the larvae of which live on the dying bark in the cankers of *Gloeosporium perennans* Zell. & Childs. This paper was discussed by Howard, Graf, and Rohwer.

The second communication on the program was presented by Austin H. Clark, of the National Museum, and was entitled "Selling Entomology."

This will be published in full in an early number of "Scientific Monthly." This paper was discussed by Howard and Baker.

The next communication on the program was presented by C. F. Doucette, of the Bureau of Entomology, and was entitled "Narcissus Production Methods in the Puget Sound Area with Special Reference to Insect Control." Motion pictures were shown of certain phases of narcissus bulb culture on the Pacific Coast, largely the plants as they appear in the fields, with some views of digging and other cultural operations carried on by machine. Brief discussion of the relation of the bulb flies to the cultures was made.

Pictures were also shown of Mt. Rainier, and attention called to it as a comparatively untouched area as far as insect collecting is concerned, and an area of exceptional ecological promise with its great variations in zones within short distances. This paper was discussed by Baker, Graf, Howard, and Gahan.

Remarks were made by Dr. David Griffiths, in charge of Bulb Culture Investigations of the Bureau of Plant Industry, who discussed bulb work in the Puget Sound Region with particular reference to daffodils, narcissus, tulip, and lily. He stressed the growing importance of this industry; one company in Oregon alone having shipped 7,000,000 lily bulbs the past season to the British Isles, Egypt and other destinations. According to the census figures the annual average is 190,000,000 bulbs; although the past season, being a poor one because of too much cold weather, the total was cut down to 160,000,000 bulbs. He also emphasized the high quality of the product as being equal to the best produced in other countries. Doctor Neil Howard, of the Bureau of Entomology, on invitation also discussed briefly the past season's work with the Mexican bean beetle and gave some figures on rearing and liberation of a tachinid parasite which gives excellent promise. The extensive drought of the past season greatly depleted the bean beetle population; although the pest is far from being exterminated.

The meeting adjourned at 9:45 p. m.

J. S. WADE,
Recording Secretary.

Actual date of publication, March 21, 1931.

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CONTENTS

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 33 APRIL, 1931 No. 4

NOTES ON HIPPELATES (DIPTERA: CHLOROPIDAE), WITH A NEW BRAZILIAN SPECIES.

By J. M. Aldrich, *U. S. National Museum.*

The genus was established by Loew in Berliner Ent. Zeitschrift, vol. 7, 1863, p. 38 (Centuries, part. 3, No. 69). He described two species, *nobilis* and *plebejus*, and strangely overlooked the hind tibial spur in his *Oscinis pallipes* (page 39), and *Oscinis flaviceps* (page 40), which also belong to *Hippelates*, as I found in examining the types, at the Museum of Comparative Zoology, in 1915. Coquillett designated *plebejus* as type in Proceedings U. S. Nat. Mus., vol. 37, 1910, p. 552; while Enderlein designated *nobilis* as type, in Sitzungsberichte Ges. Naturforsch. Freunde, 1911, p. 191, probably not having seen Coquillett's paper.

Malloch published a thorough revision of the North American species in Proceedings U. S. Nat. Mus., vol. 46, 1913, pp. 239–266, with two plates. As he had not seen Loew's types, he made some mistakes in identifying the Loew species, which I corrected in these proceedings, vol. 31, 1929, p. 35.

A new paper entitled "Die neotropischen Chloropiden," by Dr. Oswald Duda has lately been sent to me by the author, with the explanation that it is a mere fragment, hardly one-eighth of his manuscript, of which he was unable to get the remainder published. It was published in Folia Zoologia et Hydrobiologia, vol. 2, September, 1930, pp. 46–128. The author attempted a revolutionary treatment of the family, but the part printed consists only of keys and is almost impossible to follow. I refrain from further discussion of it at present.

Mr. C. H. Curran has published four species of *Hippelates* in American Museum Novitates, No. 220, 1926, pages 4 and 5; these are all from the West Indies.

It is not proposed to revise the genus herein, but merely to give some notes along with the description of the new species.

The standing of *Hippelates* has been questioned in recent years. Kertesz examined the type of *Cadrema lonchopteroides* Walker, described from Celebes in Proceedings Linn. Soc., vol. 4, 1860, p. 117. His report is in Annales Mus. Nat. Hung., vol. 12, 1914, p. 674. The type is headless, but the hind tibia has a long curved apical spur (mentioned by Walker), and Kertesz states positively that *Cadrema*, of which it is the sole species, must take priority over *Hippelates*. No one seems to have seen another specimen of *lonchopteroides*, which is strikingly marked in having an apical dark spot in the wing. Becker's *Parahippelates fuscipleuris* from New Guinea, has such a spot, but from the description seems to have longer plumosity on the arista. From existing data by Walker and Kertesz, I believe *lonchopteroides* is nearly related to the widespread *Prohippelates pallidus* Loew, and is far more likely to be congeneric with it than with *Hippelates plebejus*. I therefore continue to use *Hippelates*, leaving *Cadrema* for elucidation when additional material of the type species shall have been discovered. I am indebted to Mr. Malloch for calling to my attention the occurrence of *pallidus* in the Pacific region; it is evidently the same species which Becker identified as *Hippelates nigricornis* Thoms., in his work on Indo-Australian Chloropidae, Annales Mus. Nat. Hung., vol. 9, 1911, p. 103. Malloch reported it from Samoa (insects of Samoa, Chloropidae, 1930, p. 245).

Hippelates pallipes Loew.

I have just mentioned that Loew published this as an *Oscinis*. The type was from Cuba (Gundlach). He published *Hippelates flavipes* in Berliner Ent. Zeitsch., vol. 10, 1866, p. 184 (Centuries, pt. 6, No. 95); this species was also from the same collector in Cuba. His type series contains two species, his own *pallipes* and in minor part *partitus* Becker. I designate the part agreeing with *pallipes* as the true types, believing that less confusion will result from sinking the name *flavipes* than from transferring it to another species.

Hippelates currani, new name.

I propose this for *Hippelates collusor* Curran, Amer. Mus. Novitates, No. 220, 1926, p. 4. Townsend described *Oscinis collusor* from Lower California, in Proceedings Cal. Acad. Sci. sec. ser., vol. 4, 1895, p. 619. His type was in the California Academy and was destroyed in the San Francisco fire; I had examined it a few months before, but did not get enough of a description to place it except as to the genus. It is a *Hippelates*, as might be surmised from his statement that the species annoys people, causing irritation of the eyes.

I have recently identified three specimens of *currani* that were sent by Dr. A. da Costa Lima, of Rio Janeiro, who received them from Dr. M. Florentino da Silva, of Parahyba do Norte, Brazil.

Hippelates plebejus Loew.

The relationship with *nobilis* and *proboscideus* is not altogether clear, but I identify the last-named in a series of 13 from Higuito, Costa Rica (Schild), and six from Panama (5 Trinidad River, 1 Boqueron River, all collected by Busck); having examined the types of *nobilis* and *plebejus*, I tentatively separate the three species as follows:

Scutellum bordered with reddish.. *plebejus.*
Scutellum wholly black, concolorous with mesonotum.
  Hind femora and tibiae ringed with brown; cheek one-third
    eye-height.. *nobilis.*
  Hind femora and tibiae wholly or almost wholly yellow;
    cheek one-fourth eye-height.. *proboscideus.*

In *nobilis* the ocellar triangle may not show the shining black spot in the apex, and if present it may be narrow as indicated by Loew; in *proboscideus* it is present and rounded in all the specimens seen. *Proboscideus* shows no characters to justify the subgenus *Siphomyia* which Williston based upon it, and which Duda in his recent paper cited above elevates to full generic rank.

Hippelates longulus Becker.

Described in his work on the nearctic Chloropidae (Ann. Mus. Nat. Hung., vol. 10, 1912, p. 89). The single type, a female, was returned to me. Becker made a mistake in the locality, calling it Canada, when it is Grenada, W. I.; it should have been in his neotropical paper.

I have carefully examined the type, and can make it out to be nothing but a specimen of *capax* Coq., which Malloch has made the type of the new genus Pseudohippelates.

Hippelates brasiliensis, new species.

Resembles *Hippelates pallidus* Loew, but has narrower cheeks and has distinct white pollen on the parafacial and upper part of cheek.

Thorax shining black, including pleurae; frontal triangle shining black, large; legs wholly pale yellow, only the last tarsal joint sometimes brownish.

Male, female. Frontal triangle large, highly polished, its upper angles barely separated from the eyes, its sides convex, the tip sometimes yellow, almost touching anterior edge of front. Lower part of front yellow, becoming brownish upward. When viewed from in front and a little below, the parafrontals are white pollinose like the parafacials. Antennae pale yellow, third joint wider than long, its upper edge infuscated; arista yellow on basal joint, the remainder black and distinctly pubescent under moderately high power (20 diameters). Face dark in middle; palpi yellow, rather large; proboscis brownish black, the main segment considerably shorter than head, labella of about equal length, folded back; inner edge of mouth dark. Cheek yellow, in side view about one-eighth eye-height, without prominent angle in vibrissal region; when viewed more from below, the lower third is shining, the rest white pollinose.

Thorax with a median row of hairs arising from punctures; next to this laterally a less distinct row not in punctures; then a row, somewhat double posteriorly, arising from conspicuous punctures giving almost the effect of a groove (all this is the same as in *pallipes*). Scutellum with the normal two minute bristles at tip.

Abdomen polished black, the base yellow for about two segments.

Legs very pale yellow, with hairs of same color, only the tibial spurs and claws black. Hind tibial spurs arising at five-sixths the length of the tibiae, which they hardly surpass.

Wings hyaline, veins very pale, costa a little darker.

Length, 1.4 to 1.6 mm.

Described from 25 specimens of both sexes received from R. C. Shannon; he writes that they were collected at the city of Parahyba, State of Parahyba, Brazil, by Dr. Eduardo Araujo, who suspected that they may be conveyors of the disease called Yaws.

Type.—Female, Cat. No. 43456, U. S. N. M.

Four of the paratypes are deposited in the Instituto Oswaldo Cruz, Rio Janeiro; four in the Instituto Biologico, Sao Paulo; and four are returned to Mr. Shannon.

BIOLOGICAL NOTES ON THE TRIGONALIDAE (HYMENOPTERA).[1]

By Curtis P. Clausen,
Senior Entomologist, United States Department of Agriculture.

In a recent paper the writer presented an account of the life history of *Poecilogonalos thwaitesii* (Westw.), parasitic in the cocoons of *Henicospilus* in India. The life history as given was incomplete, lacking information on the hatching of the egg and on the characteristics of the primary larval stage. The present paper deals with these two points in two genera, *Poecilogonalos* and *Orthogonalos*, studied in Japan.

Manner of Oviposition.

The leaf-ovipositing habit in the Trigonalidae was first demonstrated by Mr. Cho Teranishi in the case of *Poecilogonalos*

[1]Clausen, Curtis P., Biological Studies on *Poecilogonalos thwaitesii* (Westw.) Parasitic in the Cocoons of Henicospilus (Hymen.: Trigonalidae), Proc. Ent. Soc. Washington, Vol. 31, No. 4, pp. 67–79, 1929.

maga Teranishi, in 1921 (see Teranishi, 1929), and the writer has since noted a similar habit in *Poecilogonalos thwaitesii* (Westw.), *P. henicospili* Rohwer, *Orthogonalos debilis* Teranishi, and *Pseudogonalos* sp. It would therefore seem probable that this type of oviposition is general in the family.

The manner of oviposition is uniform in all of the species observed, and is here illustrated in Fig 1. The female stands on the upper surface of the leaf and curves the tip of the abdomen underneath the margin, the egg then being placed on the lower side at a distance of 0.5 to 1.0 mm. from the edge.

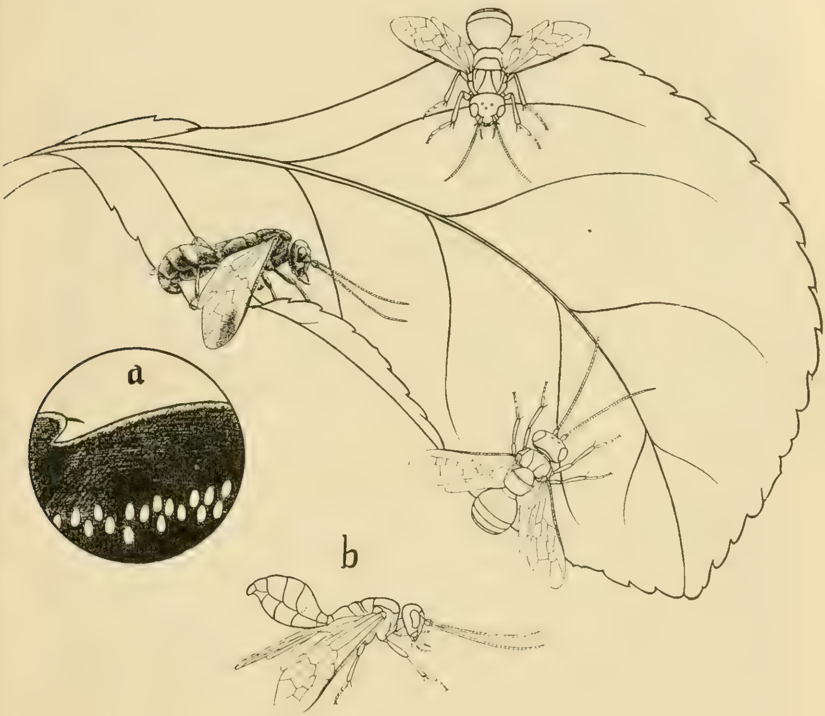

FIG. 1. The manner of oviposition in the Trigonalidae (*Poecilogonalos maga* figured, x 2.5). *a*, A typical row of eggs beneath the margin of a leaf of *Rubus palmatus* Thunb. *b*, The characteristic resting position of the female, the wings also being held in this position while in movement on the leaf or in the act of oviposition. (*Drawing by Y. Hasegawa.*)

The rate of oviposition is very rapid and egg laying extends over a considerable period of time. Teranishi[1] records the

[1]Teranishi, C., Trigonaloidea from Japan and Korea (Hym.). Insecta Matsumurana, Vol. No. 3, 4, pp. 143–151, 2 pl., 1929.

deposition of 3,599 eggs in 4 days by a female of *Poecilogonalos maga*, while the writer secured 10,641 during a period of 14 days from *P. thwaitesii* and with another individual of the same species 4,376 in a single day, and in the case of *P. henicospili* 5,782 were deposited in a period of 6 days. The normal reproductive potential in this genus is thus probably at least 5,000, assuming numerical equality between the sexes.

Plants Selected for Oviposition.

Observations have not been sufficiently extensive to permit of any general conclusion with respect to the factors involved in the choice of plants for oviposition. In the case of *P. maga* it is known that at Jozankai, Japan, in 1921 the eggs were placed almost exclusively upon the leaves of red clover, whereas at Shimajima, in 1928, oviposition was largely restricted to *Rubus palmatus* Thunb. Experiments in India upon *P. thwaitesii* indicated quite conclusively that the physical qualities of the leaf had a direct bearing upon the readiness with which the females would oviposit thereon. It is perhaps probable, however, that this factor is of secondary consideration, and that the primary influence is related to the presence of the secondary hosts upon the plants chosen for oviposition. It has not thus far been possible to investigate this phase of the problem, but its relation to the bionomics of the family is evident as bearing upon the frequency with which contact with the primary host is eventually attained.

The Egg.

In *Poecilogonalos maga* the egg (see Teranishi, 1929, pl. 6, fig. 5, 5a), is 0.1 mm. in length and 0.06 mm. in width, flat on its ventral surface and arched dorsally, and with a series of from 8 to 10 longitudinal ridges on the surface of the chorion, of which 1 or 2 may be branched. The egg of *P. thwaitesii* (see Clausen, 1929, pl. 5, fig. 2), is of somewhat similar form, though slightly more arched dorsally, and with the longitudinal ridges only 6 in number, the median 4 uniting at the anterior end. The egg of *P. henicospili* is of practically identical form. That of *Orthogonalos debilis* is 0.13 mm. in length, 0.07 mm. in width and flatter than in the above species. The chorion is somewhat translucent in contrast to its markedly opaque quality in *Poecilogonalos*, and the longitudinal ridges, while present, are irregular and indistinct.

Incubation and Hatching.

In the earlier experiments upon *P. maga* and *P. thwaitesii* it was found that the eggs deposited upon foliage by females known to be fertile invariably failed to hatch, though dissections revealed them to contain apparently fully developed and living embryos even several months after deposition. This led to the assumption that the eggs must of necessity be eaten by the secondary host before the necessary stimulus to hatching is provided. In none of the species dealt with to date has the secondary host been known with certainty, and the primary host has been known in the case of *P. thwaitesii* and *P. henicospili* only, consequently the normal cycle could not be reproduced experimentally.

Under the assumption that the salivary or digestive juices of the secondary host provide the stimulus essential to hatching, a series of experiments was conducted with various chemicals in an attempt to simulate normal conditions. At first this experimentation was entirely fruitless, but later it was found that unless the chorion was first ruptured no effect from the chemicals could be secured. This was easily accomplished by exerting a slight pressure upon a cover glass resting upon the eggs, resulting in a longitudinal split between the surface ridges. It is quite probable that this is the precise effect attained through mandibular action by the secondary host larva at the time of the ingestion of the eggs.

With this initial assistance it was found that the larva would rupture the inner membrane and emerge from the egg when immersed in a very weak solution of potassium hydroxide. These experiments indicated the probable course of events, and it was then necessary to test this interpretation by the use of substitute secondary hosts. For this purpose a number of Papilionid larvae were collected and fed with foliage of their normal food plant upon which had previously been placed a quantity of eggs of either *Poecilogonalos maga* or *Orthogonalos debilis*. These host larvae were then dissected at periods ranging from 1 to 6 hours after feeding.

In these dissections it was found that within 1 hour following ingestion several of the eggs had hatched; and that 4 hours after feeding, in the case of the host examined, 13 active larvae were found in the anterior portions of the digestive tract, 2 had penetrated into the body cavity, and 10 still remained unhatched. In another instance a considerable number of unhatched eggs were voided with the excrement. An examination of these failed to reveal any break in the chorion, though living larvae were found within them.

Following these experiments a search was made for caterpillars and sawfly larvae upon foliage in the locality at Shimajima where *P. maga* was known to be common. Among those secured was a single sawfly larva which, upon dissection, revealed in the body cavity 3 Trigonalid larvae of the first stage, which were identical in form with those of *P. maga* secured experimentally and by dissection of eggs in the laboratory. It is not implied, however, that this sawfly is the normal secondary host, as hatching of the Trigonalid eggs, within certain limits, very probably occurs in the larvae of the majority of lepidopterous and hymenopterous species of phytophagous habit found upon the particular oviposition plants. The restrictive factor is more likely to be found in a consideration of the biology of the primary parasites which attack the secondary hosts ordinarily ingesting eggs of *P. maga*.

In view of the above results, in conjunction with the dissection data secured with *P. thwaitesii* in India, it may be asserted with considerable confidence that the normal cycle of *Poecilogonalos*, and very probably other Trigonalid genera as well, is (1) the deposition of the egg upon foliage, (2) its ingestion by the secondary host (either caterpillar or sawfly larva), (3) its hatching within the digestive tract, (4) the penetration of the Trigonalid larva into the body cavity of the secondary host followed by its penetration of the derm of the primary (Ichneumonoid) host if present, and finally (5) its eventual emergence in the fourth larval stage from the prepupa of the latter, which at this time is within a cocoon in the soil. Feeding is completed externally and an irregular cocoon spun within that of the primary host.

The Primary Larva.

In the case of *P. thwaitesii* it was stated, in the paper dealing with that species, that the partially developed embryos, as found by dissections of eggs, indicated the primary larva to be of the planidium type and in general similar to that of *Perilampus*. It is now known that the form observed was fully developed, rather than being an intermediate embryonic stage, and was in all essential respects similar to the primary larvae here described and figured for *P. maga* and *Orthogonalos debilis*. In view of the fact that both hatching and development take place internally, the main requirements of the primary larva are the power of locomotion in a fluid or semifluid medium, and of penetration, first of the wall of the digestive tract and then of the derm of the primary host. Lacking the requirement of mobility on a plane surface externally, its morphological characteristics are markedly different from those of a planidium.

The primary larva of *P. maga* (fig. 2, A) is 0.12 mm. in length, with 12 body segments, and is widest in the mid-thoracic region. The head is broadest at its juncture with the thorax, somewhat retracted into the first segment, and with the slender mandibles largely extruded. The first thoracic segment has a transverse row of 5 heavily chitinized hooks ventrally, directed caudad, the lateral hairs being successively slightly smaller. Dorsally is a large palmate and heavily chitinized plate, attached at its anterior half, and with the free portion apparently comprising a double series of "teeth," as figured. The second segment has a transverse row of rather small, stout spines ventrally, 8 to 9 in number. Slightly laterad of each end of this row is a group of 3 heavier hooks, directed latero-caudad. Dorsally is an irregularly set row of 8 or 9 hooks which are considerably larger than those of the ventral row. The third segment bears a transverse row of ordinary setae ventrally, a dorsal row of hooks similar to those of the preceding segment, and a few delicate setae at each end of the row. The abdominal segments have ventral and dorsal rows of setae, these forming a complete ring on the last 2 or 3 segments only.

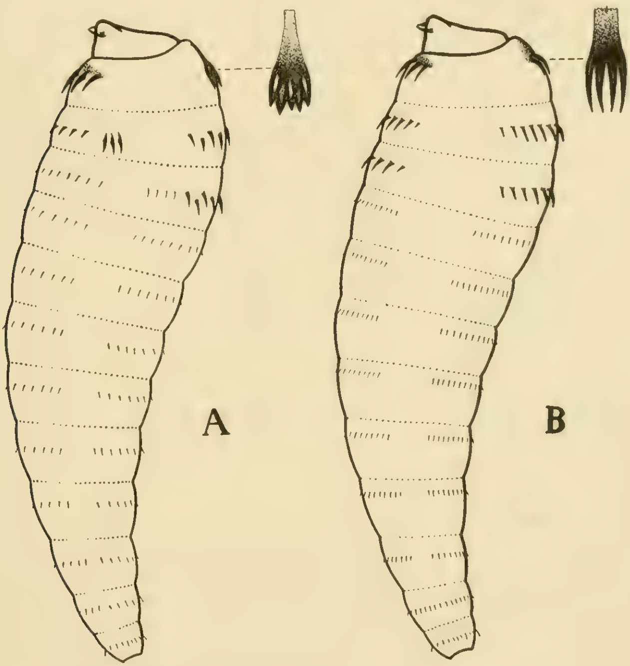

FIG. 2. The primary larval stage; (A) *Poecilogonalos maga* (x 625), (B) *Orthogonalos debilis* (x 625).

The primary larva of *Orthogonalos debilis* (fig. 2, B) is of similar form but with several minor distinguishing characters. The palmate plate of the first thoracic segment is apparently simple, with 4 teeth. The ventral row of hooks is present on the third as well as on the second segment, and these are heavier than those on the second segment of *P. maga*. The group of 3 heavy hooks at the lateral margin of the second segment is lacking.

Host Relationships.

From the relatively few rearing and collection records available with respect to the Trigonalidae we find that these parasites are limited to three groups of primary hosts, the Tachinidae, the Ichneumonoidea, and the Vespoidea. The course of development as a parasite in the Tachinidae is probably identical with that in the Ichneumonoidea. As to the Vespoid hosts we are faced with some difficulty. In no instance does the record establish beyond doubt that the one given is the true host, and the individuals which emerged may have come either from a lepidopterous scavenger or from some other insect in the nest. A consideration of the possibilities, however, would indicate that the records for this group of hosts are authentic. On the basis of our present knowledge it may be assumed that the Trigonalid species concerned deposit their eggs upon foliage, and that this necessitates the eggs being eaten by some phytophagous larva. The scavengers found in the Vespoid nests do not fulfill this condition. It is conceivable that an occasional parasitized caterpillar might find its way into the nest, but that this should occur frequently in the same nest is improbable.

On the assumption that these host records are correct the only logical explanation of the mode of access of the Trigonalid larvae to the wasp larvae in the nest is that they enter through the agency of the parent wasp herself. The Vespoid adults, being of entomophagous habit, may take these minute Trigonalid larvae into the crop along with the body fluids of the caterpillar carrier, and they may thus be transported to the nest and fed to the Vespoid larvae, following which development would proceed normally.

It appears logical to assume that the species recorded as having been reared from Vespoidea are normal parasites of Ichneumonoidea, of which a portion have been diverted to another host. The first-stage larvae occur in the body of the phytophagous secondary host in the course of progress to the primary but, through the consumption of the body contents of the secondary host by a Vespoid adult, they are included in the regurgitated food given to the wasp larvae. These last, being closely related to the supposed normal host, provide a suitable medium for development.

The successive steps in the life cycle of the Trigonalidae in the three groups of hosts (hypothetically in the case of Vespoids) may be outlined as follows:

Trigonalid female.

Eggs deposited upon foliage.

Eggs eaten by caterpillars or sawfly larvae.

Larvae parasitized by Ichneumonoid (before or after eggs have been eaten).	Larvae eaten by adult Vespoid.	Larvae parasitized by Tachinid (before or after eggs have been eaten).
Primary trigonalid larva penetrates body of Ichneumonoid larva.	Body fluids of larvae, containing primary trigonalid larvae, fed to Vespoid larvae.	Primary trigonalid larva penetrates body of Tachinid larva.
Develops within Ichneumonoid larva.	Develops within Vespoid larva.	Develops within Tachinid larva.
Adult emerges from Ichneumonoid cocoon.	Adult emerges from Vespoid cell.	Adult emerges from tachinid puparium.

With the above mode of development in Ichneumonoid and Tachinid hosts the question arises as to why this family of parasites does not develop on these hosts irrespective of what the secondary host may be, providing only that it is of phytophagous habit. The Scarabaeidae, with their Tachinid and Ortalid parasites, immediately come to mind. In Japan in recent years vast numbers of parasitized *Popillia japonica* beetles have been collected, largely in localities where Trigonalidae are known to occur, yet not a single Trigonalid has been reared from this material. The explanation may lie either in the failure of the beetle to break the egg chorion, or in the lack, in the fluids of the digestive tract, of the requisite chemical components to induce activity.

Mortality Factors.

The mode of development shown for several species of *Poecilogonalos* as indirect parasites of phytophagous larvae reveals an unusual series of factors causing mortality, the aggregate effect of which is to necessitate an exceptionally high reproductive capacity to maintain the numerical status of the species. The more important of these factors may be listed as follows:

1. The egg may be deposited on host plants not frequented by larvae of the secondary host. This is an uncertain factor, as already stated, and may be of little importance.

2. If deposited upon the proper plant species the eggs may not be eaten by the secondary host larvae. This factor is considered to be the most important of the series in that it is dependent not only upon the presence of the secondary host larvae but upon their numerical abundance as well. The placement of the eggs at the margin of the leaf enhances the chance of their being eaten, as the greater proportion of leaf-feeding larvae begin feeding at that point. If only a single secondary host larva is present on the plant the chance of its consuming one or more eggs is more or less in proportion to the dispersion of the Trigonalid eggs upon the foliage. From the viewpoint of maximum survival, a single egg upon each leaf would give the greatest chance of success. The optimum condition would also seem to be provided by secondary host species of gregarious habit.

3. If eaten by suitable secondary host larvae a portion of the eggs may not hatch in the digestive tract. This factor, of rather uncertain value, is probably more or less constant within any single secondary host species, but may vary considerably between species owing to difference in form of mandibles and the manner of feeding. It may be assumed that larvae which swallow their food in large fragments will rupture the chorion of fewer eggs than those which masticate it more thoroughly. Thus, also, the earlier-stage larvae are probably more effective than the larger mature ones.

4. The secondary host larva which consumes the egg may not contain a primary parasite larva. The percentage of successful parasitism upon the primary host may be considered to be in direct ratio to the proportion of secondary host larvae which have eaten Trigonalid eggs. Thus, if 50 per cent of the secondary host larvae consume these eggs then, by the law of chance occurrence, the effective parasitization of the primary host will be of the same value. The third factor mentioned above is here disregarded, it being offset by superparasitism.

5. Superparasitism. This factor accounts for a considerable mortality in the early larval stages, as was shown in the case of

P. thwaitesii in India. With a 54 per cent field parasitism upon the Henicospilus host an average number of 1.8 larvae of the third stage were found in each host, as determined by dissections of living material and an examination of the remains in empty cocoons. In the third stage cannibalistic tendencies are most pronounced, and it is probable that the individuals which first attain this stage effect a considerable, further mortality upon the second stage, which is defenceless. Owing to their delicate and unpigmented integument the remains of these latter could not be distinguished in dissections of the primary host larvae.

Because of the manner of oviposition a considerable number of eggs may be placed upon a single leaf and all eaten by a solitary secondary host larva. So far as known the Trigonalidae dealt with are solitary parasites of the larger Ichneumonoidea, which are themselves mainly solitary, so that irrespective of the number of eggs eaten only a single one can develop to maturity.

The above mortality factors are those which enter into the problem where an Ichneumonoid is the primary host. They are probably of identical value in relation to the Tachinid species attacked. In connection with parasitism of Vespoidea, and the assumed cycle of events as outlined, other factors enter, and the fourth mentioned above is eliminated.

THE OVIPOSITION HABITS OF FELTIA SUBGOTHICA HAW. (NOCTUIDAE, LEP.).[1]

By W. V. Balduf. *University of Illinois.*

For several years I have been finding a species of *Copidosoma*[2] frequenting the flowerets of various *Helianthus* species at Oak Harbor, Ohio, during the latter part of August. While making a search in 1930 for the possible hosts of this Chalcid, I frequently discovered the eggs and very small larvae of a moth in *Helianthus* heads taken at Oak Harbor and West Lafayette, Ohio, and at Urbana, Illinois. Specimens of larvae hatched from the eggs found in these flowers at Urbana were reared to the moth stage. They proved to be the Noctuid, *Feltia subgothica* Haworth. Incidentally, no *Copidosoma* sp. was obtained from the eggs or larvae of this cutworm. A survey of the literature dealing with the habits of American species of *Feltia* and the foreign forms recorded in the Review of Applied Entomology revealed no information regarding what is probably the true habit of

[1]Contribution from the Entomological Laboratories of the University of Illinois No. 151.

[2]Determined by A. B. Gahan, U. S. National Museum.

depositing eggs. Records of oviposition reported in various papers refer to observations on caged moths, which, in view of the present finding, obviously performed abnormally due to the absence of the oviposition plants selected in nature. The following is a summary of my findings, together with pertinent notes from the literature relating to the egg-laying habits and development in this genus in general and *Feltia subgothica* Haw. in particular.

IDENTITY OF THE MOTH.

Specimens of moths submitted to Doctors Schaus and Heinrich of the United States National Museum for identification brought their report as follows in a letter from Doctor Harold Morrison: "The smaller specimens are *Feltia ducens* Walk., the larger specimens *F. subgothica* Haw. These are probably variants of one species, *F. subgothica* Haw. having priority. The larvae and genitalia are similar in both forms." The smaller specimens referred to by these specialists were taken between September 12 and September 30, 1930, flying about *Helianthus* flowers growing in a certain bed in the gardens of the floriculture division of the University of Illinois. No other moths of this genus were found there or in that neighborhood during that period. Many eggs and newly hatched larvae occurred in the flowers of the same bed at the same time. From these eggs were reared all the larger specimens mentioned in the above letter and identified as *Feltia subgothica* Haw. These findings confirm the conclusions of Schaus and Heinrich that *ducens* and *subgothica* are probably variants of one species.

LIFE HISTORY OF FELTIA.

Of the twenty species of *Feltia* listed in Barnes and McDunnough, Check List of Lepidoptera of North America, only three seem to be fairly well known in the United States. These are *Feltia annexa* Treitschke, the granulated cutworm, *F. gladiaria* Morr., the clay-backed cutworm, and *F. ducens* Walk. and herein called *Feltia subgothica* Haw., long designated as the dingy cutworm. Their stages, and more or less of their seasonal development, have been described. All possess the cutworm habit, but may at times climb upon plants, including fruit trees to feed on the leaves. All are general feeders, consuming weeds, field crops and vegetables.

Jones (1) found apparently five and possibly six generations annually of *F. annexa* at Baton Rouge, while in Illinois, Forbes (2) took moths of this species in July to August, and again in August to September, the latter ovipositing before winter, indicating the occurrence of two generations in this latitude.

It seems to winter as a larva and is most destructive in April or May.

Doctor Forbes (3) found that *F. gladiaria* Morr. winters as a partly grown larva in the latitude of Urbana, Illinois, and is destructive from the middle of April to the beginning of June. By the middle of June all larvae have entered the earth for transformation, but have been observed to remain there as larvae in a torpid state for more than six weeks. Moths consequently do not appear until September and early October. Eggs are laid promptly, and only one generation develops in a year.

Feltia subgothica Haw. occurs throughout the United States and in all the Canadian provinces, according to Professor Slingerland (4). Forbes (3) took moths of this species during all of July, August and September, but found it most abundant in the latter part of August. Oviposition follows closely upon emergence of the adult, the eggs hatch promptly, and the larvae are quite small to a half inch long during the winter. Growth is rapid in warm spring weather, and maturity is attained mostly in the first half of June, when they enter the ground. Here they spend an unusually long period in preparation for pupation. The life history accounts given by Slingerland for New York and by Gibson (5) for Canada agree in all essential respects with that by Forbes.

It will be noted that *F. gladiaria* and *F. subgothica* have one generation in a year, and their several stages run closely parallel with regard to seasonal occurrence. In each of these species there is a pronounced delay between entrance of the mature larvae into the soil and their pupation.

OVIPOSITION.

The eggs of all these species have been obtained, but no mention is made of the place of deposition, except by Jones (1, p. 10), who writes concerning *F. annexa* that "no eggs have been collected in the field. In the insectary they were deposited at night singly over objects to which the moths had access, with the flattened side of the egg adhering to the surface upon which it rested. Riley has stated that moths which he had under observation scattered their eggs irregularly and singly on grass, though he considered this habit exceptional and probably abnormal, as the result of confinement. * * * Once egg-laying had begun, eggs usually were deposited every night during the period of oviposition." A series of moths observed byJones deposited from 311 to 1374 eggs per individual. Theobald (8) states that the moths of *F.* (*Agrotis*) *exclamationis* L. appear in England in June and July and lay their eggs on leaves near the soil or actually on the soil. Dyar (7) reports seventy-five specimens of *F. vancouverensis* Grote taken from May 31 to July 28, and describes the egg. Slingerland (4, p. 578) tabulated captures of *F. subgothica* at Ithaca, New York, for 1889 and 1892. Moths came to the traps from July 4 to September 18 in 1889 and from June 24 to September 30 in 1892, the largest numbers appearing during the latter half of August in each year. Inasmuch as oviposition follows soon after issuance from the chrysalises, these records are significant for the dates of oviposition. Slingerland (p. 577) describes the egg. All his attempts to secure egg deposition failed excepting that one moth laid ten eggs on clover leaves in a bottle. Crumb (6) reports that the main flight of *F. subgothica* (*ducens* Walk.) takes place in Tennessee between September 10 and October 10, whereas in Illinois, Iowa, New York, and Canada the main flight occurs between August 15 and September 5.

The presence of the eggs of *F. subgothica*, in abundance, in the flowerets of various *Helianthus* species is regarded as evidence that the normal manner and place of oviposition of this species is to deposit them into flowerets rather than on leaves and stems of plants or on the soil, as is the common habit of many cutworm moths. In 1930, I dissected numerous flowerets of different *Helianthus* collected at Oak Harbor and West Lafayette, Ohio, in latter August, and at Urbana during September and early October, the results of which studies are given hereafter. Eggs were found in the flowers from each of these localities.

The species of *Helianthus* containing the eggs of *F. subgothica* range in size from the common large sunflowers to the smaller types like *H. tuberosa*, or Jerusalem artichoke, growing in profusion along railroads for miles east of this city. *H. cucumifolia*, a species of intermediate size growing in the University gardens, yielded a large proportion of the eggs, but was visited more frequently than the other species. Despite the difference in size of the flower heads, the dimensions of the individual flowerets from the several species of *Helianthus* found to contain the eggs were more or less uniform. The petals of *Helianthus* are united, as are also the flattened stamens, which form a narrow tube only a few millimeters in diameter. However, the bases of the filaments remain separated, leaving openings from the stamen tube into the bottom of the corolla. The anthers, which are free, and are drawn down into the stamen tube before the pollen is shed, discharge their masses of pollen into the stamen tube. These facts have significance in the economy of *Feltia subgothica.*

Most of the eggs found in flowers were taken from a small bed composed of *H. cucumifolia* and another undetermined form of this genus in the University gardens in September, 1930. The moth was not observed in the act of oviposition, but a series of *subgothica* having been reared from eggs taken from these flowers, there can remain no doubt that oviposition by this species took place in these flowers. The smaller, lighter color variant of this moth, was one of the common species of Noctuidae in the garden in September. Several hours were devoted to observing the moths in the early part of the nights of September 12 and 15. They flew about the flowers, but spent most of the time at rest on the heads and in inserting their siphons into the corolla tubes of the *Helianthus*. Many other blooming ornamentals, chiefly moss rose, heliotrope, zinnia, sweet alyssum, marigold, petunias, and lantana, growing in the immediate vicinity of the *Helianthus* were, strange to say, not visited at all by these moths. Other species of Noctuidae were actively sipping nectar from a variety of blossoms, but *F. subgothica* confined its attention to the *Helianthus*. On other nights this insect occurred commonly on members of this group blooming in my own garden.

The act of placing the eggs in the flowerets represents a considerable degree of precision on the part of the moth and suggests that it is an old, well-established habit. Careful dissections of one thousand flowerets taken at Oak Harbor and West Lafayette, Ohio, and at Urbana, Illinois, from August 25 to October 7, 1930, produced eighty-six instances of infestation by eggs or newly hatched larvae of *F. subgothica*, their occurrence being distributed throughout the above period. In all excepting two of these cases, the eggs had been deposited into the small anther tubes. The much larger and more easily accessible corolla contained the eggs in the other two instances. It is obvious that considerable accuracy of manipulation is required of the moth to thrust her ovipositor into so small a tube. Naturally one wonders why the larger corolla tube is not selected for oviposition.

The number of eggs per anther tube varied from one to eight, with three to six common. The average for the infested flowerets is near three, and about eight per cent of the flowerets dissected contained eggs. In practically all instances, the eggs, regardless of the number per floweret, were placed in the lower half or lower two-thirds of the stamen tube. Usually they were found in a rather straight row or column, but the individual eggs assumed many positions, being attached to the walls of the stamen tube by their sides as well as their upper or lower surfaces. Less often the eggs had been pushed down in an irregular mass at the bottom of the tube, which not infrequently caused the sides of the tube to bulge out prominently, and in one instance the wall of the tube was actually broken. When four to eight eggs occupied a single tube, it was not uncommon to find two or more of them poked out through the openings at the bottom of the stamen tube into the corolla. The fact that the eggs, regardless of number per tube, occur in the lower part suggests that the moth introduces the full length of the ovipositor into the flower when depositing them.

OBSERVATIONS ON THE LATER STAGES.

One particular lot of eggs removed from a single flower head were obviously newly deposited. They hatched in ten days in room temperatures during early September. None of the several hundred eggs obtained failed to hatch. Some already had hatched when they were found. The newly emerged caterpillars commonly remove most of the egg shells, judging by the fragments often left. The shells appear to be sticky when the eggs are laid. The part that makes contact with the wall of the stamen tube usually remains intact when the rest has presumably been eaten. Invariably, the stamen tubes containing newly hatched caterpillars also contain at that time a good supply of fresh pollen, which suggests that the female moth has a rather keen sense for the selection of flowerets that are in the most advantageous state of development for her progeny. The new larvae remain, for perhaps several days, in the stamen tube. Strangely, their food preferences at this time are markedly at variance from those of their later larval life as cutworms which eat a great range of both noxious and useful plants. In the stamen tube they consume three parts of the flowerets. As long as the pollen supply lasts they use it as food. It was commonly observed that several small, first instar larvae were feeding in one tube. Neither in this instar, nor in any other during the larval stage, when a number of larvae were kept in close confinement, was there observed the least evidence of a cannibalistic tendency. There is distinct evidence that larvae originating in one tube may subsequently migrate to adjoining stamen tubes and eat the pollen there. Pollen is the chief food while the larva lives in the flower. Considering this, one can readily see the advantage of depositing the eggs into the stamen tube rather than in the corolla. In addition to the pollen, the small larvae sometimes also eat the black strap-shaped pieces that help to form the stamen tube, and less frequently the fleshy receptacle is gouged to some extent. No evidence was seen to show that they eat the seeds. Another caterpillar which, judged by its plump form and pink color, seemed to be mature in early September, frequents the heads of *Helianthus*. When small it enters the seeds from the receptacle to eat out the cotyledons, several of which are consumed by one larva, and spins a run way on the tops of a group of seeds when it reaches maturity. This is a different habit from that of *F. subgothica*. Efforts to rear these insects have not been successful. The mature larva is similar to a full-grown codling worm in color and form, but somewhat smaller. It is much less common than *subgothica*, and was present in a series of heads of common sunflower, and Jerusalem artichoke at Urbana.

The larvae of *F. subgothica* uniformly left the flowerets and heads of *Helianthus* while they were still in the first instar. In this instar they travel in a semi-looping manner, and are moderately clothed with rather long hairs. It was not possible to trace them after they left the flower head. No evidence could be found to show that they eat the leaves of *Helianthus*. The larvae exhibited a strong negative reaction to light in all their instars, which suggests that the small larvae get down to the ground and hide under plants or in the soil in the day time after forsaking the place of their origin. While tender foliage of *Helianthus*, including Jerusalem artichoke, was at hand they thrived on it in cages. They refused to eat the fleshy roots of the artichoke. After frosts killed the *Helianthus* the larvae were carried through on greenhouse lettuce without any difficulty. If there is a natural pause in development for the hibernation period it did not become apparent in the two lots of larvae reared to maturity under insectary conditions.

The larvae began to reach full size and fed less voraciously shortly before Christmas, having developed from eggs collected on September 11 and 15, 1930. During the first half of their larval stage they ceased to crawl in the semi-looping manner, and a row of V-shaped bars appeared on the upper surfaces of the body segments. As recorded by Doctor Forbes, the larvae enter the soil where they delay pupation for a considerable number of days. The pupal cells are oblong-oval in form and without silk lining. Those in my cages descended about two inches into the loose moist soil provided. There was not definite uniformity in the time of pupation or of emergence of the adults reared from a given lot of the same age. The first moth issued on January 20, from the first lot, and the first of lot two appeared on February 5. The dates of emergence have, of course, but little value because the rearing conditions were not natural. According to Forbes, this species passes the winter as partly grown larvae, and the adult normally appears chiefly in August and September. The moth was prone to remain quiet and sometimes appeared to feign death when disturbed in the cages during the day.

Aside from the interest in the oviposition habits of the moth and the food and habitat of the first instar larva, the choice of places for depositing eggs has significance due to its bearing on the economic importance of this moth. Various wild species of *Helianthus*, notably *tuberosa*, grow plentifully near Urbana along the fences separating fields, by the roadside, and on railroad grounds. If it is generally true that *Feltia subgothica*, and probably some of its close relatives also, are limited to the flowerets of *Helianthus* or similar wild Compositae for oviposition, infestations of cultivated crops may be expected to arise and be most severe at first in those parts of fields adjoining areas in which these plants are growing. Furthermore, it may reasonably be expected that the adult stage of the moth is concurrent with the blooming period of these *Helianthus* species selected for oviposition, and that only one generation develops annually in moth species with this oviposition habit. Should the moths be obligated in nature to deposit their eggs only in such flowers, the control of the cutworms could be effectively accomplished by keeping the borders, or neighboring areas, of fields free of the ovipositional plant. Professor Forbes (3, p. 27), speculating on the possible bearing of the place of oviposition on the subsequent damage by the larvae, writes that "there is some reason to believe that the moth may lay her eggs in fall among the succulent weeds in the corn field, particularly when a severe drouth has made the pasture and meadow lands less inviting. In accordance with this supposition these cutworms have not infrequently been found in early spring generally distributed through corn on old corn ground." Is it not probable that the spring distribution of this cutworm will prove to be through areas nearest the occurrence of *Helianthus?* Their taste for a great variety of plants probably also facilitates their spread from the *Helianthus* infested centers.

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MINUTES OF THE 427TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 427th meeting of the Society was held March 5, 1931, in Room 43 of the New National Museum. A. C. Baker, President, presided. There were present 47 members and 36 visitors. The minutes of the previous meeting were read, corrected, and approved.

S. A. Rohwer reported that a request had been granted from F. B. Colton, Editor, Associated Press Science, that his name be placed on the Society mailing list in order that an account of all the scientific papers of interest may be available to newspapers outside of Washington.

The first paper of the evening was by Mr. J. E. Graf, retiring President of the Society. The address was on "Some Problems in Entomological Administration."

This paper comprised a brief résumé of some of the more important considerations in the field of administration of an entomological organization comparable to the U. S. Bureau of Entomology. The introductory matter stressed the highly peculiar character of such a field, particularly the necessity for maintaining constructive cooperative relations with certain other designated organizations. In addition to routine work the necessity also was pointed out for contacts that must be made entirely outside the beaten path and illustrations of such were given. Then followed a discussion of the more fruitful types of investigation which profitably might be followed,—notably (1) a comprehensive investigation of the rôle of insects in transmitting diseases such as filterable viruses and various mosaics; (2) a program of work pertaining to biological control of insects, particularly the rôle of parasites and diseases in control of a given pest, the value of acclimatization, changed host relationships and new environments; (3) insect physiology also was pointed out to be a particularly difficult though promising field—in the near future its usefulness was indicated in the study of chemical control of pests; (4) developments in the increasing use of the term "ecology," such being not a new designation but merely a more exact use of an old subject bearing on the status of effect of climate and other environmental factors in insect development, the determination of the tolerance of insects to climatic changes, and the development of standards for the measurements of the more important considerations which make climate.

In summary it was stressed that "research is a gamble, good or bad, depending on the thought given to its planning and the intelligent care applied to its conduct." The standing of an administrator is determined from the character of the research in his charge as well as the direction of the more routine responsibilities in which he is enmeshed. The successful administrator should have the rare faculty of knowing people as well as problems, the real fruitage of successful administration being opportunity for service. (Abstract approved by author.)

Mr. Geo. P. Englehardt, of Brooklyn, N. Y., gave an informal talk on the Brooklyn Museum and his long connection with that institution. He mentioned the transfer of the collection of Lepidoptera from that museum to the U. S. National Museum. He spoke of the New York Entomological Society and its endownment of $12,000 for a publication fund; also the Brooklyn Entomological Society and its three main publications, viz., The Bulletin, The Glossary, and Entomologica Americana. There was mention made of the first three Directors of the Brooklyn Museum.

Mr. A. B. Gahan introduced a short systematic paper "On Certain Hymenopterous Parasites of Stored-Grain Insects," which will appear in the Journal of the Washington Academy of Sciences, by the following remarks: "I have been induced to present this paper before the society by three considerations: (1) To satisfy the cravings of the program committee for something filling and thereby to get them, temporarily at least, off my neck; (2) To demonstrate that in addition to his other accomplishments a taxonomist must be a detective, an international diplomatist, and an optimist; (3) To insure that the contents of this paper will be known in a general way at least to a few individuals aside from the four or five in the world who will be interested enough to read it. As to the first consideration, I can only hope that the committee will be so discouraged by this result of their effort that they will let me rest in peace hereafter. The second consideration needs some explanation. Apparently to some economic workers a taxonomist is a sort of up-to-date encyclopaedia which one has only to consult in order to find out all about some particular thing about which he knows nothing himself. If some lowly creeping thing arouses his idle curiosity by alighting on his hat, he immediately sends it to a taxonomist to find out what it is and whether by any chance it may be a wood infesting species. If the idea occurs to him that it might be interesting to know just how many pounds of animal matter on a given acre of soil is represented by insects, being perchance an ecologist with little else to do, he forthwith proceeds to trap, net, snare, or otherwise corral all of said insects and send them to a taxonomist for naming, for he must of necessity know their names in order to calculate how much they weigh. I am led to these conclusions by the amount and character of the material which comes to me. Since July 1, 1930, I have disposed of exactly 154 separate lots of parasitic Hymenoptera sent in for determination. On my desk at the present time are an even one hundred additional lots awaiting determination. These lots vary in extent from sendings of a few specimens to shipments comprising five Schmitt boxes. In character they run the gamut from specimens beautifully mounted and completely labelled with all data regarding host, locality, date, collector, etc., to specimens rolled up in a wad of glue in imitation of an amber fossil with such illuminating information as that they were collected while sunning themselves on the docks at New Orleans. Just why it should be necessary to know the name, habits, and ancestry of every microhymenopteron that happens to be unlucky enough to get caught trespassing upon a certain area of sugar beet field, pine forest, or piece of prairie sod at a given time is a mystery that has never been made quite clear to me. There are possibly close to a million species of parasitic Hymenoptera in the world, with possibly one-fifteenth of that number described. With perhaps a dozen individuals in the whole world professionally engaged in the classification and identification of these insects, it is easy to see what a simple matter the identification of such material becomes. As matters stand at present, the single chalcidologist at the British Museum and the one at the United States National Museum are probably handling more than half of the chalcidoid material collected the world over. What is true of taxonomists in parasitic Hymenoptera is true to a large extent, at least, of taxonomists in other groups. The professional entomological taxonomist today resembles nothing quite so much as a machine for grinding out names. Is it not clear that he needs must be an optimist not to become sunk in a sea of despond? The determination of a given species is not always a mere matter of squinting down the barrel of a microscope and coming up with a correct name. It sometimes requires considerable sleuthing as well as international cooperation, to say nothing of months of correspondence as will be demonstrated by the paper I am about to present." (Author's abstract.) Dr. N. E. McIndoo made some remarks on this paper.

Mr. J. E. Graf made a few remarks on the work being carried on by Mr. S. E. Crumb. This work is on the European Earwig problem in the West. Most of the work is being carried on at Portland, Oregon, and Seattle, Washington. A great deal of attention has been given to bait.

Mr. Lee A. Strong, Chief, Plant Quarantine and Control Administration, spoke briefly to the Society.

Mr. P. H. Timberlake spoke of the migrations of certain species of chalcid flies that have taken place through commerce. From New Zealand a species of *Bruchophagus* was sent to him for determination which had been reared from the seeds of hemlock and fennel, together with its parasite, a species of *Tetrastichus*. Through the help of Mr. Gahan, this *Bruchophagus* was determined to be *Systole geniculata* Förster, which is known to be an important enemy of aniseed in Europe. As fennel occurs in the Hawaiian Islands, it was thought that the *Bruchophagus* ought to occur there also. Consequently, Mr. O. H. Swezey of Honolulu was asked to look for insects in the seed of fennel and not many months later reported success in finding both a *Bruchophagus* and a *Tetrastichus*, which prove to be identical with the New Zealand insects.

Dr. J. M. Aldrich announced that a new Entomological Journal is to be established at Sao Paulo, Brazil, by Mr. Thos. Borgmeir.

Mr. James I. Hambleton, of the Bee Laboratory, Somerset, Md., made a few remarks to the Society. CHAS. T. GREENE,

Recording Secretary—pro tem.

REFERENCES TO MINUTES OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, 1918-1930, INCL.

Compiled by J. S. WADE.

By vote of the Entomological Society of Washington, at its 424th meeting, December 4, 1930, the Executive Committee was instructed to arrange for the publication of the minutes of the meetings of the society in its own Proceedings, beginning with January, 1931, thus conforming to procedure which has obtained from the first meeting, February 29, 1884, to the 305th meeting, January 7, 1917. Beginning with the 309th meeting, January 4, 1918, the minutes were published in the Journal of the Washington Academy of Sciences and this procedure continued to and including the 424th meeting, December 4, 1930. No printed copy could be located by the compiler of the minutes of the 306th, 307th, and 308th meetings other than brief notations in the Proceedings (vol. 19, pp. 2, 9) that given papers were presented at variously indicated meetings. The references which follow covering the period during which the minutes were published in avenues other than through the Society have been assembled in order that they may be preserved in the Proceedings, thus rendering such consecutive sequence more readily available for consultation in libraries throughout the world.

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PROCEEDINGS OF THE

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NOTES ON METEORUS (ZEMIOTES) NIGRICOLLIS THOMSON, AN OCCASIONAL PARASITE OF THE EUROPEAN CORN BORER.

By H. L. Parker.[1]
European Parasite Laboratory, U. S. Bureau of Entomology, Hyères, Var, France.

INTRODUCTORY.

This species was first described from Sweden. It has been taken in mugwort (*Artemisia vulgaris*) by the collectors of the European Parasite Laboratory, of the U. S. Bureau of Entomology, in northern and western France (North and South Sequanian zones and Armorican zone).

Meteorus nigricollis Thom. (Fig. 1, male), is a reddish hymenopteron about one-fourth inch long. The female, though similar to the male in other respects, has a protruding ovipositor. This species is distinguished from other braconid parasites of the corn borer, such as those of the genera Apanteles, Microgaster, Microbracon, etc., by its rather large, plump thorax, its petiolate abdomen, by the fact that it is several times as long as any one of these, and by its red coloring. It differs from *Macrocentrus gifuensis* Ashm. (the only one with which it is likely to be confused) by the fact that *M. gifuensis* is a slender, delicate, light-brown insect having an ovipositor as long as the body whereas *M. nigricollis* is stouter, of a reddish color, with the ovipositor shorter than the abdomen.

Meteorus nigricollis seems to be of no importance as a controlling factor of *Pyrausta nubilalis* Hbn. Since the first cocoon was taken in 1926, about two million larvae of *P. nubilalis* have been collected in the areas in which this parasite occurs and only 28 specimens of the Meteorus have been found.

SEASONAL HISTORY.

Little is known concerning the actual field activities of *M. nigricollis*. The cocoons have been found in the field from November to late March. It is probable that the eggs are laid

[1]The writer thanks Miss Esther Hart for her drawings of the adult and cocoon, and Dr. A. Roman and Messrs. C. F. W. Musebeck and R. A. Cushman for help concerning the identity of this insect.

FIG. 1. FIG. 2.

in the young host larvae in July and August, and that the larvae reach maturity and spin their cocoons in the fall, thus allowing for one generation each year. The host also has one generation per year in the above mentioned zones.

DISCOVERY AND BREEDING.

Our field collectors working in the vicinity of Tours, France, sent to the Hyères laboratory a single cocoon of this species taken from Artemisia in November, 1926. Although no host remains accompanied the cocoon, it attracted attention and was immediately placed upon the "suspicious" list. No adult issued from this cocoon. In March, 1927, another cocoon was received without host remains and no adult emerged from it. The next winter six cocoons were received from Paris, Lille, and Tours, still without host remains. No adults issued from any of these cocoons, and the writer began to despair of identifying this species. In January, February and March, 1928, several additional cocoons arrived, one of which finally produced an adult. As yet, however, there was no indication as to the identity of the host. The writer was unable to prevail upon the field collectors to procure the host remains with these cocoons. In the winter of 1928–29, one female, emerging in the laboratory on February 14, lived for 47 days and paid some attention to larvae of *P. nubilalis*, although she died without ovipositing. Finally, by offering pecuniary rewards, the writer obtained, in January, 1930, a cocoon accompanied by the host remains which was identified as a *P. nubilalis* larval skin. At about the same time two males and a female issued in the laboratory from cocoons collected on November 20.

The female just mentioned was given sugar water for food, and after a day's separation the males were placed with her. The males seemed to be sexually active at once. They started the usual "courtship" process peculiar to the parasitic Hymenoptera, i. e., fanning the female by rapid vibrations of the wings, at the same time bringing the body to an almost vertical position. They were allowed to remain with her until the next day and were then removed. Actual copulation was not observed because the female seemed to move around too rapidly. It is probable, however, that mating took place, as a female was later found among the offspring.

After seven days of feeding, a third-stage *P. nubilalis* larva was given to the female parasite upon a bit of leaf where she had been feeding. This attracted her attention and she immediately deposited an egg in it. About a dozen other small larvae were stung and then, the supply being exhausted, fully grown overwintering host larvae were offered to her. To the surprise of the observers she stung these as well. During the next seven days (March 1–7) forty-nine larvae were stung by this individual, 34 of which bore one egg each, and one of which, owing to long exposure, bore two.

This female died on March 7, after having lived 20 days.

Another female, which emerged in the laboratory on April 6, lived 29 days but laid only 3 eggs.

OVIPOSITION.

The act of oviposition is quite different from what might be expected of a rather nervous, fast moving insect.[1] Upon perceiving a host larva, the female immediately becomes still, and fixes her attention upon it as if "stalking" the prey. She moves towards the latter, evidently further excited or "inspired" by its slight movements, for when the host remains motionless no oviposition takes place. As she approaches the host the abdomen is brought forward under the thorax, the ovipositor pointing horizontally forward is apparently fondled by the mouthparts for an instant and then, guided continually by the sheaths,

[1]The act of oviposition in *M. versicolor* Wesm. is similar, according to Muesebeck (Jour. Agr. Research, Vol. XIV, No. 5, 1918, p. 201.)

it is slowly thrust forward much in advance of the female's head until the point touches the host. It is evidently inserted slowly and painlessly, as the host generally makes no movement during the insertion. After the egg is laid, however, the host seems to be aware of the withdrawal of the sting, for it gives a sudden lunge as if to free itself from this contact. After pulling the ovipositor out of the host, the female slowly straightens out her abdomen and moves away, apparently not anxious to continue. Oviposition therefore seems to be, at least in captivity, with *P. nubilalis* for host, a series of complete incidents each exactly similar in cause, execution and effect to the one immediately preceding it, and not, as is the case with certain other parasitic species such as the Campoplegines, a definite and prolonged searching for hosts with apparently no other preoccupation than to deposit an egg.

HATCHING, FEEDING AND GROWTH.

The parasitized larvae were isolated in vials at 20°C. and given the necessary care. Frequent dissections were made to observe the progress of development.

After 24 hours, the eggs were found to be in the blastula (Fig. 4) stage, the pedicel being practically empty; after four days, the embryo was formed, the egg being greatly enlarged and the chorion lined inside by a serosal membrane composed of more or less hexagonal cells containing rather large nuclei (Fig. 6). On the fifth day some larvae were hatched and others were still within the egg (Fig. 5) but turning and twisting, apparently scraping the walls of the egg with the mandibles and pushing with the tail in an effort to break out. When the larva finally breaks out it leaves the sack-like egg shell containing the serosal membrane floating free in the body cavity. Other eggs laid in full-grown host larvae hatched in seven days under the same conditions.

After ten days a larva was found to be still in the first stage with the mid-gut somewhat distended by a yellowish substance. At this point it was noted that the fat of the host was discolored (being slightly gray to violet) in spots and somewhat hardened. On the seventeenth day in one case, and on the eighteenth in another, parasite larvae were observed to be in the second stage with the skin of the first stage about half off the body. At this point the serosal membrane had become dissociated into isolated cells, which had floated out of the bag-like eggshell and, having increased in size, had become quite conspicuous in the blood of the host as large, round or oval cells with big nuclei.

No further observations were made until the twenty-first day after deposition, when the first cocoon was spun. Upon opening another host a last (probably third) stage larva was found.

At the same time it was noticed that nearly all the hosts were considerably discolored. Externally they were of a dirty brownish color. Internally the fat body, bearing apparent wounds in many places, was of a grayish violet color, while in the center of each "wound" were two small dark spots, probably the wounds made by the mandibles of the feeding first or third stage larva, as it holds with these appendages to the fat body in order to suck out the fat. In addition the pericardial cells were strongly stained, being a rusty brown color and standing out most distinctly against the whitish muscles.

In the case of *Eulimneria crassifemur* Thoms., an ichneumonid parasite of *P. nubilalis*, it has been noted in an earlier publication[1] that where several eggs are laid in one host, only one larva lives and the others die. It was further pointed out that the death of the supernumerary larvae was probably not due entirely to combats between them, but that there was reason to suppose that the earliest feeding larva poured some substance, perhaps a cytolytic enzyme, into the host's blood, thus causing the death of the younger larvae or eggs. Paillot,[2] without giving any further hypothesis on the subject, says that this is not so. It would seem to the writer, from these observations on Meteorus, that the feeding parasite does pour some substance into the blood of the host and that this substance, whatever it be, discolors the fat, and as the host larva tries to purify its blood by excretory activities the pericardial cells become highly colored with it. It must be pointed out that occasionally, though very rarely, the discolored condition of the pericardial cells will be observed in *apparently* unparasitized larvae from the field. Whereas in the writer's experiments every larva bearing a parasite was so discolored, the discoloration of the fat in the manner hereinbefore described has never been seen in unparasitized larvae.

It may be pointed out in this connection that Balduf[3] states that when an egg of the parasite of *Dinocampus coccinellae* Schrank is laid in a host coccinellid which is already occupied by a well-established larva of the same species, the larva hatching from the last egg does not live longer than the first instar.

In addition to the state of affairs previously described, the body cavity of a *P. nubilalis* larva contains a great quantity of the Meteorus serosal cells, now much larger than they were when observed on the seventeenth day. These cells, whose structure is

[1]Thompson, W. R., and H. L. Parker. U. S. Dept. Agr. Tech. Bul. No. 58, 1928.

[2]Paillot, A. In International Corn Borer Investigations, Scientific Reports, Vol. 1, 1928, Chicago.

[3]Balduf., W. V., Ann. Ent. Soc. America, Vol. XIX, 1926, p. 478.

shown in Fig. 7, are spherical in form and are lodged singly and in groups among the organs and tissues of the host. It is not known whether or not these cells reproduce by division. None were seen dividing in the sectioned material. It is apparent, however, that they have the power of growth by the absorption of materials from the host's blood. In this respect they are comparable to the trophamnios in certain Platygasters and other parasitic Hymenoptera, some of which reproduce by polyembryony. They also resemble in general structure the pseudogerms or trophamniotic fragments of *Macrocentrus gifuensis*, a polyembryonic braconid.

In résumé, the time required for the development of this species at 20°C. is about as follows:

From egg to first stage	5– 7 days.
From egg to second stage	17–18 days.
From egg to cocoon	24 days.
From cocoon to adult	21 days.
Average time for development	45 days.

After the completion of internal feeding the parasite larva pierces the host skin and works its way out, leaving the host carcass about half empty. This carcass invariably turns black. The parasite larva sometimes constructs its cocoon near the old host skin, but more often it moves away a short distance before spinning. The cocoon is completed in about twenty-four hours.

Generally, Meteorus cocoons are suspended from the leaves or twigs by a short thread. Such is not the case with this species, however, as they are spun in the tunnel of the host larva.

Several days after spinning, the blackish larval meconium is cast within the cocoon, the insect pupates, and after about twenty-one days (15 days at 25°C.) the adult chews off a small cap at the more sharply pointed end of the cocoon, and emerges. Fig. 2.

In the material considered in this work there were 16 individuals for which it was possible to determine the sex, 15 males and 1 female, of which 3 males reached the adult stage and 12 were determined from larvae in the second or third stage.

DESCRIPTIONS OF IMMATURE STAGES.[1]

Egg (Plate 2, Fig. 3).—Length 0.47 mm., width 0.079 mm., club-shaped, arched, translucent, whitish, without spines or tubercles.

[1]As the internal anatomy of the larva of *Meteorus nigricollis* is similar to that of many other braconid larvae described elsewhere, the writer considers it sufficient for this paper to describe and illustrate the larval organs in *grosso modo*.

First stage larva[1] (Fig. 8).—Length 1.3 mm., composed of a broad, heavily chitinized, dark head capsule (Fig. 10, followed by nine more or less equal, cylindrical body segments and a tenth which is prolonged into a pointed tail slightly more than half as long as the first nine segments together. A pair of sharp, curved mandibles (Fig. 9) and a pair of inconspicuous labral papillae are present (Fig. 10 *lbrp*). The tracheal system is composed of a longitudinal trunk on each side of the body, connected anteriorly by a dorsal commissure; a branch extends into the head from each trunk. There are no ventral commissures, spiracles, or segmental branches. There are no spines or setae on the cuticle.

Second stage larva (Fig. 11).—Length 4 mm. The larva of this stage has changed considerably in appearance from that of the earlier stage. It has a more or less hemispherical head, whitish like the rest of the body, and ten more or less equal body-segments, the last of which is very slightly pointed ventrally to the anal opening. The mandibles are not apparent or are not at all chitinized. The mouthparts are, however, differentiated into labrum, maxillae, and labium. The body, owing to the presence of large lobes on each segment, is not cylindrical but appears somewhat flattened dorsoventrally; there are no spines on the cuticle. The internal organs are easily visible; the mid-gut, filled with a yellowish creamy substance, is distinctly separated from the hind-gut by a short constriction; the salivary glands (Fig. 11, *sg*) consist of two long, tortuous tubes on each side of the mid-gut extending almost its entire length; the Malpighian tubes (Fig. 11, *mt*) are two thin wavy tubes lying ventrally, one on each side of the nerve chain, and extending from the hind-gut forward to the second abdominal segment; the fat body consists of a thin layer of small cells between the mid-gut and the muscles and between these and the hypodermis, a few tiny white urate cells can be seen distributed among the fat cells; the tracheal system is similar to that of the first stage, except that there is now a dorsal and a ventral branch in each segment; the integumental muscular system (Fig. 12), the reproductive gonads, imaginal discs, and heart are of the usual braconid types.

Third stage larva (Fig. 13).—Length 5 mm. Subcylindrical, slightly flattened and arched dorsoventrally; tapering slightly at both ends, composed of head and thirteen segments; color grayish white.

The head (Fig. 14) is almost hemispherical, bearing dorsally two rather large round spots in the center of which is a sensory papilla representing the antennal rudiments (Fig. 14, *ant*); the mouthparts are somewhat more distinctly delineated than in previous stages, having the labrum, maxillae, and labium separated by brownish sutures; the mandibles are again apparent (Fig. 14, *md*), and various sensory papillae are present on the labrum, maxillae, and labium; the head is covered with small rugosities, and underneath the labium there are many tiny cuticular spines and tubercles.

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[1]Other meteorus larvae of the first stage have been described by Muesebeck (Jour. Agr. Research XIV, No. 5, p. 202. 1918) and Strickland (Dom. Canada Dept. Agr. Bul. 26, N. S., p. 6, 1923), and they are similar to that of *M. nigricollis*.

Silvestri (Bol. del Lab. di Zool. Gen. e Agr. XVI, p. 241. 1922. Portici) figures a larva somewhat similar in outline to that of *M. nigricollis* and supposes it to be that of *Meteorus cinctellus* Nees. From a study of the head characters it seems certain that this larva is an ichneumonid.

GENERAL ANATOMY.

The body is almost entirely covered by tiny cuticular spines, except for the intersegmental lines and small areas around the spiracles; small hardened discs are present externally opposite the imaginal buds of the legs, wings, and external reproductive organs.

The internal anatomy is very similar to that of the second stage. The mid-intestine is full of food material and occupies the greater part of the body cavity; it does not communicate with the hind-gut, which is a short flask-shaped organ in the extreme posterior end of the larva; the salivary glands and Malpighian tubes are somewhat thicker than in the second stage but retain the same general form and disposition; there are only a few dozen urate cells and they are very small; the tracheal system is similar to that of the second stage except that there are nine pairs of spiracles open on segments II and IV to XI, and the segmental branches are much ramified; the ventral branch divides shortly after leaving the lateral trunk into two almost parallel branches extending ventrally along or near the anterior intersegmental line. There is a stub of a spiracular branch in segment III, but no spiracle; there are no ventral commissures, not even posteriorly, as is the case with certain other braconids such as Macrocentrus, Microbracon, etc.

LIMITING FACTORS.

Our knowledge concerning *M. nigricollis* is extremely limited. Few observations have been made upon its activities in the field, and the number and variety of its hosts are unknown to us.

It would seem logical, in view of the fact that the females show a certain reluctance to oviposit in *P. nubilalis* larvae, to conclude that this species is not the usual host of *M. nigricollis*. The scarcity of this insect as a parasite of *P. nubilalis* would further warrant such a conclusion.

It is noted in this connection that the corn borer is an *efficient* host for this species in the sense that when eggs are deposited in it they hatch and grow to maturity easily. In 25 cases upon which it was possible to make observations, only one egg died within the host while 24 hatched. Ten of these were later killed for study and fourteen reached the fully grown larval stage. It can not therefore be maintained that *M. nigricollis* is not "adapted" to live in the larva of *P. nubilalis*.

If, however, *P. nubilalis* is the principal host of *M. nigricollis*, then it is not improbable that its scarcity can be accounted for, at least partially, by a certain inherent weakness in this species. In any case the remarks that follow would apply to *M. nigricollis as a parasite of P. nubilalis*.

Before going into the explanation of the above-mentioned "inherent weakness" in this species it is well to summarize the data upon the fate of the eggs laid in the laboratory:

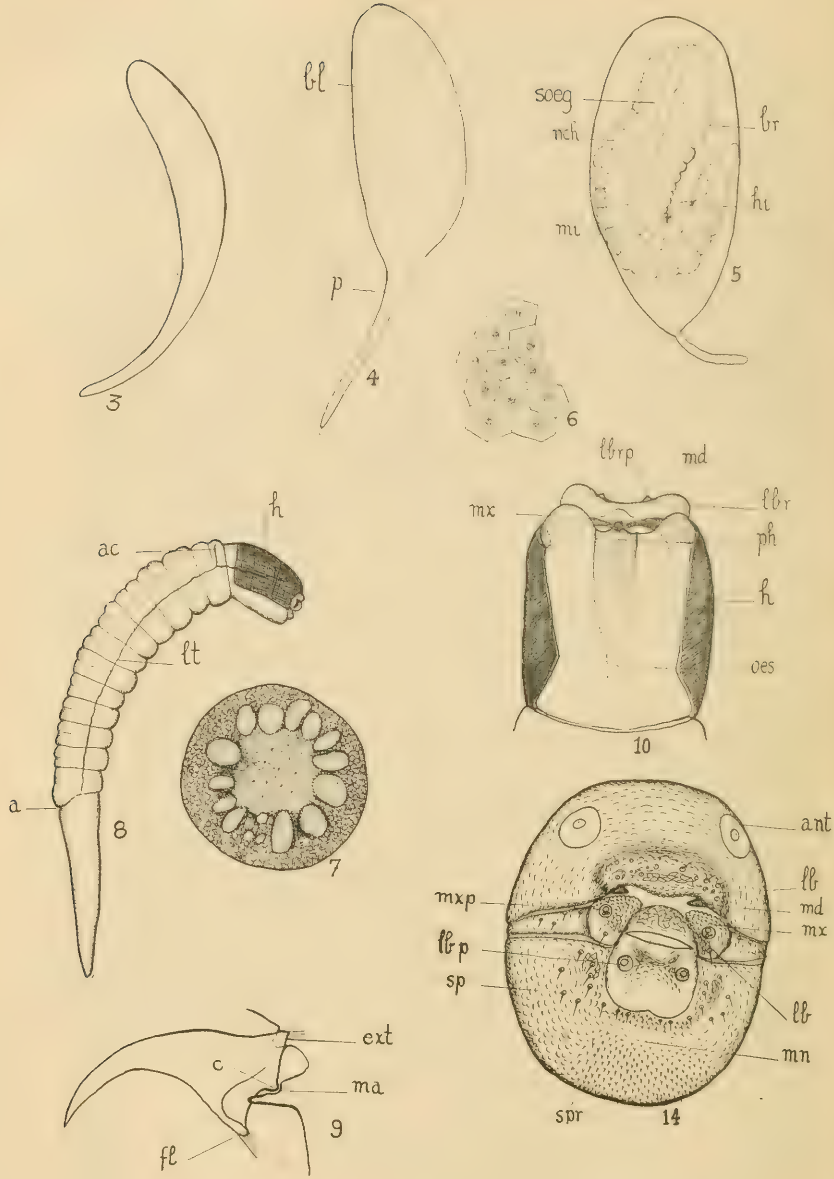
35 eggs were laid; 1 egg was found dead in host larva; 16 eggs and young larvae were fixed for study; 3 last-stage larvae issued from host larvae and were fixed for study; 11 larvae issued from host and died without properly defecating; 11 individuals spun cocoons completely; 1 died in cocoon after defecation; 3 individuals issued as adults.

The large proportion of larvae dying in the fully grown stage can be accounted for by their failure to defecate properly. This is the constitutional weakness referred to above. As is well known, in the parasitic Hymenoptera there is no communication between the mid-intestine and hind-intestine until just about pupation time, when the wall separating the two is broken down and all the accumulated materials are then voided simultaneously. These eleven larvae of *M. nigricollis* were unable to break down this wall and expel their feces.

Examination of the larvae showed that metamorphosis was well under way. The histoblasts of the antennae, legs, wings, and external reproductive organs were greatly lengthened and developed to the point where they bore a resemblance to the corresponding imaginal organs; the wall of the adult intestine was being formed and the larval wall was seen to be shedding its old cells to the interior. The junction between the mid-intestine and hind intestine was blocked by a bunch of these old cells, some of which had been forced out into the anterior part of the hind-intestine.

The general appearance of a larva in the above condition is a somewhat unhealthy yellowish color, against which the dark contents of the mid-intestine show prominently. Some desultory spinning is done by larvae in this condition, movements become slower, and in about 30 to 40 days after emergence from the host the larva is dead or dying.

These observations probably shed some light upon the failure to procure adults from a number of cocoons received in the laboratory, as set forth in the earlier part of this paper, and seem to the writer to be the most plausible explanation for its scarcity as a parasite of *P. nubilalis.*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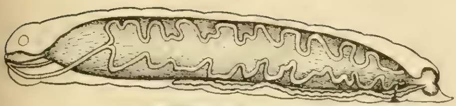

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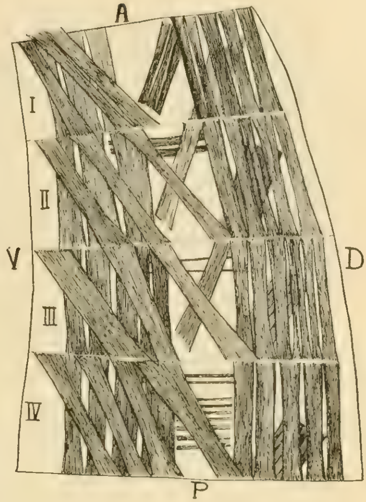

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Explanation of Plate 2.

Fig. 3. Newly laid egg.
Fig. 4. Egg in blastula stage.
Fig. 5. Larva about to hatch, same scale as figs. 3 and 4.
Fig. 6. Aspect of the serosal membrane.
Fig. 7. Serosal cell after hatching of larva, enlarged.
Fig. 8. First-stage larva.
Fig. 9. Mandibles of first-stage larva.
Fig. 10. Head of first-stage larva.
Fig. 11. Second-stage larva.
Fig. 12. Integumental muscles of Segments I–IV of larva.
Fig. 13. Last-stage larva.
Fig. 14. Head of last-stage larva.

THE LARVA OF BOROS UNICOLOR SAY AND THE SYSTEMATIC POSITION OF THE FAMILY BORIDAE HERBST.

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INTRODUCTION.

The larva of *Boros unicolor* Say is one of numerous species that were collected by Dr. F. C. Craighead and the writer from beneath the bark of several dead shortleaf pine trees in the Pisgah National Forest, near Asheville, North Carolina, in August, 1926.

At the time infested sections of wood containing larvae were caged out of doors. In June, 1927, when the writer next visited the locality, the larvae had transformed to imagines. A series of reared specimens were determined by W. S. Fisher, of the division of taxonomy and interrelations of insects, U. S. Bureau of Entomology, as *Boros unicolor* Say.

Subsequent collections of larval material by the writer revealed that *Boros* attacks pine trees within two to three months after the death of the trees and continues to infest them for a period of over three or four years. There is apparently only one generation a year. Trees are selected that have retained some of their moisture; and because those killed by the southern pine beetle dry rapidly near the top, most of the *Boros* larvae are usually concentrated in the lower portion of the trunk where more moisture is present.

The larvae probably feed upon decaying vegetable matter that is found beneath the bark of the trees. Many larvae of various sizes have been found together in the same tree, indicating that repeated infestation occurs over a long period of time.

Leonard (*8*)[1] states that adult beetles of *Boros unicolor* have been taken in New York State in the months of February, March, April, and November, and Blatchley (*1*) records one specimen which was removed from beneath the bark of pine in Indiana in October.

DESCRIPTION OF THE MATURE LARVA OF BOROS UNICOLOR SAY.

Length, 27 mm.; color testaceous, with head, thorax and eighth and ninth abdominal segments darker; mandibles, antennae, tips of claws, and ninth abdominal segment piceous; anterior and posterior margins of prothorax, and posterior margins of the following ten segments longitudinally, very finely striated; tergal shields of all thoracic and of the first eight abdominal segments with a light median longitudinal suture; anterior portion of tergal shields of mesothoracic and all of the following eleven segments smooth, shining, and ornated with a transverse, somewhat curved, medianly obliterated, linear depression with a raised anterior margin. Larva elongate, with sub-parallel sides, decidedly depressed, about nine times as long as wide (Plate 3, fig. 7); ninth abdominal segment movable up and down, plate-like, with falcate, slightly incurved urogomphi. Head, thorax, and abdomen sparsely furnished with setae, present mostly on the lateral and posterior margins of thorax and abdomen.

Cranium rounded (Plate 3, figs. 1 and 2), nutant, exserted, about two-thirds as long as wide (from posterior margin of labrum (*lab*) to the occipital foramen), broadest medianly, sharply curved posteriorly, dorsally and ventrally more or less flattened; a few reddish setae present.

Frons (*f*) fused with clypeus (*cl*), together constituting five-sixths of length of cranium; limited by a lyriform frontal suture; on each side with one seta in the margin immediately behind labrum, one near base of antenna, and one near each of the tentorial pits (*tp*).

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[1]Numbers in parenthesis refer to literature cited.

Epicranial halves separated dorsally by a short epicranial suture and ventrally by the gula (*gu*) plus the posterior part of the submentum (*sm*); each epicranial half dorsally with one seta near basal membrane of antenna, one seta in the ocellar group, one seta near the frontal suture between tentorial pit and anterior end of epicranial suture, and several minute setae near occipital foramen; ventrally on each side with one long seta near anterior margin of basal membrane of antenna, one long seta near end of hypostomal margin, and one long seta at margin of ocellar group; side margins of head posteriorly with one small seta.

Gula (Plate 3, fig. 1, *gu*) distinct, subtrapezoidal, wider than long, widest posteriorly, with a small sclerotized plate in the center, and with membranous margins laterally.

Labrum (figs. 2 and 10, *lab*) testaceous; movable; well developed, transversely subrectangular, one-third wider than long, anterior margin slightly convex, anterior corners rounded; disc between center and lateral margins with one long seta on each side, and more laterally with one short seta near the margin; along anterior margin with four dorsally placed setae on each side, and with four rather short and slightly curved setae ventrally on each side (Pl. 4, fig. 11).

Ocelli contiguous to basal membrane of antenna; distinct; five on each side of head, arranged in two groups; three in an anterior and two in a posterior group (Pl. 3, fig. 2).

Antenna attached to a distinctly colored rim immediately behind the dorsal mandibular fossa (Pl. 3, fig. 1); basal antennal membrane (fig. 2, *bm*) well developed; three antennal articles present, all ferrugineo-testaceous; anterior portion of each article rather membranous; basal article subcylindrical, about three times as long as wide, and about one-fourth longer than the second article; second article apically on ventro-lateral side, bearing a minute supplementary appendix beside the apical article; apical article cylindrical and only about one-half as long as the second one; all three articles with numerous minute setae along the sides and, in addition, with a transverse series apically placed along the edge of the membranous portion.

Mandibles dark; slightly asymmetrical; both apically trifid (Pl. 3, figs. 3 and 4, a^1, a^2, a^3), each with two additional teeth along the cutting edge between apex and molar part (*m*); molar part of left mandible anteriorly with a strong conical projection (fig. 4, *m*); molar part of right mandible (fig. 3, *m*), with a similar but smaller and more flattened projection; grinding surfaces of both mandibles facing each other, and both slightly carinate; cutting edge on ventral surface slightly excavate; molar portion of right mandible, in addition to the described grinding surface, with faint asperities on the ventral side (only seen with the aid of the compound microscope); back of mandible rounded opposite the cutting edge and the molar part, and bearing one seta anteriorly and one posteriorly.

Maxilla dorsally almost completely covered by the mandible (Pl. 3, figs. 1 and 6); quite well sclerotized except apically where rather membranous along the outer margin; palpiger (*pag*) small, indistinctly separated from stipes (*sti*), and rather membranous; near its exterior margin with a seta; palpus (fig. 6, *mxp*) surmounting mala by about one-third of its own length; with three articles, all testaceous, anterior portions rather membranous; basal article clavate, about one-third of the entire length of palpus, nearly as long as wide, near apex on outer side with two small setae; second article subcylindrical, slightly wider than long, apically with one or two setae; distal article slightly conical, longer than wide, about twice as long as distal article of labial palpus, with soft tip bearing several tactile hairs.

Mala testaceous; fused with stipes; obtuse, with slight terminal incision near the inner margin (Pl 3, fig. 6, *ma*); dorsally in the anterior part of the inner margin with a continuous series of well developed, somewhat curved, strong setae, rest of the dorsal surface without setae; ventrally in anterior part of inner margin with several spine-like setae, especially strong and more or less amalgamated at the corner-projection of the mala; in addition with one long seta along median portion of exterior margin near anterior portion of palpiger.

Stipes (figs. 1 and 6, *sti*) well sclerotized, slightly darker along exterior margin; two well developed setae present on ventral side, one near the middle of the interior, and one near the middle of the exterior margin; in addition with one small seta on the dorsal side near the middle of the exterior margin.

Cardo (*ca*) well sclerotized, subrectangular, slightly longer than maxillary palpus, divided into two parts, disti-cardo anteriorly and proxi-cardo posteriorly; inner margin of disti-cardo adjacent to the maxillary articulating area (*mar*).

Maxillary articulating area (*mar*) slightly protuberant, membranous, indistinctly divided into three parts.

Submentum (fig. 1, *sm*) well sclerotized, trapezoidal, broadest posteriorly; side margins slightly concave and adjacent to the maxillary articulating area anteriorly, convex posteriorly; on each side bearing one long seta near end of transverse middle line.

Mentum (fig. 1, *me*) lightly sclerotized, particularly in the posterior half; slightly wider than long, cup-shaped, side margins free; on each side of posterior half with one short seta.

Prementum fig. 1, *pm*) lightly sclerotized, indistinctly separated from ligula (*li*); without setae.

Labial palpus (*lp*) about half as long as maxillary palpus; with two articles; each article testaceous, with the anterior portion rather membranous; palpifer (*paf*) indistinctly separated from the rest of the premental area (*pm*), apically on inner margin bearing a single seta; basal article of palpus cylindrical, about twice as wide as long; apical article conical, slightly longer than wide, apically with soft tip bearing minute tactile hairs.

Ligula (Pl. 3, fig. 1, *li*) slightly testaceous, broadly conical, as wide as long, on each side with about three setae and many tactile hairs along the margin and on the buccal surface (Pl. 4, fig. 16, *li*).

Prehypopharynx (fig. 16, *prh*) simple; membranous, with side margins slightly sclerotized posteriorly; whole surface covered with tactile hairs (which can be seen only with aid of compound microscope).

Posthypopharynx (*poh*) composed of median anterior area, a median posterior hypopharyngeal chitinization, and a pair of postero-lateral areas. Median anterior area (fig. 16, *mea*) membranous and without tactile hairs. Median posterior sclerome (fig. 16, *hsc*) not projecting, transverse, supported by sclerotized rods. Paired postero-lateral areas generally membranous, slightly sclerotized posteriorly.

Epipharynx (Pl. 4, fig. 11, *eph*) soft skinned, with heavily sclerotized side margins and with a posterior, transverse, broad sinuous, sclerotized band (*tb*); with two elongate patches of minute teeth (t^1) extending posteriorly from the middle of the sclerotized band toward oesophagus; immediately behind the teeth with eight sensory punctures (so^2), in front of the teeth (t^1) with two tiny sclerotized hooks (*h*), and immediately in front of the hooks with eight more sensory punctures (*so*); rest of epipharynx beset with tactile hairs.

Legs inserted widely apart; well developed and all of about the same size; each leg consisting of five articles, tarsus and claw fused into a tarsungulus (Pl. 4, fig. 13 and pl. 3, fig. 5). Coxa (Fig. 13, *cox*) somewhat membranous, subrectangular, wider than long, bearing a few short setae; trochanter (*tr*) slightly testaceous, about one-fourth longer than wide, with a few moderately long or short setae; femur (*fe*) testaceous, with posterior face slightly darker, about one-fifth longer than wide, sparsely armed with setae, one of which is much longer than the rest; tibia (*ti*) testaceous, twice as long as wide, with some short and fine setae all over, and distally with a few long setae; tarsungulus (*ta*) strong, with a broad, testaceous basal part and a falcate, piceous tip, two setae present near base.

Prothorax subquadrate, about one and one-half times as long as head (Pl. 3, fig. 7). Prothoracic presternum (Pl. 3, fig. 5) lightly sclerotized, very large and divided into two subtriangular lateral parts (y^1) and a subspatulate median part (y^2); each lateral part with one anterior and one posterior minute seta, median part without setae. Eusternum (*eu*) and sternellum (*stl*) rather membranous; eusternum situated in front of the legs, sternellum behind them; eusternum apparently separated into two parts by posterior end of presternum; sternellum unpaired, transverse; eusternum without setae, sternellum with one pair of minute setae. Poststernellum (*z*) lightly sclerotized, large, subtriangular, widest anteriorly. Prehypopleural and posthypopleural areas (h^1 and h^2) both present, very lightly sclerotized; prehypopleural area particularly well developed and internally adjacent to the presternal area; each prehypopleural area with a minute seta; the posthypopleural areas without setae. Epipleurum consisting of a small pre-epipleurum (ep^1), internally adjacent to the presternal and prehypopleural areas, an elongate narrow medio-epipleurum (*ep*) and a small, triangular post-epipleurum (ep^2). Prothoracic tergal shield (Pl. 3, fig. 7) subquadrate; in each anterior corner bearing two setae, and posteriorly near median suture a single, minute seta.

Mesothorax and metathorax subrectangular, somewhat wider than long, not fully as long as prothorax. Presternal areas (*y*) of both segments paired, small, subtriangular, and separated by the poststernellum of the preceding segment; each presternal area with two minute setae. Eusternum of both segments (Pl. 3, fig. 5, *eu*) indistinctly separated from sternellum (*stl*), testaceous, subquadrate; with two small setae anteriorly and one posteriorly. Sternellum (*stl*) subquadrate; one seta medianly on each side. Poststernellum (*z*) of mesothorax subrectangular, transverse, with one seta medianly on each side; poststernellum of metathorax absent. Prehypopleurum (h^1) well developed, with a small sclerome near the condyle for the articulation of the leg; posthypopleurum (h^2) present. Pre-epipleural area of mesothorax (ep^1) with a large spiracle facing dorso-laterally, pre-epipleurum of metathorax with a vestigial spiracle; two minute setae present on each area; medio-epipleural (*ep*) and post-epipleural (*ep*[2]) areas about as in the prothoracic segment. Mesothoracic and metathoracic tergal shields (fig. 7) sclerotized, subrectangular, only slightly wider than long; mesothoracic shield with a small thickening anteriorly in the middle, both shields with a transverse linear elevation inside of and parallel with the front margin; terga of both thoracic segments with the setae arranged as in the prothorax.

First seven abdominal segments built alike, all transversely subrectangular. Sternal areas almost fused and rather well sclerotized; hypopleural and epipleural areas rather membranous, longitudinal and narrow; tergal areas (Pl. 3, fig. 7 and Pl. 4, fig. 12, *ter*) covered by a transversely rectangular shield, anteriorly marked by a medianly broken, transverse, linear impression extending from near the median suture to the lateral edge of the shield, passing in front of the spiracle where the impression is somewhat indistinct; shield marked posteriorly along the lateral margin by a longitudinal impression extending the length of the segment. Setae of the first seven abdominal segments arranged alike. On each side of sternum only one seta, placed postero-laterally (Pl. 4, fig. 12, *ster*); hypopleurum with a few minute setae in an anterior transverse series and a few minute ones in a posterior transverse series (fig. 12, *hp*); epipleurum (*ep*) without setae; tergum (*ter*) with one seta in front of spiracle below the longitudinal impression and in front of the faint lateral end of the transverse impression, one seta posteriorly below the longitudinal impression, one seta antero-medianly behind the spiracle and above the longitudinal impression, two setae posteriorly, close together, just above the longitudinal impression, and one seta paramedian, close to the posterior margin of the shield.

Eighth abdominal segment longer than any of the first seven abdominal segments and twice as long as the subsequent ninth, excluding the urogomphi. Sternal area of eighth abdominal segment, rather well sclerotized, elongate and narrow (Pl. 3, fig. 8, *ster*), hyplopleural (*hy*) and epipleural (*ep*) areas slightly sclerotized, hypopleurum wider than in the preceding segments; tergal area covered with a shield, marked on each side with an anteriorly convex, transverse impression and with a straight longitudinal impression. Sternum without setae; hypopleurum with four small setae along the posterior margin; and two along the inner margin; epipleurum and tergum with setae as in the preceding segments.

Ninth abdominal segment smaller than eighth; movable in directions up and down. Venter of segment consisting of an anterior and a posterior part; anterior part membranous, with a series of small plates on both sides of the tenth segment; posterior part large, subtriangular, heavily sclerotized, and divided longitudinally by a median suture (Pl. 3, fig. 8, *IX* and *X*). A posteriorly somewhat projecting and hook-shaped pair of the small plates present nearest to the tenth segment and surrounding it, possibly supporting the body when the posterior large plate is moved upward; also a sclerotized, posteriorly directed pit present at the base of each urogomphus. Tergum of segment one-half the length of the eighth abdominal tergum, plate-like, heavily sclerotized with the exception of a median longitudinal suture and a small anterior membranous portion connecting it with the shield of the eighth abdominal segment; anteriorly with a lobe-like projection on the lateral margin; posteriorly projecting into a falcate urogomphus, curving inwards; between urogomphi an unpaired median subtriangular projection (figs. 7 and 8). One seta present on the small plate surrounding the tenth segment, rest of small plates without setae; large posterior ventral plate with a small seta medianly on each side; lobe-like projection of tergum with one long and one short seta (fig. 7); each urogomphus with one long seta near base on inner margin, two long setae dorsally and two more ventrally near the tip, and several soft hairs along inner margin.

Tenth abdominal segment (Pl. 3, fig. 8, *X*) ventral, membranous, trilobed. Area surrounding lips covered with minute setulae.

Spiracles (Pl. 3, fig. 9) annular, with oval mouthpiece, transversely directed, cup-shaped, sides provided with minute tubercles, at bottom with a linear opening. Thoracic spiracles located dorso-laterally in the pre-epipleura; the mesothoracic ones large, the metathoracic vestigial. Abdominal spiracles dorsolaterally placed in the tergal shields immediately behind and below the point of intersection between the transverse and longitudinal linear impressions of the shield.

COMMENTS.

The genus *Boros*, of which *Boros unicolor* is the only American species, is rather aberrant both in the imaginal and larval stages.

Based on the characters of the imagines this small unit has been classified very differently from time to time. In 1797 Herbst (*4*) created the genus, called it *Boros* and gave his type specimen the specific name *elongatus*, but in so doing overlooked the fact that Panzer (*11*), in 1796, already had given it the specific name *schneideri*. Thus his new specific name became a synonym. In 1827 Say (*13*) described the North American species *Boros unicolor* and in part commented as follows: "I received this insect from Dr. J. F. Melsheimer under the name I have adopted. It is certainly very closely allied to *B. elongatus* Herbst." In 1872 Motschulsky (*9*) described another species, *Borocus*[1] (= *Boros*) *sibericus* from Siberia. In 1854 Mulsant (*10*) included *Boros* in the Tenebrionidae ("Tenebrionides") between *Bius* and *Calcar*, and in 1858 Redtenbacher (*12*) likewise placed this form near the position assigned to it by Mulsant. In 1859 Thomson (*15*) made the genus *Boros* the type of a new family, Boridae, and placed this between the Tenebrionidae and the Alleculidae (Cistelidae). However, at the suggestion of LeConte (*6*) he later changed its systematic position to near the families Salpingidae and Pythoridae in his "Phalanx II." LeConte, in 1862, regarded *Boros* as a genus of the family Pythidae, tribe Pythini, and placed it just before the genera *Crymodes*, *Pytho*, and *Priognathus*. Since then it has been included as a genus either in the Pythidae or in the Tenebrionidae. Henshaw (*3*) and Blatchley (*1*) have it in the Pythidae, Gebien (*2*) and Leng (*7*) in the Tenebrionidae, subfamily Tenebrioninae. Kiesenwetter and Seidlitz (*5*) noted that *Boros* did not conform to the rest of the Tenebrionidae.

[1]*Borocus*, a new name, is apparently a lapsus for *Borus* since Motschulsky does not include the name in his key to genera in the preceding pages.

The larva of *Boros unicolor* shows definitely that the genus can not be placed in the Tenebrionidae. The larvae of the Tenebrionidae, whose taxonomic relationship was first treated by Schiödte (*14*), are defined by the following family characters: Body never depressed, prothoracic coxae with apices contiguous (except in a few genera), clypeus and labrum distinct (Pl. 5, figs. 14 and 17), cardo simple (Pl. 5, fig. 15, *ca*), and sternum of the ninth abdominal segment without a series of asperities or of sclerotized plates. None of these characters are common to *Boros*, as is evident from the above-given description of the larva of *Boros unicolor*.

To the larvae of the Pythidae, however, the larva of *Boros* is very closely related, and also to the larvae of the Pyrochroidae and Othniidae. Like the larvae of all of these three families it has a very depressed body, the prothoracic coxae are widely separated, the clypeus is fused with the frons, and the cardo is divided into two parts (Pl. 3, figs. 1 and 6).

The mandible of *Boros*, which has a trifid apex, a cutting edge bearing two additional teeth, and a mola with carinate surface, likewise indicates close relationship to all of the three mentioned families, but particularly to the Pythidae and Pyrochroidae, because the larvae of the Othniidae possess teeth on the grinding surface of the mola, which is not the case in the Pythidae (fig. 19) and the Pyrochroidae. The hypopharynx of *Boros* resembles in general that of all of the three families, but is most nearly built as in the Othniidae. The epipharynx of *Boros* (fig. 11), on the other hand, is more similar to the epipharynx of the Pyrochroidae than to the epipharynges of the other two families. Also in regard to the structure of the eighth and ninth abdominal segments *Boros* resembles the Pyrochroidae mostly; both in *Boros* and in the Pyrochroidae the tergum of the eighth abdominal segment is about twice as long as that of the ninth (urogomphi not included), and there is a pair of pits in the margin between the bases of the urogomphi; in the Pythidae and the Othniidae, on the other hand, the eighth and ninth abdominal terga are subequal in length and only one pit is present in the margin between the bases of the urogomphi. In a very essential character *Boros* differs from the Pyrochroidae, the ninth abdominal sternum being provided with a row of sclerotized plates in *Boros* (fig. 8) but with a row of asperities, arranged in a continuous arch, in the Pyrochroidae (Pl. 4, fig. 23).

Considering the above-mentioned structural differences it is quite evident that the genus *Boros*, although closely related to all of the three discussed families, can not be included in any of them, and possesses sufficient distinguishing characters to warrant its being recognized as the larval type of a separate family. The characters of the larva thus lead to the same conclusion which Thomson (*15*) reached in 1859 through his study of the characters of the imago, and substantiates the correctness of his classification of the Boridae as a separate family.

For the larval form of the Boridae the following family definition is outlined. It is based exclusively on the characters found in the mature larva of the species *Boros unicolor* Say, the larvae of the other species of the genus being unknown.

FAMILY BORIDAE HERBST

Larva elongate, depressed, with sub-parallel sides, well sclerotized, smooth shining, with few and short setae, color testaceous. Head extended. Labrum distinct; clypeus fused with frons; on each side with five ocelli, arranged in two transverse groups; antenna contiguous to mouth-frame, consisting of three setiferous articles, the second bearing a minute apical supplementary appendix. Mandibles slightly flattened, asymmetrical, with apex tridentate, cutting edge bearing two additional small teeth, molar structure quite strong, protruding, and with carinate grinding surface. Ventral mouth parts retracted; maxilla with entire and obtuse mala, maxillary palpus with three articles; cardo divided into two parts; maxillary articulating area large and distinct; gula, submentum, and mentum distinct, prementum[1] broad, labial palpus with two articles; ligula large, subconical and hairy. Epipharynx semi-membranous, bearing two hooks and many minute teeth; hypopharynx with sclerome. Legs all alike, strong and five-jointed; coxae inserted widely apart. Prothorax with very large presternum, consisting of a median spatulate part and two lateral subtriangular parts. Tergal plates of mesothorax, metathorax, and the first eight abdominal segments anteriorly with subtransverse, medianly obsolete linear groove with raised front margin; tergal plate of eighth abdominal segment about twice as long as of ninth (excluding urogomphi); tergal plate of ninth abdominal segment heavily sclerotized, transversely subrectangular, bearing a pair of slightly flattened, backwardly directed, falcate urogomphi; one pair of well sclerotized pits present on the ventral side of the tergal plate in the margin between the bases of the urogomphi. Spiracles annular. First thoracic spiracle dorso-laterally seated in the pre-epipleurum of mesothorax; second thoracic spiracle present in epipleurum of metathorax but vestigial; abdominal spiracles dorso-laterally placed in the terga of the first eight abdominal segments.

Explanation of Plate 3.

Figures drawn with aid of camera lucida by the author.)

Fig. 1. *Boros unicolor.* Head. Ventral view; *ca*, cardo; *epc*, epicranium; *gu*, gula; *li*, ligula; *lp*, labial palpus; *ma*, mala maxillaris; *mar*, maxillary articulating area; *me*, mentum; *mxp*, maxillary palpus; *pag*, palpiger, developed as a basal membrane of the maxillary palpus; *paf*, palpifer, developed as a basal membrane of the labial palpus; *pm*, prementum; *sm*, submentum; *sti*, stipes maxillaris.

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[1]As "prementum" that part of the labium is designated which lies between the mentum and the ligula, and which morphologically consists of the median fused stipes labii and the labial palpifers.

Fig. 2. *Boros unicolor.* Head. Dorsal view, also diagrammatic sketch of lateral view to show position of ocelli and arrangement of setae in ocellar group; *bm*, basal membrane of antenna; *cl*, clypeus; *epc*, epicranium; *f*, frons; *lab*, labrum; *1*, *2*, *3*, first, second, and third articles of antenna; *tp*, dorsal tentorial pit.

Fig. 3. *Boros unicolor.* Right mandible. Ventral view; a^1, a^2, and a^3, tricuspidate apex; *t*, teeth of cutting edge; *m*, molar part with carinate grinding surface.

Fig. 4. *Boros unicolor.* Left mandible. Dorsal view. Explanation of letters as for figure 3.

Fig. 5. *Boros unicolor.* Part of head and prothoracic and mesothoracic segments. Ventral view; *ep*, epipleurum; ep^1, pre-epipleurum; ep^2, postepipleurum; *eu*, eusternum; h^1, prehypopleurum; h^2, posthypopleurum; *stl*, sternellum; *y*, presternum; y^1, lateral parts of presternum; y^2, median part of presternum; z, poststernellum.

Fig. 6. *Boros unicolor.* Maxilla of larva from ventral side: *ca*, cardo divided into two parts. Explanation of letters as for figure 1.

Fig. 7. *Boros unicolor.* Larva. Dorsal view; *VIII*, eighth abdominal segment. *IX*, ninth abdominal segment.

Fig. 8. *Boros unicolor.* Eighth, ninth and tenth abdominal segments. Ventral view; *ep*, abdominal epipleurum; *hp*, abdominal hypopleurum; *ster*, sternal shield of abdominal segment; *ter*, tergal shield of abdominal segment; *VIII*, eighth abdominal segment; *IX*, ninth abdominal segment, and *X*, tenth abdominal segment.

Fig. 9. *Boros unicolor.* Sixth abdominal spiracle with portion of trachea.

Explanation of Plate 4.

(*Figures drawn with aid of camera lucida by the author.*)

Fig. 10. *Boros unicolor.* Anterior portion of head. Dorsal view. Explanation of letters as for Plate 1, figure 2.

Fig. 11. *Boros unicolor.* Epipharynx and anterior margin of labrum; *eph*, epipharynx; *h*, median hooks; *so* and so^2, sensory organs; *t*, teeth; *tb*, transverse band.

Fig. 12. *Boros unicolor.* Metathorax and first abdominal segment. Lateral view. Explanation of letters as for Plate 1, figure 8.

Fig. 13. *Boros unicolor.* Prothoracic leg. Anterior face; *cox*, coxa; *fe*, femur; *ta*, tarsungulus; *ti*, tibia; *tr*, trochanter.

Fig 14. *Tribolium confusum.* Head. Dorsal view. Explanation of letters as for Plate 3, figure 2.

Fig. 15. *Doliema pallida.* Maxilla of larva. Ventral view. Explanation of letters as for Plate 3, figure 6.

Fig. 16. *Boros unicolor.* Labial palpus, hypopharyngeal region and oesophagus. Viewed from buccal cavity; *fm*, fossa for mandible; *hbr*, hypopharyngeal bracon; *hsc*, hypopharyngeal sclerome; *li*, ligula; *lp*, labial palpus; *mea*, median area of hypopharyngeal region; *oes*, oesophagus; *poh*, postero-lateral part of hypopharynx (paragnath ?); *prh*, prehypopharynx.

Fig. 17. *Tenebrio obscurus*. Anterior portion of head. Dorsal view. Explanation of letters as for Plate 3, figure 2.

Fig. 18. *Pytho planus*. Head. Dorsal view; *3*, third article of antenna; explanation of letters as for Plate 3, figure 2.

Fig. 19. *Pytho planus*. Left mandible. Ventral view. Explanation of letters as for Plate 3, figure 3.

Fig. 20. *Othnius* sp. Right mandible. Ventral view; *mt*, teeth of mola; explananation of rest of letters as for Plate 3, figure 3.

Fig. 21. *Pytho planus*. Terga of eighth and ninth abdominal segments. *VIII*, eighth abdominal tergum; *IX*, ninth abdominal tergum.

Fig. 22. *Neopyrochroa femoralis*. Terga of eighth and ninth abdominal segments. *VIII* and *IX*, as in figure 21.

Fig. 23. *Neopyrochroa femoralis*. Eighth, ninth, and tenth abdominal segments. Ventral view; *VIII*, eighth abdominal segment; *IX*, ninth abdominal segment; *X*, tenth abdominal segment.

Fig. 24. *Neopyrochroa femoralis*. Epipharynx and anterior margin of labrum. Explanation of letters as for Plate 4, figure 11.

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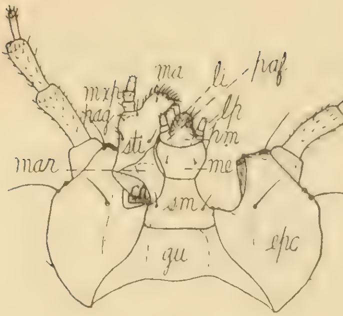
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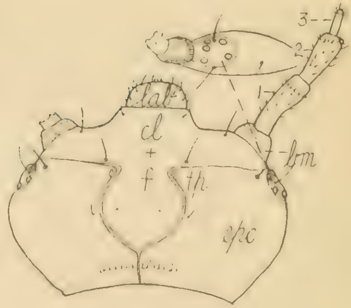
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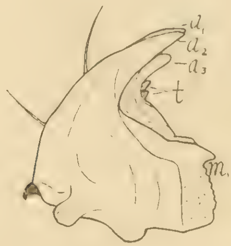
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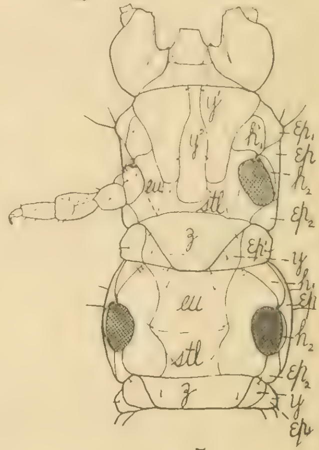
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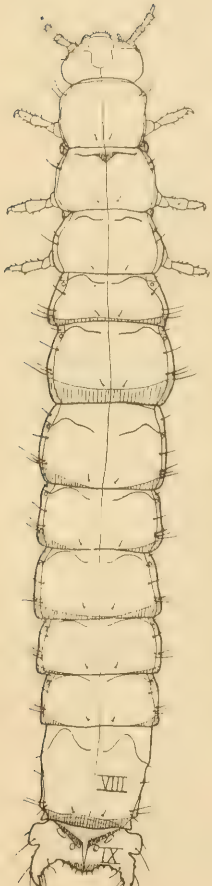
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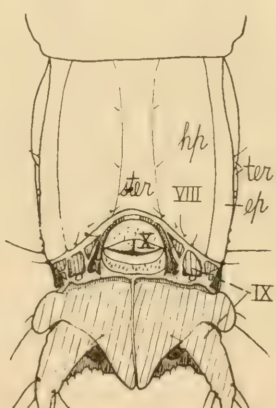
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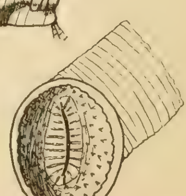

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NOTES ON DIPTERA NO. 5.

By J. M. Aldrich, *U. S. National Museum.*

The preceding paper, No. 4, "Notes on Synonymy of Diptera," was published in these Proceedings, Vol. 32, 1930, pp. 25–28.

I am under obligation to Dr. William Schaus for the opportunity to consult in his private library both the first and second editions of Drury's "Illustrations of Exotic Entomology," referred to in the following pages.

1. Possible Occurrence of *Teichomyza fusca Mcq. in* South America.

Several years ago Professor Cockerell sent me four specimens of this common European Ephydrid, three of which were labeled "Ilo, Peru, at light, Aug. 9," the other "Antofagasta, Chile, at light, Aug. 7." At first I thought I had a new genus, and so reported. Some time elapsed, and Professor Cockerell gently reminded me that I had not yet described his new genus. Finally I got to work on the matter, possibly after a second reminder, and about the first thing discovered that it was the European species. Writing to Professor Cockerell for more information, he wrote me that the light was on the Grace steamship on which he was a passenger. As the species breeds in urinals, a question immediately arose whether the species had been actually living on the land, or had been breeding on the boat itself. I inclined to the latter view, although it would seem a simple matter for the fly to get ashore and become introduced while some vessel was in a dock. Professor Cockerell gives the following reasons for believing that the flies came from shore to the light:

1. The Grace boats do not go to Europe, where the fly occurs, but to New York, where it is not known.

2. The electric lights were watched during the voyage and the fly occurred only at the places noted.

The vessel had been docked at Valparaiso a couple of days before, but was off-shore when the fly was collected. In the dry region where the collections were made, conditions on the adjacent shore were very favorable for the breeding of the fly, unflushed urinals being common.

2. Subgenera of *Cuterebra.*

Dr. Arminius Bau has published a subdivision of *Cuterebra* into four subgenera, in Centralblatt f. Bakterologie, Parasitenkunde und Infektionskrankheiten, vol. 77, 1929, pp. 542–544. His grouping of the species is based almost wholly upon the markings of the head. Those which show no markings he puts in *Paracuterebra*, including *cuniculi* Clark and *ornata* Bau. Since *cuniculi* is the genotype of *Cuterebra*, he should have called this subgenus *Cuterebra*.

Species having the head ornamented only with shining black spots, from one to five pairs, he puts in subgenus *Metacuterebra*, mentioning numerous species.

Species having both shining black areas and white pollinose ones on the head he places in the subgenus *Orthocuterebra*, mentioning numerous species, among them *lepusculi* Tns., which Townsend (Insecutor Inscit. Menst., 5, 1917, p. 25) has shown to be a synonym of *Bogeria princeps* Austen. Since *lepusculi* is a synonym of the genotype of *Bogeria*, obviously the subgenus should have been called *Bogeria*.

Species having no shining black areas but having white pollinose ones he puts in the subgenus *Protocuterebra*, mentioning six species, among them *americana* Fab., which Townsend made the type of *Atrypoderma*, new genus, in 1919 (Proc. U. S. Nat. Mus., 56, p. 592). Therefore Bau should have used *Atrypoderma* for this group.

To remove any uncertainty I designate the following as subgenotypes: for *Paracuterebra*, *cuniculi* Clark; for *Orthocuterebra*, *lepusculi* Tns.; and for *Protocuterebra*, *Musca americana* Fab. My acquaintance with the species of *Metacuterebra* is not sufficient to justify me in selecting a type.

3. What is *Musca pilosa* Drury?

In the first edition of his "Illustrations of Exotic Entomology," vol. 1, 1770, p. 109, Drury gives a brief description of an unnamed fly, which is figured on plate 45, fig. 7. No locality is mentioned, but the other insects on the plate are from Jamaica and Antigua. In the index he cites the figure as *Musca pilosa*. In the second edition of the work, 1837, edited by Westwood, the description of the fly is on page 104, where Westwood has changed the name to *Echinomyia pilosa*. He distinctly states in his introduction that he did not see the specimens, hence his new generic reference is merely from the figure.

Drury's description is brief and gives few characters; it is as follows:

"The *Head*, is red brown.—The *Eyes*, the color of horn.—The *Antennae*, are short and thick, without any hairs.—The *Thorax* and *Abdomen*, are entirely covered with thick black hairs, or rather bristles, when compared with the size of the insect. The *Wings* (only two), are opake and brown, not transparent.—The *Breast*, is black, and covered with black bristles as the abdomen. —The *Legs*, are also black, with a number of spines on each."

The figure shows golden pollen on head, but the main character shown is the abdominal spines, which are clearly represented as very numerous, covering the abdomen. The wings in the figure are not so black as the description indicates.

I know of only one specimen from Jamaica which has the abundant spines shown in *pilosa;* this is Townsend's type of *Hystriciella aurifrons*, the species being also the type of the genus. It is in the National Museum (Riley Collection). I think it is certainly the same species, if a specimen can ever be identified from such an early figure.

Now as to the status of the genus *Hystriciella.* The genus and species were described by Townsend in Insecutor Inscit. Menstruus, vol. 3, 1915, p. 95. Townsend compares it with *Hystricia*, pointing out various differences. If he had compared it with *Jurinia* (genotype *gagatea* R. D., as identified by Townsend in the National Museum), these differences would have disappeared almost entirely. The two species are very much alike; the area covered by the dense spines is about the same in both, but there are more spines in *pilosa.* My conclusion is that *Jurinia pilosa* is the correct name for the species, making Townsend's genus and species synonymous.

In this connection it is necessary to consider the somewhat involved question of the correct interpretation of *Musca hystrix* Fabricius. It was described by Fabricius in Systema Entomologiae, 1775, p. 777, in the following terms:

> "Musca hystrix; antennis setariis, pilosissima, atra, ore albicante. Statura M. ferae at triplo minor, tota atra, nitens, immaculata, pilis densissimis, elongatis, rigidis tecta."

The habitat was "America," and he cited "Drury, Ins. I, pl. 45, f. 7," apparently considering this as unnamed by Drury. In Systema Antliatorum, 1805, p. 310, he referred the species to *Tachina*, still citing Drury. Wiedemann, Auss. Zweif. Ins., vil. 2, 1830, p. 283, quoted the original description and gave a new one from specimens in the Fabrician collection and his own, noting that the size indicated by Fabricius was altogether too small. He also described another species which he found under the name of *hystrix* in the Copenhagen Museum; this was obviously different and need not be discussed here. I saw what was probably the same specimen in the Copenhagen Museum, and noted that "pilis densissimis" does not apply at all.

It is practically certain that the species described as *hystrix* by Wiedemann in his own and the Fabrician collection, was not the same as the one originally described by Fabricius. We know what it was, as Brauer and Bergenstamm, Zweifl. Kais. Mus., iv, 1889, 133, made the Wiedemann specimens type of the genus *Tachinodes*, which in the same work, vi, 1893, p. 146, they made a synonym of *Archytas* Jaennicke. In the latter place they give a partial description, indicating among other items that the species has only marginal bristles on the abdomen. This certainly can not be made to harmonize with Fabricius's "pilis densissimis."

Williston had already discussed *hystrix*, in Trans. Amer. Ent. Soc., vol. 13, 1886, p. 299. He referred it to *Jurinia*, and analyzed his material into three "forms or species." All had a row of spines on the second abdominal segment, and the third antennal joint was said to be but little longer or not longer than the second; while *hystrix* of Wiedemann (B. B.) has only a single pair of marginals on the second abdominal segment, the third antennal joint longer and very convex, etc. On the following page he described *Jurinia hystricoides*, which is the same as *hystrix* of Wiedemann.

Brauer, Sitzungsber. Kais. Akad., vol. 107, 1898, p. 501, reported that the type of *Jurinia metallica* Robineau-Desvoidy (in the Bigot collection) is apparently the same species as *hystricoides* of Williston.

Coquillett, Revision N. A. Tachinidae, 1897, p. 142, has *Archytas hystrix* based on an identification of Brauer and Bergenstamm (therefore *hystrix* of Wiedemann), which is as he indicates the same as *Jurinia hystricoides* Williston. He places Williston's *hystrix* in *Jurinella* as a synonym of *metallica* R. D. Afterward, in Proc. U. S. Nat. Mus., vol. 25, 1902, p. 120, he adopts Brauer's conclusion and places *metallica* under his *hystrix*, adopting *adusta* V. d. w. (which he had made a synonym) as the available name for Williston's *hystrix*.

Townsend, Insecutor Inscit. Menst., vol. 3, 1916, p. 73, described *Jurinopsis floridensis*, new genus and species, which is, as he says, Williston's *hystrix*; his type is a male with very black antennae and brownish palpi, agreeing with Williston's form b. This being a different species does not affect the history of *hystrix* Fabricius nor of *hystrix* Wiedemann.

Curran, Canadian Entomologist, vol. 60, 1928, p. 204, places *hystrix* Williston and *hystrix* Coquillett (in part) as synonyms of *metallica* R. D., in the genus Archytas. On page 206 of the same work he adopts *pilosa* Drury as the proper name for *hystrix* Wiedemann.

Now as to the valid names for the species. As already intimated, I think we must let the original *hystrix* fall as a synonym of *pilosa*, not in *Archytas* where Curran places it, but in *Jurinia*. *Juriniopsis* of Townsend may stand as a good genus, but his *floridensis* is antedated by *Jurinia adusta* Van der Wulp, Biologia, Dipt., ii, 1890, p. 28. I saw the types of *adusta* in the British Museum. Walker described the same species as *Tachina basalis* in 1849, List etc., pt. 4, p. 713; but he had preoccupied this name himself in 1837. I saw the type of Walker 1849. *Juriniopsis adusta* V. D. W. may therefore stand for this species.

Hystrix of Wiedemann is the same as *Jurinia metallica*

Robineau-Desvoidy (Myodaires, 1830, p. 35), the type of which I saw in the Collin (Bigot) collection, as Brauer did. It bears a label in the handwriting of Robineau. I would call the species *Archytas metalica* R. D.

We therefore have the following:

Jurinia pilosa Drury.
- Musca pilosa Drury.
- Musca hystrix Fabricius.
- Hystriciella aurifrons Townsend.

Juriniopsis adusta Van der Wulp.
- Jurinia adusta Van der Wulp.
- Jurinia hystrix Williston.
- Jurinella metallica Coq. 1897.
- Tachina basalis Walker (preoc.).
- Juriniopsis floridensis Townsend.
- Jurinia metallica Curran.

Archytas metallica Robineau-Desvoidy.
- Jurinia metallica Robineau-Desvoidy.
- Tachina hystrix Wiedemann.
- Tachinodes hystrix Brauer and Bergenstamm, 1889.
- Archytas hystrix Brauer and Bergenstamm, 1893.
- Jurinia hystricoides Williston.
- Archytas hystrix Coquillett.
- Archytas pilosa Curran.

Eurycephalomyia Hendel. I am confident that I have at last unraveled the mystery of this genus. It was described by Roeder in Berl. Ent. Zeitschrift, vol. 25, 1881, p. 211, as Eurycephala, in the subfamily Ulidiinae of the Ortalidae; the sole species was *myopaeformis*, new, from California. The genus being preoccupied, Hendel proposed to change the name to Eurycephalomyia in Wien. Ent. Zeitung, vol. 26, 1907, p. 98. He did not identify the species, and in his Genera Insectorum paper on Ulidiinae, 1910, p. 68, he quoted the generic and specific descriptions of Roeder. Williston, in his 1908 Manual of North American Diptera, p. 277, placed the genus from the description among the Ulidiinae. Coquillett redescribed *myopaeformis* as *Tetanops polita* in Journal N. Y. Ent. Soc., vol. 8, 1900, p. 22, his description being based on three females from Colorado. Hendel gave it a third name, as *Tetanops aldrichi*, in Wien. Ent. Zeitung, vol. 30, 1911, p. 20, basing his description on several specimens of both sexes which I sent him, collected at Moscow, Idaho. He had not seen *polita* Coq., and its description seemed to indicate some color differences. I have compared Coquillett's types with a part of my Idaho series which I retained, and which I had compared with the specimens sent to Hendel; he did not return any types to me.

For many years I did not have access to Roeder's description, and recently have been engaged in other families and have made no recent efforts to identify the species. I now find that Roeder's description leaves practically no doubt of the synonymy indicated above. The mystery arose from having Eurycephalomyia in the wrong subfamily; it belongs to Ortalinae.

The species is common in the West, and I obtained a long series on flowers at Moscow, Idaho. Ira M. Hawley reported it as injuring sugar beets in Utah, in Journal Econ. Ent., vol. 15, 1922, p. 388, and vol. 16, 1923, p. 378; the larvae burrow in the beet. He called it *Teganops aldrichi* from my identification, and it was mentioned by Essig with this habit in his insects of Western North America, 1926, p. 605. It has also been reported under this name from Lethbridge, Alta., by Gibson (The Entomological Record, 1926, in Report Ent. Coc. Ont.), and from Burns, Ore., by Cole and Lovett, in their List of the Diptera of Oregon, 1921, p. 328. Cole also figured the genitalia of the male under this name, in Proceedings Cal. Acad. Sci., vol. 16, 1927, 485, figs. 249, 250.

The genus I believe to be a valid one, differing from Tetanops not only in the wrinkling of the front and cheek (below the eye), but also in the shape of the head, which is shorter and has the front more nearly vertical than in *myopina* Fall., type of Tetanops, with which our *T. luridipennis* and *integra* substantially agree. Roeder, while placing it in Ulidiinae, stated that it forms a transition to the Ortalinae. The punctures on the front which are mentioned by Roeder are really of insignificant size compared with those of Tetanops.

A NEW SPECIES OF ENCARSIA FROM CUBA (HYMENOPTERA: APHELININAE).

By A. B. Gahan,
U. S. Department of Agriculture, Bureau of Entomology.

What appears to be a new species of Aphelininae recently received from the Estacion Experimental Agronomica of Cuba is herewith described.

Encarsia cubensis, n. sp.

Belongs to the group having only four joints in the middle tarsus. Is readily separated from all of the species known to me except *E. quaintancei* Howard by the presence of an area around the stigmal vein bare of cilia. May be readily distinguished from *quaintancei* by the fact that the second funicle joint is longer than either the first or third and by the fact that the propodeum and a broad band at the base of the abdomen are pale yellow like the scutellum.

Female.—Length 0.5 mm. Antennae slightly clavate, the last three joints slightly thicker than the three preceding; pedicel twice as long as the first flagellar joint, which is about as long as broad; second flagellar joint about as long as the pedicel and distinctly a little longer than the third; fourth joint equal to the second; two apical joints subequal in length, each very slightly longer than the fourth flagellar joint. Eyes sparsely hairy. Praescutum and axillae reticulated; scutellum and scapulae appearing granular under high magnification; praescutum with four bristles, one at each anterior angle and a pair in front of the scutellum; scutellum about twice as broad as long, with four bristles; propodeum very short, its spiracles elliptical. Forewings rather small, measuring about 0.48 mm. from base to apex and about 0.17 mm. in width at the widest point; marginal vein very slightly longer than submarginal; post-marginal absent, stigmal short; submarginal vein with two short erect bristles above; marginal vein with eight marginal bristles; longest marginal cilia equal in length to approximately one-third the greatest width of wing; disk of wing ciliated but with a moderately large area adjacent to the apex of venation, a narrow elongated area near the posterior margin in apical half of wing, and the basal portion to apex of submarginal vein bare. Fore and hind tarsi distinctly 5-jointed, the middle pair distinctly 4-jointed. Abdomen ovate, as long as or a little longer than the thorax and usually somewhat narrower than the thorax; ovipositor not exerted, originating at about basal one-third of abdomen. Head, pronotum, praescutum, axilae, pleura, and a broad band across the abdomen near the middle, as also the basal lateral margins of abdomen, black or blackish. Antennae, orbits very narrowly, a transverse line across the front below ocelli, scapulae for the most part, scutellum, propodeum, all legs, and the base as well as apex of abdomen, pale yellowish.

Male.—Unknown.

Type-locality.—Santiago de las Vegas, Cuba.

Type.—Cat. No. 43530, U. S. N. M.

Described from three females mounted on a single slide in Hoyen solution, received from S. C. Bruner and said to have been reared from the woolly white fly, *Aleurothrixus howardi* (Quaintance) in Cuba.

This species in the opinion of the writer could be placed in *Prospaltella* about as appropriately as in *Encarsia* except for the four jointed middle tarsi. The three apical joints of the antennae are slightly thickened but the last two joints seem to be slightly more closely joined to each other than to the preceding joint. One could interpret the antennae as having a three-jointed funicle and a three-jointed club, or a four-jointed funicle and a two-jointed club, with about equal propriety.

MINUTES OF THE 428th REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 428th meeting of the Entomological Society of Washington was held April 2, 1931, in Room 43 of the new building of the National Museum. Dr. A. C. Baker, President, presided. There were present 28 members and 27 visitors. The minutes of the previous meeting were read and approved. D. P. Curry, Assistant Chief Health Officer of the Panama Canal Zone, Ancon, Panama, was admitted to membership. The chairman of the program committee read a letter from Dr. F. L. Campbell, of the U. S. Entomological Laboratory at Blair Road, Takoma Park, Md., extending invitation to the society to meet at this laboratory at the time of the regular meeting on June 4, next. This invitation was accepted with thanks by vote of the society.

The first communication on the regular program was presented by Dr. W. S. Hough, Winchester Research Laboratory of the Virginia Agricultural Experiment Station, Blacksburg, Va., and was entitled, "Codling moth experimental work in Virginia with special reference to resistance to Arsenate of lead poisoning." Working with codling moth larvae from Grand Junction, Colorado, and native Virginia larvae at Winchester, Virginia, since 1927, it has been shown that these larvae represent two distinct strains with respect to their ability to enter fruit sprayed with such materials as lead arsenate, cryolite, barium fluosilicate and rotenone. Crosses are intermediate between the tolerant Colorado strain and the intolerant Virginia strain. Larvae from Washington State compare favorably with the Colorado-Virginia crosses. The Colorado larvae also show their superiority over the Virginia larvae in their ability to enter unsprayed fruit and to endure starvation. Factors influencing the origin of the strains and the nature of the difficulties are under investigation. (Author's abstract.) A number of slides relative to experimental work and comparative tabulations were shown. Comments were made on this paper by McIndoo, Howard, Hyslop, Baker, Campbell, Wood, Wadley, Larrimer, Rohwer, Bulger, and F. F. Smith.

The second communication on the program was given by Dr. M. W. Blackman of the Bureau of Entomology and was entitled, "Some factors influencing brood survival of the Black Hills beetle." The most important factors affecting brood survival of the bark beetle aside from available food are the climatic factors including moisture, temperature and air currents. Of these the amount of moisture in the inner bark in which the larvae live is especially important in seasons where the soil moisture available to the tree is deficient. At such times there is a direct correlation between subcortical moisture and brood survival. There is also considerable evidence to indicate that epidemics of the Black Hills beetle develop during periods of years when available soil moisture is greater than normal and that they are naturally controlled by several seasons of stronger deficient soil moisture. The reverse of this seems to be true with many other bark beetles. High subcortical temperature is also fatal to brood but the development of lethal temperatures is often prevented by strong air currents which serve to equalize air-temperature and bark-temperature. Air currents may affect the brood adversely by promoting desiccation of the bark. Of the insect factors affecting survival the most important are the larvae of Cerambycids, which often rob the barkbeetles by eating a large portion of the inner bark, and also incidentally eat the larvae and pupae as well. Of the bird enemies the nuthatches and bluebirds, which prey upon the adult beetles during flight and attack, are considerably more important than the woodpeckers, which while they destroy many larvae, also destroy a correspondingly larger percent of the insect enemies inhabiting the bark. (Author's abstract.) Comments on this paper were made by Baker and Rohwer.

A visitor, Prof. Wm. E. Hoffmann, of the Lingnan University of Canton, China, on invitation, addressed the society and gave a brief résumé of his work in China and of entomological conditions in various sections of that country. He stressed the difficulties of conducting research work because of the unsettled political conditions and civil war and the extreme handicap of dissemination of the information obtained because of the limitations of popular use of the language among research workers, in other countries. He referred very briefly to the antiquity of the country and the historic background of all present day scientific work. Comparative data were given on methods of conducting university training and research work in China and other countries, notably Japan and Formosa. He directed special attention to a scientific quarterly now being issued in that country under the auspices of the Lingnan University and to periodicals published in other parts of the country.

Meeting adjourned at 10:10 P. M.

J. S. WADE,
Recording Secretary.

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PROCEEDINGS OF THE

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ON THE CLASSIFICATION OF BRAZILIAN CULICIDAE WITH SPECIAL REFERENCE TO THOSE CAPABLE OF HARBORING THE YELLOW FEVER VIRUS.[1]

By RAYMOND C. SHANNON.

(*From the Yellow Fever Laboratory of the International Health Division of the Rockefeller Foundation, at Bahia, Brazil.*)

CONTENTS.

I. INTRODUCTION.

Experiments carried on in the yellow fever laboratory at Bahia during the last two years (1929-1930, Davis and Shannon) indicate that the Brazilian species of Culicidae which are capable of harboring the yellow fever virus for periods of time longer than the usual incubation period in stegomyia all belong to a single tribe, the Culicini, and further that this condition is restricted to certain genera within the tribe, namely: *Psorophora*, *Aëdes*, and *Mansonia*.

The only other species of the tribe Culicini which annoy man to any great extent belong to the genus *Culex*, and of these, *C. quinquefasciatus* is the chief offender in the tropics. However, experiments conducted on this species have shown it to be at least a highly unfavorable host for the virus of yellow fever.

In connection with these observations, it is of interest to note that the species of the genus *Culex* are considered to have been, originally, feeders on avian blood. (It would appear that *C. quinquefasciatus* has retained this instinct to a large extent,

[1]The studies and observations on which this paper is based were conducted with the support and under the auspices of the International Health Division of the Rockefeller Foundation.

since it feeds upon birds with the same alacrity as it feeds upon man.) On the other hand, the species of *Psorophora*, *Aëdes*, and *Mansonia* feed primarily on mammalian blood.

Of the other tropical American genera belonging to the tribe Culicini, namely, *Haemagogus*, *Aëdomyia*, *Orthopodomyia*, *Lutzia*, and *Deinocerites*, it is probable that only the first, because of its close relation to *Aëdes*, will be found capable of harboring the yellow fever virus for an appreciable length of time. *Aëdomyia* rarely attacks mammalian hosts; in fact, the evidence at present available indicates that it prefers avian blood. The species of *Orthopodomyia* and *Lutzia* are not known to attack men. *Deinocerites*, a crab-hole breeding species confined to the Caribbean coast region, attacks man rather rarely. As this genus is directly derived from the genus *Culex*, it is probable that it likewise can not harbor the yellow fever virus. *Culicella*, the only other Culicine genus occurring in America, is confined strictly to temperate regions.

A number of experiments made on species belonging to the Sabethine and Anopheline tribes, indicate that these mosquitoes are unfavorable hosts for the virus. The tribe Megarhinini may be entirely disregarded, as it contains no blood-sucking members; while the Uranotaeniini attack man with extreme rarity.

The foregoing observations are in accord with those made in the yellow fever laboratory at Lagos, Nigeria, with but one exception. Successful transmission of yellow fever by means of biting was obtained there with a number of species of the genus *Aëdes* and with *Mansonia africanus*. *Eretmopodites chrysogaster*, a derivitive of the genus *Aëdes*, proved to be a favorable host for the virus. The exception mentioned occurred in the case of a species of *Culex*, namely, *C. thalassius*. Infection was obtained by injecting specimens of this species after an "adequate" incubation period. (Bauer, 1928; Philip, 1929, 1930.)

Although the primary object of the present paper is to give a revision of the Brazilian species belonging to the genera *Psorophora*, *Aëdes*, and *Mansonia*, it is considered advisable, for purposes of orientation, to include a classification of the tribes and genera of the subfamily Culicini (Brazilian) as a whole.

Experience has shown that the key to the American tribes and genera proposed by Dyar and Shannon (1924), a modification of that proposed by Edwards (1922), is unsuitable except for the specialist. Most of the characters used in it are very minute and difficult of detection; whereas some of the really obvious characters are omitted. The reason for this course was that the more obvious characters are frequently not absolute and are usually applicable only to the female sex, whereas the characters used appeared to be absolute and common to both sexes. However, many of the less absolute and uni-sexual characters can be of material assistance in the classification of the tribes and genera, especially since, as a matter of fact, it is specimens of the female sex that are more commonly collected; and even in the cases where males are obtained, as by rearing, females as well are incidentally procured.

It has been more or less customary in the past to avoid using characters based on the scales for tribal and generic distinctions, evidently because of the belief that such characters are too plastic and therefore do not posses generic or tribal value. However, the general appearance of the insects is largely dependent upon the development and color of the scales, and the use of scale characters will doubtless prove of value even in generic and tribal keys. In fact, at least as far as the American mosquitoes are concerned, one of the most absolute characters (which is also easy of discernment) for separating the tribe Anophelini from all other tribes, is based on scales.

In the key here presented, therefore, an attempt has been made to include all of the characters, whether absolute or not, which may prove of value in classification. The more obvious characters, frequently possessed only by the female, are in bold face type. Thus for preliminary and rapid identification only the characters given in bold face type need be considered.

All the tribes and all but two of the genera found in America occur in Brazil. Although the key has been prepared primarily for the identification of the Brazilian fauna, the two genera not found here (*Culiseta* and *Deinocerites*) are also included for the sake of completeness.

The fact that the key has been based primarily on Brazilian mosquitoes makes it possible to emphasize certain characters for the separation of the three genera, *Psorophora*, *Aëdes*, and *Mansonia*, which are probably the only Brazilian genera that have any important relation to yellow fever. Thus, although the nature of the wing scales easily distinguishes the species of *Mansonia* from those of the Brazilian species of *Aëdes*, there are two North American Aëdines (*grossbecki* and *squamiger*) which also have large wing scales. However, these two may be easily distinguished from *Mansonia* by the uniformly black proboscis and by the scales on the mesopleura (preanepisternum), characters obviously more easily apprehended than the presence or absence of setae on the stem vein, the character formerly utilized by Dyar and Shannon.

Certain characters, apparently not before used in mosquito taxonomy, are also included in the key. One of these is concerned with the separation of the Anophelini on the basis of the absence of scales on the first abdominal tergite. It is evidently a character of tribal value, as shown by the following discussion.

II. RELATION BETWEEN THE HABITS OF THE ADULTS AND THEIR EXTERNAL CHARACTERS.

Inasmuch as habits influence the development of characters, or vice versa, a knowledge of one is of assistance in understanding the other.

The family Culicidae probably developed from a type possessing a short proboscis (i.e. shorter than the head); five segmented, pendulous palpi which exceeded the length of the proboscis; and a simple vestiture of fine hairs on the head, body, legs, and wing veins.

These primitive features are still retained by one subfamily of the Culicidae, the Dixinae, while the only important departure shown by the Chaoborinae is the scale-like development of the vestiture of the wing veins.

All the species of the subfamily Culicinae, however, have the greatly elongated proboscis and the palpi more or less straight and directed forward, exceeding the length of the proboscis only in the male sex of certain species; the males frequently also have the apical segments directed upward. All these species have a more or less well developed vestiture of scales on the occiput, body, and wing veins. The subgenus *Stethomyia* (*Anopheles*) is probably the nearest approach to the primitive type among the American mosquitoes as regards vestiture; the proboscis and palpi are greatly elongated and approximate in length, which no doubt was the condition existing in the progenitors of the Culicinae, or true mosquitoes.

The extreme departure from the *Stethomyia* type is found in the species of the genus *Sabethes:* proboscis long and slender; palpus with but a single, forward directed segment far shorter than the proboscis; the hairs of the head and body and wing veins almost entirely replaced by broad flat scales, mostly of a deep metallic coloration; and a remarkable development of scales on the legs, forming broad, blade-like structures.

The habits probably most responsible for the development or modification of adult characters are: (1) food habits; (2) time of activity; (3) modes of concealment; (4) methods of attack; (5) mating attitudes.

The subject is necessarily an involved one, and therefore attention can be drawn to but few of the outstanding features. Incidentally, it may be that because the female has undergone greater changes in habits than the male, she has also been the more completely modified structurally; while the male still retains more or less completely many of the primitive features.

(1) Food Habits.

The more tangible modifications have taken place in the mouth parts (clypeus, palpi, and proboscis), flight ability, and mode of attack (e.g., contrast the methods of stegomyia, *Mansonia*, and *Wyeomyia* species), and probably certain modifications of the legs and claws.

Modifications of the mouth parts.—Probably all the Brazilian Culicines, except *Megarhinus*, *Lutzia*, and possibly *Orthopodomyia* and some species of *Culex*, suck blood.

It is apparent, however, that the blood-sucking instinct is not equally developed in all the blood-sucking species. These differences in food habits no doubt have brought about some of the modifications of the mouth parts which are discussed below.

(a) *The proboscis.*

The proboscis is straight in all mosquitoes except those of the genus *Megarhinus* and certain species of *Wyeomyia* (subgenera *Dodecamyia* and *Dyarina*). The latter are blood-sucking and probably feed on flowers as well. The former feed only on flowers and probably on honey dew, and the proboscis is peculiarly modified accordingly. The basal portion is rigid and stout but tapers outwardly, forming a slender downward-curved organ. However, the curved portion is very flexible during life and can be straightened and turned with the greatest ease when the insect is searching for food or water.

In most of the other Culicines the proboscis is of remarkable uniformity; it varies little as a rule in length and girth, and only in certain groups and species are definite markings present.

(b) *The palpi.*

Originally, these structures were probably elongated and straightened to serve as a protection for the long, slender proboscis. At least it would appear that the elongated condition of the palpi was the primitive one for the group. This condition prevailed in practically all Anophelines (a recently described Old World species of Anophelini, *Brugella travestitus* Brug., has very short palpi in both sexes, *vide* Edwards, 1930). Long palpi, which not infrequently exceed the length of the proboscis, also occur in all males of *Megarhinus*, in the majority of the Culicini, and in a few species of the Sabethini (all *Joblotia* and certain species of *Goeldia*). The palpi are very short in the tribe Uranotaeniini and in all other Sabethines; moderately short or very short in *Aëdeomyia*, and in certain species of *Haemagogus*, *Aëdes*, and *Culex* (Culicini).

In the females (except the Anophelines) the palpi present a wide range of variation. Not only are they reduced in length (usually considerably), but also in the number of segments. Fusion appears to take place chiefly at the base of the organs, but it is apparent in some cases that the apical segment or segments have disappeared.

It is possible that the variation results from differences in mode of attack or of feeding. However, during the act of feeding, the palpi are directed upward, and when the proboscis is deeply imbedded, the palpi are at right angles to the proboscis. This condition is common to *Anopheles*, *Mansonia*, *Aedes*, and *Culex*. and probably to all other genera as well.

In length of palpi. the species of *Megarhinus* present an intermediate condition between the long and the short types. The palpi may be nearly as long (subgenus *Ankylorhynchus*) or two-thirds as long (subgenus *Megarhinus*) as the proboscis, but always exceed the antennae in length. The females of both subgenera show only three large, distinct segments (four in the male, the basal segment being fused with the one following). The reduction in this case has occurred at the terminal end of the palpus, as a rudimentary segment can be seen at the apex.

The greatest variation occurs in the tribe Culicini, which contains the most blood-thirsty members of the family. Only in certain species of *Psorophora* do the palpi approximate half the length of the proboscis, but even in these cases, they are decidedly shorter than the antennae. Certain species (e.g., *Aëdes scapularis*) still retain the full set of segments, but all have been greatly reduced in size, principally the first, second, and fifth segments. The majority of species, however, possessed only three to four segments, including the fused basal joint.

The greatest reduction has occurred in the tribes Uranotaeniini and Sabethini, which have only a single segment (two, counting the fused basal segment).

(c) *The clypeus.*

This structure is peculiar in that it appears to be developed in accordance with the intensity of the blood-feeding habits. The females of most Culicini and Anophelini have a more or less well developed collar of sclerotin surrounding the base of the mouth parts; whereas in all males and in the females of *Megarhinus*, *Uranotaenia*, and the Sabethines and certain Culicines as well, the sclerotization is limited to the upper portion of the clypeus, which appears as a lip-like structure between the antennae and the mouth parts. In *Megarhinus*, it differs further, being much broader than it is long. It is at least as long as it is broad in all other tribes.

(2) Time of Activity.

The most striking modifications in appearance, affecting chiefly the vestiture and coloration, appears to have resulted from the differences in the time of activity. Apparently the more important distinction that should be made in this connection is the time and manner of mating (i. e., courtship). This, in turn, may possibly be due to some fundamental difference in biology, such as change of larval habitat or feeding methods or both.

The males of many of the Nematocerous Diptera, which are aquatic in the immature stages, orient themselves to some conspicuous object at the time of mating, and are thus enabled to form swarms to which the females are attracted. Swarming usually occurs during twilight hours. Among such species the localizing of the males is probably sufficient to overcome the difficulties of the sexes in finding one another, and consequently there is little need for bright colors, which otherwise would have had to be developed for the purpose of attracting the sexes, unless the insects resorted to still other methods. In this connection, it may be pointed out that the species which swarm usually have sombre colors, or if they possess definite markings, these are not, as a rule, of metallic lustre.

The males of most, or all, of the more primitive mosquitoes form their swarms about dusk, and it is noteworthy that although many have definite color markings, these consist of various shades of black, brown, and white, and are almost invariably of a non-metallic nature.

It may be assumed, therefore, that the progenitors of the present day mosquitoes were of a uniformly dark color, without scales, except possibly on the wing veins, and that they accomplished the act of mating through the process of swarming during twilight hours.

The Brazilian species which more nearly approach this primitive type of vestiture (general absence of scales) belong to the Anopheline subgenus *Stethomyia*. Unfortunately nothing is known of their mating habits, but the females of this group are among the few Anophelines which fly more or less freely and feed during the day. Their chief time of feeding, however, is probably early evening. Also, they are the only Anophelines in America that possess a conspicuous white marking in the *integument* of the mesonotum (a narrow white longitudinal line). Dr. Davis reports that the variety *brasiliensis* of *Anopheles albitarsis* is well known to have day-flying and day-feeding habits in the state of Minas Geraes. It is interesting to note that in this form the tip of the abdomen is conspicuously white.

The Anophelines as a class are probably the most primitive of the American mosquitoes in body vestiture. In the species possessing an elaborate development of scales, these are usually on the wings, although *Chagasia* has a remarkable development of scales on the mesonotum. The Anophelines are the only group which do not have scales on the first abdominal tergite, and in fact most species have few or no abdominal scales.

The majority of the species of the tribe Culicini (exceptions noted below) have the poorest development of scales on the first tergite, frequently consisting of a rather small patch. In the Uranotaeniini, the first tergite is fairly well clothed with scales, but the scales lack a metallic lustre. The highest development occurs in the Megarhinini, Sabethinini, and *Haemagogus* (Culicini) which have the first tergite and the sides of the thorax densely clothed with scales, more or less of a bright metallic lustre. A number of species of the tribe Culicini, chiefly certain species of *Psorophora* and certain subgenera of *Aëdes* and *Culex*, as well as all the Brazilian species of *Uranotaenia*, have scattered patches of metallic scales.

The two extremes of scale vestiture, therefore, are represented by *Stethomyia* (*Anopheles*), with only a small patch of scales on the head and hair-like scales on the wings, and *Sabethes*, with a mail-like covering of metallic scales on the occiput and body, and an enormous development of the scales on the legs. Other peculiarities of scale vestiture, as shown by certain members of the family, are the presence of scales on the clypeus (*Stegomyia*, *Aëdomyia*, and certain Sabethines) and on the postnotum (certain Sabethines), normally an absolutely bare structure except for a tuft of setae on the postnotum in the Sabethini and in certain small groups of Culicini.

As stated above, these modifications probably have been brought about chiefly in response to changes in mating habits. This will be shown in the following. We have personally observed the mode of mating of only a few species (stegomyia, *Culex quinquefasciatus*, *Mansonia justamansonia*, *Wyeomyia bromeliarum*, *Limatus durhami*, and *Megarhinus trinidadensis*). Howard, Dyar, and Knab (1912), however, cite observations on *Aëdes atropalpus*, *Culicella*, and various species of *Anopheles*. These observations have been used in the generalization here made.

(a) *Day fliers.*

The day fliers may be divided in two groups: (A) those which mate during the day and (B) those which mate during twilight hours.

Group A.—The Megarhines, Sabethines, certain subgenera of *Aëdes* (*Stegomyia*, *Howardina*, and *Finlaya*), the Aëdine genus *Haemagogus*, and the subgenus *Carrollella* (*Culex*) belong in this group. All are more or less marked with metallic colors, and all breed in natural containers (tree holes, etc.) in or about woodlands, where they are protected from the sun (except the domesticated stegomyia, which breeds in artificial containers in and about houses). As a rule they do not fly far from their larval habitats, and, as far as is known, the males do not form swarms at the time of mating. The males of these groups are occasionally seen on the wing during the day, whereas the males of group B appear to be on the wing only during twilight hours. The majority of the species are rare, and it is therefore probable that the brilliant colors were developed to enable the sexes to detect one another more easily.

The male Megarhines rest on the leaves of plants in patches of sunlight and await the appearance of the females. Nothing is known regarding the mating of the Culicine groups, except in the case of *Stegomyia*. The males of this group frequently rest in the immediate vicinity of people and await the coming of the female in search for food, or rest on exposed perches (projections of furniture, etc.) where they can easily detect passing females. The Sabethine males drift about the woodlands in slow flight, exhibiting their colors, or, as in the case of the males of *Limatus*, fly slowly up and down tree trunks, purposely exhibiting the blue marking on the proboscis. The latter differ from all other mosquitoes in having a proboscis which can be flexed at the middle; the outer half can be bent upwards at right angles to the basal half, and at the base of the outer half there occurs a conspicuous metallic blue spot edged with black.

Quite probably the Uranotaenines belong to group A, since they possess metallic markings and are day fliers, but their larval habitats (marshy pools, etc.) differ from those of the other species included in this group. Nothing is known regarding their mating habits.

Group B.—At least the majority of the species of *Psorophora*, *Aëdes*, and *Mansonia* probably belong in Group B. In reality, this group is intermediate between the true day fliers and the essentially twilight and night fliers, since, although the females are frequently on the wing in great numbers during the day, seeking food, their hours of greatest activity are at twilight. Moreover, females of this group may be found abroad at all hours of the night. The group differs as a class from Group A, in being ground-water breeders, much stronger fliers, and of a more blood-thirsty nature. The adults usually occur in more or less open land areas, and probably as a result of this their bodies are more heavily sclerotized than are those of most other mosquitoes. This is indicated by the fact that dried specimens undergo less shrinkage than specimens of the majority of the other species. We have personally observed the swarming of *Mansonia justamansonia* only, but according to the records given by Howard, Dyar, and Knab (1912) relative to the swarming of allied species of *Aëdes*, it is probable that the Brazilian species of this genus (aside from those listed under group A) likewise swarm. Nothing is known regarding the mating of the species of *Psorophora*. Certain of these, as well as *Mansonia arribalzagia* and *M. lynchi*, new species described below, have metallic markings, and in view of this fact, it is possible that they do not form swarms. The genus *Culicella*, which is not found in Brazil, may belong to group B.

(b) *The essentially twilight and night fliers.*

This class includes practically all Anophelines, all species of the genus *Culex*, except *Carrollella* and possibly *Microculex*, and probably the species of *Lutzia* and *Deinocerites* as well.

The typical representatives are either entirely dark in color, or show a color pattern consisting of two or three non-reflecting colors—black, brown, and white. Feeding takes place as a rule only at twilight and during the night; in fact, the great majority of the species are relatively inactive during the day. Consequently, it is to be expected that mating takes place only at twilight, and that the males, in most or all cases, swarm. Such is certainly the case with *Culex quinquefasciatus*; and, according to observations made on several species of *Anopheles* in various parts of the world, this is, in all probability, the case with the Brazilian Anophelines.

Finally, with regard to the modification of vestiture as occasioned by habits, it is of interest to note that the males have not kept pace with the females. In the male the wing scales are usually small and less numerous, while the abdomen is usually less completely scaled and retains the hairs to a greater extent. As a specific example of this, the abdominal tergites of the female *Aëdes taeniorhynchus* are completely scaled and the hairs are greatly reduced in number and size; in the male the sides of the tergites are unscaled, but possess instead numerous long hairs.

(3) Modifications due to Modes of Concealment and Attack.

The only probable example of adaptive coloration to be found in the Brazilian mosquitoes occurs in the genus *Orthopodomyia*. The adults of this genus are mottled brown and white and greatly resemble certain species of *Mansonia*. But while the *Mansoniae* are strong fliers and notoriously blood-thirsty, the *Orthopodomyiae* are not known to suck blood (the clypeus is lip-like; in *Mansonia* it is collar-like); and although the adults are rarely found, they have occasionally been seen resting on tree trunks.

(4) Modifications due to Methods of Attack.

These are not readily apparent in the structure, but express themselves rather in the psychological attitude. The behavior of stegomyia, *Mansonia*, and the Sabethines is characteristic and distinctive. These characters, however, are unsuitable for use in a key and therefore need not be further considered here.

(5) Modifications due to Method of Mating.

Probably the chief modification brought about by the method of mating occurs in the claws of the females. Knab (1907) states his belief that in the species in which the claws are simple, the position of copulation is one in which the sexes are end to end and facing in opposite directions (based on observations made on *Anopheles*, *Culex*, and *Culicella*), while in the species in which the female has toothed claws, the position in copulation is face to face, the pair clasping each other (observations made on stegomyia and *Aëdes varipalpus*).

However, this rule does not appear to apply to the Sabethini. The mating position assumed by *Wyeomyia bromeliarum* and *Limatus durhami* is similar to that of stegomyia, yet the females of both of these species have simple claws. On the other hand the claws of the males are somewhat more modified in the members of this tribe than is the case in others.

III. KEY TO THE TRIBES AND GENERA OF BRAZILIAN CULICINAE.

(*The characters which are, as a rule, most convenient for identification, are printed in* **bold face type.**)

Tribe Anophelini.

1\. First abdominal tergite without scales; hind coxa slightly shorter than width of mesipimeron; proboscis straight; **palpi of female straight and approximating the length of the proboscis** (certain females of *Megarhinus* have palpi nearly as long as the proboscis, but in these the proboscis is strongly curved downward and the last palpal joint is strongly directed upward); scutellum crescent shaped with the setae uniformly distributed, except in *Chagasia* which has a trilobed scutellum with the setae grouped on the lobes; base of hind coxa distinctly below upper margin of the meso-merocoxa, except in *Stethomyia* where the two are almost on the same level; legs very long and slender; the hind basitarsis longer than the hind tibiae; spiracular setae usually present; sides of thorax with few or no scales; squamal fringe of setae present; color pattern limited to non-metallic shades of black, gray, brown and white (Anophelini)..........2.

First abdominal sclerite with at least a patch of scales; hind coxa distinctly longer than width of mesepimeron; **palpi of female decidedly shorter than proboscis,** except in certain species of *Megarhinus* (large and of brilliant metallic coloration); scutellum trilobed with the setae grouped on the lobes, except in the Megarhinini, which have the posterior margin straight..........4.

2\. Integument of mesonotum with a very slender, distinct white longitudinal line; **antennal hairs of female as long as width of thorax;** spiracular setae absent..........*Stethomyia.*

Integument of mesonotum without a slender white line (some species of the subgenus *Anopheles* have a broad grayish line); **antennal hairs of female much shorter than width of thorax;** spiracular setae present..........3.

3. Scutellum trilobed; **antennal hairs of female with knobs of scales at apices of the first seven basal flagellar joints;** terminal antennal joints of male circular in cross section; sides of mesonotum with erect scales; hind basitarsis nearly twice the length of hind tibia..........*Chagasia.*

Scutellum crescent shaped; flagellum of female without knobs of scales, except occasionally on first one or two joints; hind basitarsus but little longer than hind tibiae..........*Anopheles.*

Tribe MEGARHININI.

4. **Very large more or less metallic colored species with the proboscis strongly curved downward; palpi of female longer than the antennae;** clypeus much broader than long; thorax (including the sides) and abdomen densely covered with scales; length of the forked branches of second vein much shorter than the preceding simple section (similar to that in *Uranotaenia*, see plate 7) a spurious vein present on inner side of fifth vein as well as an outer, the former with a V-shaped ending; base of hind coxa in line with upper margin of the meso-merocoxa; spiracular setae present; squamae without fringe of setae ....(Megarhinini) *Megarhinus.*

Proboscis straight, occasionally slightly distorted (except in certain small species of the Sabethines which have a very long, strongly recurved proboscis); **females with the palpi much shorter than the antennae;** clypeus at least as long as broad; no spurious vein on inner side of lower branch of fifth vein (only the outer one present)..........5.

Tribe URANOTAENIINI.

5. **Small to very small species, the thorax brown with metallic blue or white lines or spots, mesonotal setae well developed;** palpi (both sexes) extremely small, each with but a single segment; spiracular setae present; sterno-pleura with a transverse suture (plainly visible in potash-treated specimens); base of hind coxa distinctly below upper margin of meso-merocoxa; wings without villi (except in *U. geometrica*); **branches of second vein much shorter than the preceding simple section; anal vein ending at, or slightly before, the fork in the fifth vein** (see plate 7) (certain species of *Haemagogus*, tribe Culicini, have their venational characters closely approaching the ones here given; they may easily be distinguished from *Uranotaenia* by the dense covering of metallic scales on the mesonotum and abdomen and lack of setae on the mesonotal disk); wing with patches of silvery white or metallic blue scales, at least along base of fifth vein; squamae without fringe of setae..........

(Uranotaeniini) *Uranotaenia.*

Mesonotum of various colors, the disk with or without setae; sternopleura without transverse suture; wings with villi; **branches of second vein at least as long as, usually longer than, the preceding simple section** (except certain species of *Haemagogus*, see above); fifth vein uniformly scaled .... 6.

Tribe Culicini.

6. Palpus of female with two to four differentiated segments; **hind tibia at least as long as fore tibiae; base of hind coxa distinctly below upper margin of meso-merocoxa** (except *Haemagogus*); spiracular setae usually absent; squamae with a fringe of setae (very rarely incomplete); postnotum usually without setae (present in some species of *Haemagogus*, *Deinocerites*, and *Culex*, i. e., the subgenus *Carrollella*); disk of mesonotum usually with setae (Culicini) .... 7.

Palpus of female with a single well developed joint; **hind tibia distinctly shorter than fore tibia; base of hind coxa in line with upper margin of meso-merocoxa;** spiracular setae present, except in *Limatus;* squamal fringe incomplete (*Joblotia* and certain species of *Goeldia*) or entirely absent; sides of thorax for the greater part densely scaled; disk of mesonotum densely scaled and without setae; postnotum always with a tuft of setae; metallic colors usually present (especially on head and prothoracic lobes) .... *Sabethini* 16.

7. **Scales on anal vein large and outstanding, their outside margins forming a broad line** (the width being more or less equal to the length of the scales forming the fringe on the posterior margin of the wing) .... 8.

Scales on anal vein very small and usually closely applied to the vein, forming but a slender line .... 10.

8. **Antennal joints scarcely longer than broad;** clypeus with scales (dull white in color) **wing membrane rather completely overlaid with scales;** width of anal cell only about equal to the length of the scales composing the posterior wing fringe .... *Aedeomyia.*

Antennal joints distinctly longer than broad; clypeus bare; **posterior portion of the wing with large areas of membrane exposed;** width of anal cell distinctly greater than length of fringe scales .... 9.

9. Without spiracular and mid-mesepimeral setae; **fourth and fifth fore tarsal joints shorter than the third** .... *Orthopodomyia.*

Either post-spiracular or mesephimeral setae present (usually both); **fourth and fifth fore tarsal joints longer than the third** .... *Mansonia.*

10. **Brilliant metallic dark blue to green with sides of thorax and abdomen densely white scaled;** first abdominal tergite entirely scaled; tergites three to four and disk of mesonotum without setae; spiracular and post-spiracular setae absent; hind basitarsus distinctly shorter than hind tibia .... *Haemagogus.*

Without brilliant dark blue or green coloration; first abdominal tergite but partially scaled; all abdominal tergites with setae, at least on posterior margins; disk of mesonotum very rarely without setae .... 11.

11. **Lower side of stem vein setose;** spiracular setae present; postspiracular setae absent (*North American*) .... *Culicella.*
Lower side of stem vein bare .... 12.

12. **Hind basitarsus shorter than hind tibia;** eighth abdominal segment of female usually not apparent (being retracted into the seventh), the dorsal surface unscaled, **tip of abdomen rather sharply pointed,** the effect being chiefly from the prominent, laterally flattened, cerci (exceptions: the subgenus *Finlaya* (*Aëdes*) has the eighth segment exposed and scaled above and the cerci but little protruding; *Howardina* (*Aëdes*) has both the eighth segment and the cerci short); pulvilli absent; postspiracular setae present .... 13.
Hind basitarsus slightly longer than hind tibia, eighth abdominal segment of female visible and scaled dorsally; **tip of abdomen blunt,** the cerci short, and inconspicuous; pulvilli present; post-spiracular and spiracular setae absent .... 14.

13. **Spiracular setae present** .... *Psorophora.*
Spiracular setae absent .... *Aëdes.*

14. **Very large species with dark and light wing areas** .... *Lutzia.*
Moderate to small species; **wing scales all dark** .... 15.

15. Antenna much longer than proboscis (**Caribean coast region**) .... *Deinocerites.*
Antenna not longer than proboscis .... *Culex.*

Tribe SABETHINI.

16. Prothoracic lobes sublateral; palpi of female more than twice the length of clypeus; male palpi usually long, approximating length of proboscis .... 17.
Prothoracic lobes collar-like; palpi of female distinctly shorter than in preceding group; male palpi always short .... 18.

17. **Clypeus setose** .... *Joblotia.*
Clypeus bare .... *Goeldia.*

18. **Mesonotum with brilliant golden and purplish areas;** length of palpus not exceeding that of clypeus; spiracular setae absent, the area being densely scaled .... *Limatus.*
Mesonotum without this coloration; length of palpus somewhat longer than that of clypeus; spiracular setae present .... 19.

19. **At least the middle legs with paddle-like development of scales;** fore femora shorter than the middle ones; prealar and propleural setae absent .... *Sabethes.*
Legs without paddle-like development of scales, i. e., uniformly slender; fore femora as long as middle ones; propleural setae present .... 20.

20. Prothoracic lobes closely approximated dorsally; prealar setae absent; **general coloration a deep metallic blue** .... *Sabethoides.*

Prothoracic lobes moderately approximated; prealar setae present; **rarely with a deep metallic general coloration** .... 21.

21. Lower sternopleural setae all located below level of upper margin of meso-merocoxa .... 22.
Lower sternopleurals extending above this level .... 23.

22. Wing scales broad .... *Miamyia.*
Wing scales narrow .... *Wyeomyia.*

23. Postnotum covered with white scales; wing scales narrow .... *Menolepsis.*
Postnotum with few or no scales; wing scales broad .... *Dendromyia.*

IV. CLASSIFICATION OF THE BRAZILIAN REPRESENTATIVES OF PSOROPHORA, AËDES, AND MANSONIA.

Genus **Psorophora** Robineau-Desvoidy, 1827.

A genus evidently of tropical American origin and entirely of American distribution, most probably derived from the Aëdine subgenus *Ochlerotatus.* The largest of the blood-sucking mosquitoes belong here. The larvae occur in transient rainpools and develop with great rapidity.

Three subgenera are recognized on the basis of the external characters of the adults and genitalic characters of the males.

The following subgeneric classification is principally based on the characters of the females.

KEY TO THE SUBGENERA OF PSOROPHORA (*Brazilian Species*).

1. Very large species; mesonotum with smooth longitudinal nude areas. Female: Palpus equal in length to five or more of the basal flagellar segments; tarsal claws toothed .... Subgenus *Psorophora.*
Moderate size species; mesonotum with uniform distribution of scales; palpus of female decidedly shorter .... 2.

2. Tarsi dark except the fifth hind tarsal (and sometimes the fourth), which is completely white; claws of the female toothed .... Subgenus *Janthinosoma.*
Tarsal segments white ringed; claws of the female simple .... Subgenus *Grabhamia.*

Genus **Aëdes** Meigen.

The genus *Aëdes* is second only to *Culex*, in the number of its species found in America. Dyar (1928) records eight subgenera and 110 species of *Aëdes.* The species of this genus found in North America (75) outnumber all other species of mosquitoes found there. However, the American tropics possess a very limited Aëdine fauna.

Six of the subgenera, but only thirteen of the species, are at present known to occur in Brazil.

A comparison of the subgenera and species occurring in Brazil and in America as a whole follows:

Subgenus	America	Brazil
Aëdes	1	0
Aëdimorphus	1	0
Stegomyia	1	1
Conopostegus	1	1
Howardina	13	2
Finlaya	8	2
Taeniorhynchus	10	2
Ochlerotatus	75	5

The first three subgenera are typically an Old World group, while representatives of probably all the others, except *Conopostegus*, likewise occur there. The Old World possesses, in addition, about eight subgenera not represented in America.

KEY TO THE SUBGENERA OF AËDES (*Brazilian*).

1. Clypeus, prothoracic lobes, mesopleura, mesepimeron (upper portion only) and hind coxa with white scales of metallic lustre; occiput without erect scales (save those composing the ruff); tarsi with white rings. Female: eighth abdominal tergite scaleless and retracted; tarsal claws toothed........*Stegomyia*.
   Clypeus without scales........2.
2. Mesepimeron with scales of distinct metallic lustre extending nearly its entire length; other markings distinctly metallic. (Tree-hole breeding species)........3.
   Mesepimeron with the scales confined to the upper half; markings not distinctly metallic; hind coxa with few or no scales. Female: Eighth abdominal tergite unscaled and retracted, the cerci long (exception: *fluviatilis*, as in *Finlaya*); claws toothed. (Ground-water breeders)........5.
3. Hind tarsi with a single pale ring at base of first segment; mesonotum with golden markings. Female: Eighth abdominal segment retracted; cerci short; claws simple........*Howardina*.
   Hind tarsi without rings or with a broad ring involving the apex of the first and the base of the second segments; mesonotum with silvery markings. Female: Eighth abdominal segment protruding and scaled above; claws toothed........4.
4. Base of costa black scaled; hind tarsi without ring; a slender line extending full length of mesonotum; occiput without erect scales aside of the ruff........*Conopostegus*.
   Base of costa white scaled; hind tarsi with rings; mesonotum with sides broadly silvered (at times the silvered areas confluent); occiput with erect scales........*Finlaya*.
5. Hind tarsi with rings; sides of first abdominal tergite with white scales.. *Taeniorhynchus*.
   Hind tarsi without rings; sides of first tergite without scales....*Ochlerotatus*.

KEY TO SPECIES OF PSOROPHORA AND AËDES

(Because there are but few species in Brazil belonging to these genera and because of the difficulty of separating them generically, they have been grouped together.)

1. Proboscis with a more or less distinct light ring or area at about the middle; tarsi with rings on all the segments .... 2.
   Proboscis uniformly dark .... 4.
2. Abdominal white cross-bands on the basal margins of the tergites; last hind tarsal completely white; claws toothed .... *Aëdes* (*Taen.*) *taeniorhynchus*.
   Abdominal cross-bands (more or less interrupted in the middle) on the posterior margins of the tergites; last hind tarsal black with a white basal ring; claws simple .... 3.
   Wings with whitish and dark scales .... *Ps.* (*Grab.*) *confinnis*.
   Wing scales all dark .... *Ps.* (*Grab.*) *cingulata*.
4. Very large species; length of palpus equal to at least the five basal flagellar joints; mesonotum with scaleless, shining longitudinal areas .... 5.
   Moderate to small species; palpus distinctly shorter; mesonotum uniformly scaled, sometimes sparsely .... 7.
5. Sides of thorax (pleurae) practically scaleless; mesonotum with a pair of uniformly slender white lines .... *Ps.* (*Ps.*) *genumaculata*.
   Sides of thorax largely covered with scales .... 6.
6. Median mesonotal stripe golden brown; proepimeron without scales (or extremely few) .... *Ps.* (*Ps.*) *ciliata*.
   Median mesonotal stripe black: proepimeron with large scattered white scales .... *Ps.* (*Ps.*) *cilipes*.
7. Fifth and usually the fourth hind tarsals completely white, remainder of the tarsi black .... 8.
   White markings of the tarsi, if present, not confined to the fourth and fifth hind tarsals .... 10.
8. Mesonotum with small, uniformly scattered scales .... *Ps.* (*Jan.*) *ferox*.
   Mesonotum with a broad, dark, central stripe; the sides light colored .... 9.
9. Fourth hind tarsal white; sides of mesonotum with yellowish scales .... *Ps.* (*Jan.*) *lutzi*.
   Fourth hind tarsal partly black; sides of mesonotum whitish .... *Ps.* (*Jan.*) *varipes*.
10. Hind tarsi without rings .... 11.
    Hind tarsi with rings, at least at base of first tarsal segments .... 17.
11. Prothoracic lobes silvered; a slender silvery line extending from between the eyes backwards to tip of scutellum; mid-femur with a white exterior spot beyond the middle .... *Aëdes* (*Conop.*) *leococelaenus*.
    Prothoracic lobes with lusterless scales, mid-femur without an isolated white spot .... 12.
12. Integument of mesonotum bright reddish yellow with a posterior pair of black spots and but very sparsely clothed with small yellow scales .... *Aëdes* (*Och.*) *fulvus*.

Integument of mesonotum dark brown and rather thoroughly covered with scales 13.

13. Mesonotum uniformly dark scaled (male with a slender white stripe).. *Aëdes* (*Och.*) *nubilus*.

Mesonotum with white stripe..... 14.

14. Mesonotum with a slender white line; antenna slightly longer than proboscis.......... 14.

Mesonotum with a broad stripe or patch of slight scales; antenna distinctly shorter than proboscis.......... 16.

16. Mesonotal stripe creamy white in color; species of moderate size........ *Aëdes* (*Och.*) *serratus*.

Mesonotal stripe bluish white; small species........ *Aëdes* (*Och.*) *hastatus*.

16. Mesonotum with a broad patch of white on anterior three-fifths (i. e., ending before wing bases).......... *Aëdes* (*Och.*) *scapularis*.

Mesonotum with a broad stripe extending as far back as the wing bases.......... *Aëdes* (*Och.*) *orinifer*.

17. All hind tarsals with rings.......... 18.

Last three tarsals without rings.......... 19.

18. Clypeus with white scales; a lyre-shaped marking on mesonotum...... *A.* (*Steg.*) *aegypti*.

Clypeus nude; anterior portion of mesonotum largely pale scaled.. *Aëdes* (*Taen.*) *fluviatilis*.

19. Mesonotum black and silvery.......... 20.

Mesonotum black and golden.......... 21.

20. Sides of mesonotum silvery; only the base of costa white scaled; palpi of male as long as proboscis .... *Aë.* (*Fin.*) *terrens*.

Female unknown, but male with anterior two-thirds of mesonotum entirely silvery; stem vein as well as costa white scaled; palpi distinctly shorter than proboscis .... *Aëdes* (*Fin.*) *argyrothorax*.

21. Mesonotum chiefly golden scaled.......... *Aëdes* (*How.*) *fulvithorax*.

Mesonotum chiefly dark scaled with slender golden lines.......... *Aëdes* (*How.*) *septemstriatus*.

KEY TO THE LARVAE OF PSOROPHORA.

1. Anterior corners of head squared; mouth brushes widely separated, prehensile; air-tube without a median enlargement. (Subgenus *Psorophora*).......... 2.

Anterior corners of head rounded; mouth brushes normal; air-tube enlarged more or less at the middle.......... 4.

2. Air-tube pecten extending far beyond the middle, the tuft (consisting of a pair of long hairs) subapical .... *cilipes*.

Air-tube pecten only extending as far as the middle; the tuft located within the outer third.......... 3.

3. Air-tube tuft multiple, shorter than the width of the tube.... *genumaculata*.

Air-tube tuft consisting of a single long hair .... *ciliata*.

4. Antenna distinctly longer than the width of the head (Subgenus *Janthinosoma*) .... *ferox*, *lutzii*, and *varipes*.

Antenna as long as or shorter than the width of the head (Subgenus *Grabhamia*) .... 5.
5. Head as long as broad .... *cingulata*.
Head broader than long .... *confinnis*.

KEY TO THE LARVAE OF AËDES.

1. Antennal hair "tuft" (arising more or less at the middle of the shaft) consisting of a single hair (minute in stegomyia); anal segment broadly membraneous on ventral surface (container, artificial and natural, breeding species) .... 2.
Antennal tuft consisting of two or more hairs (ground-water breeders) .... 5.
2. Comb scales on eighth segment arranged in a single straight row of 8–12 scales (very rarely more, occasionally 18 in stegomyia) .... 3.
Comb scales in a very irregular single row or several rows deep .... 4.
3. Posterior margin of the sclerotized plate on the anal segment not spinose; the individual scales of the eighth segment comb with the basal (semi-transparent) portion more or less sole-shaped and with the apical (opaque) portion showing a strong apical and several lateral spines; the short hair tufts of thorax and body inconspicuous and with one to three hairs .... *aegypti*.
Posterior margin of the sclerotized anal plate distinctly spinose; comb scales with the semi-transparent portion oval and with a single spine; the short hair tufts of thorax and body conspicuous and composed of four to five hairs .... *leucocelaenus*.
4. Comb scales in an irregular or double row, 12–20 in number; apical portion of the individual scales much longer than the basal, spatulate in shape, fringed but without spines; body with conspicuous stellate hairs .... *fulvithorax*.
Comb scales very numerous (40–50) arranged in a triangular patch, shape as in *fulvithorax;* body hairs similar but not as conspicuous (i. e., rather long and slender, or less spinose in structure) .... *terrens*.
5. Anal segment membraneous along ventral surface; basal portion of comb scales somewhat shorter than the coarsely fringed apical part *fluviatilis*.
Anal segment completely banded with sclerotin .... 6.
6. Pecten of air-tube with detached teeth outwardly .... *fulvus*.
Pecten consisting of evenly spaced teeth .... 7.
7. Air-tube nearly four times as long as wide; anal gills extraordinarily long .... *hastatus*.
Air-tube less than three times as long as wide; anal gills moderate or very short .... 8.
8. Comb containing 10–12 teeth in a straight line .... *serratus*.
Comb with many (20 or more) in a triangular patch .... 9.
9. Anal gills much longer than broad, body densely pilose .... *scapularis*.
Anal gills very short, nearly as long as broad; body moderately pilose .... *taeniorhynchus*.

Psorophora (Psorophora) ciliata Fabricius, 1794.

A very large, brown to very dark brown, species with moderately shaggy legs and fairly distinct tarsal rings; distinguished from its allies by the median longitudinal stripe of brown scales.

This species has an extraordinarily wide geographical range, extending from southeastern Canada to about the middle of Argentina. The form found in the middle coast states of Brazil differs noticeably from specimens taken in Argentina and North America in being of a much darker color. It does not differ structurally. The species is apparently rare in the middle coast states. Our material consists of reared specimens, a small lot collected near the city of Bahia and another from the city of Pernambuco, both collected during the early part of the rainy season.

The species also occurs in the southeastern Brazilian states (Cesar Pinto).

Psorophora (Psorophora) cilipes (Fabricius), 1805.

A very large black species with a diffuse sprinkling of white scales on occiput and thorax; abdomen deep metallic violet blue, legs shaggy in appearance, the tarsi without white rings.

Evidently of strictly tropical distribution, Mexico to southern Brazil. Has been found in all three of the Brazilian coastal regions. Our material consists of specimens reared from larvae found near the city of Bahia during the early part of the rainy season.

Psorophora (Psorophora) genumaculata, Oswaldo Cruz, 1907

A very large shining black species with a widely separated pair of slender white lines on the mesonotum; legs entirely black, moderately shaggy; wings rather strongly infuscated.

The species was placed by Dyar (1928) as a synonym of *Psorophora lineata* (Humboldt). Recently Cesar Pinto (1930) has shown it to be specifically distinct. To date, it has been found only in Brazil and Misiones (Argentina) which adjoins Brazil. Adults have been collected on a few occasions but most of our material consists of reared specimens, the larvae of which were found associated with *ciliata* and *cilipes* larvae.

Psorophora (Janthinosoma) ferox (Humboldt), 1820.

A more or less woodland species; although only moderately common, it is probably the commonest species of the genus throughout its entire range, which is coextensive with that of *ciliata* (Canada to middle Argentina).

A fairly large species of a general dark reddish-brown color; occiput with bright yellow scales; the tarsi are black with the exception of the fourth and fifth hind tarsals which are conspicuously white.

The species has been found in all three of the coastal regions of Brazil. Its principal season of abundance coincides with that of the early rainy season, but adults are found in small numbers throughout practically the rest of the year. They were, however, found in considerable abundance during midwinter in a locality (Ilhéos) some distance south of Bahia.

The larvae live in temporary rainpools having a grassy bottom, usually adjoining woodlands.

Psorophora (Janthinosoma) lutzii Theobald, 1901.

A rather rare, wide-ranging, tropical, principally woodland species, occurring from Mexico to Argentina. It is easily distinguished (except from *varipes*) by its rather dusky wings, by the broad dark stripe on the mesonotum, bordered by equally broad cream-colored areas, and by the dark hind tarsi tipped with white.

The larvae occur in temporary woodland pools, and after the first heavy rains of the rainy season the adults have a brief period of comparative abundance in their more favorable localities. The species appears to be exceedingly rare about the city of Bahia but has been seen on the wing in numbers near Estancia (Sergipe). It occurs in the three coastal regions of Brazil.

Psorophora (Janthinosoma) varipes Coquillet.

In Brazil, this species appears to be even less common than lutzii. It occurs in the southeastern states, but otherwise has practically the same distribution as lutzii. The two species are very similar in appearance, being distinguishable only by rather minor differences in color. Their habits are likewise similar. *P. varipes* has been captured in the middle coast and southeastern states of Brazil.

Psorophora (Grabhamia) cingulata (Fabricius), 1805.

Likewise a tropical woodland species (Central America to southern Brazil). Its mottled coloration, striped proboscis, and banded legs give it a superficial resemblance to species of the genus *Mansonia*, from which it may be easily distinguished by its narrow wing scales. The rather silvery cross-bands on the apical margins of the abdominal tergites constitute one of its most distinctive features.

P. cingulata appears to have a longer breeding season, at least in the vicinity of Bahia, than the other species of the genus. Despite its general abundance, larvae have been found on but few occasions, and then usually in peculiar places, such as a tin can, hoof prints in mud, etc.

The species occurs in the three coastal regions of Brazil.

Psorophora (Grabhamia) confinnis, Lynch Arribalzaga, 1891.

This species is very similar to *P. cingulata* in appearance and habits, and practically coextensive with it. It differs from *P. Cingulata* in having the abdominal pale markings entirely dull, and the whitish scales intermixed with the black on the wings.

Has been recorded from Pará and the southeastern states, but apparently does not occur in the middle coastal states.

Aëdes (Stegomyia) aegypti (Linnaeus), 1762.

This species represents the only foreign element among the tropical species belonging to the subtribe Aëdini. It differs from all Brazilian species of *Aëdes* in many respects, in structure as well as in habits. (Dyar, 1918, has shown, on the basis of the genitalic structure of the male, that it is clearly of Old World origin.) The silvery markings of the head (scales on the clypeus) and thorax (lyre-shaped design on the mesonotum and the scutellum entirely with broad flat scales) easily set it apart from all other American Aëdines. Also, it is the only species not directly dependent upon rainfall, and therefore its breeding can continue practically undisturbed by natural influences, except in the case of cool temperatures and perhaps excessive dryness of atmosphere.

Probably exists along all the main highways of travel throughout Brazil, in the lower altitudes.

Aëdes (Howardina) fulvithorax (Lutz), 1904.

The principal habitat of the rather rare species of *Howardina*, is the countries and islands of the Caribbean. *Aë. fulvithorax* is the chief representative in Brazil. Its distribution is from the southern part of the country northward to Trinidad.

The golden mesonotum, dark abdomen with bright silvery spots on the sides of all the segments and on the dorsum of the fifth to seventh segments, and the single ring on the hind tarsi (base of the first segment) easily distinguish it.

The species lives only in well wooded areas. The larvae are found in rot holes in trees and in the open ends of broken bamboos. The females attack man rather readily; they have also been captured on animal bait (horses, etc.).

Probably occurs along the entire coast of Brazil wherever conditions are favorable, although as yet unrecorded from northern Brazil.

Aëdes (Howardina) septemstriatus Dyar and Knab, 1907.

Evidently a rare species and to date has been recorded only from Nicaragua and Panama.

Agrees with *fulvithorax* in the possession of but a single hind tarsal light ring, but is somewhat larger and more robust. The mesonotum is largely dark-scaled with a diffuse pattern of golden scales forming a very slender median line extending onto the scutellum, and three pairs of additional lines which are very indefinite.

Our collection contains a single female captured on animal bait (horse) at Pará, April, 1930 (N. C. Davis). Larvae have been found in Panama in tree holes.

Aëdes (Conopostegus) leucocelaenus Dyar and Shannon, 1925.

The subgenus *Conopostegus*, containing but a single species, is clearly intermediate between the subgenus *Finlaya* (*Aëdes*) and the genus *Haemagogus*. There has been considerable difference of opinion as to whether it should be located in *Haemagogus* or in *Aëdes*. Costa Lima (1930) has recently replaced the species in *Haemagogus*. The external characters of both sexes definitely place it in *Aëdes*, although the genitalic structures of the male are rather definitely of the *Haemagogus* type. Inasmuch as it is preferable to base generic distinctions on characters possessed by both sexes rather than on the secondary sexual characters of the male, it is here proposed to keep the subgenus in *Aëdes*.

The species occurs from Panama to Argentina. In Brazil, it has, up to the present, been found only in the southeastern states. It is restricted to wooded areas, and the larvae live in tree holes. Costa Lima (ibid) gives photographs of the larval skins, from which the description of the species (as given in the larval key) is derived. The adults are known to attack man.

Aëdes (Finlaya) terrens (Walker), 1856.

Although one North American species of the subgenus *Finlaya* occurs as far north as New Hampshire and Montana, the species are chiefly of tropical distribution. *Aë. terrens* is the chief representative (at least in Brazil) and occurs from Mexico to southern Brazil.

The species is characterized by dark median stripe on the mesonotum, broadly silvered sides, and hind tarsi with two light rings, the first narrow and located at the base of the first segment, the second broad and involving the apex of the first and the base of the second segments.

We have reared two to three hundred adults and all but a very few males have the thoracic pattern as described above. The exceptions have the silvered areas of the thorax confluent, thus agreeing with the description of *terrens* as given by Dyar (1928). The terminalia of the two forms, however, show no obvious differences, and Edwards, to whom specimens were sent, states that they constitute but a single species. He further suggests that *Aë. podographicus* Dyar and Knab (including *metoecopus* Dyar, already placed by Dyar as a synonym of *podographicus*) is but a variety of *terrens*. This would extend the distribution of *terrens* to Ecuador (type locality of *metoecopus*).

Although the larvae are found about Bahia in greater abundance than are the larvae of *Aë. fulvithorax*, the adults have not as yet been found in nature, although females of *fulvithorax* have been captured on a number of occasions while in the act of attacking man. This would indicate a difference of food habits. However, females of *terrens* kept in the laboratory feed on blood with about the same facility as *fulvithorax*.

Aë. terrens is also found in the southeastern states of Brazil, but it has not been recorded from Pará. The larvae are found in tree holes and bamboo joints.

Aëdes (Finlaya) argyrithorax Bonne and Bonne Wepster, 1920.

Up to the present time this species has been recorded only from Surinam ("We have two males, one captured near a tree hole at Geiersvlijt, the other in our house at Paramaribo." Bonne and Bonne Wepster, 1925).

We have five males, reared from larvae collected in tree holes. The larvae were not isolated.

Aëdes (Taeniorhynchus) taeniorhynchus Wiedemann, 1921

The subgenus *Taeniorhynchus* is widely distributed in North America, New Hampshire, and British Columbia southwards. In South America it extends as far south as Perú and Brazil.

Aë taeniorhynchus is the best known and most troublesome species of the genus *Aëdes* (excepting stegomyia) and extends along the Atlantic coast as far north as New York, and southward as far as southeastern Brazil.

The tinged proboscis and striped tarsi give it a close resemblance to certain species of *Mansonia*. It may be distinguished from the latter by the narrow wing scales, and from the similarly marked species of *Psorophora* by the basal position of the abdominal cross-bands on the segments.

Its principal season of abundance in the middle coast states of Brazil is during the early rainy season. During the dry season of summer a brood follows upon every shower sufficient to fill the rock pools.

Aëdes (Taeniorhynchus) fluviatilis (Lutz), 1904.

A comparatively little known species, recorded, up to the present, from Surinam, French Guiana, and Brazil. The larvae are found in the rock pools of stream beds, and breeding therefore is largely governed by rainfall. It attacks livestock and man, and when dwellings are located near the breeding sources it probably is troublesome.

Aëdes (Ochlerotatus) scapularis (Rondani), 1848.

The great majority of the American species of *Ochlerotatus* are of strictly north-temperate distribution. *Aë. scapularis*, the commonest tropical species, occurs from the West Indies to Argentina. The large patch of white scales on the anterior two-thirds of the mesonotum is sufficient to distinguish it from its Brazilian allies.

The larvae are found in grassy rain pools, and the species is the only one of the subgenus which breeds freely in suburban districts.

Aëdes (Ochlerotatus) serratus (Theobald), 1901.

Strictly tropical, Mexico to Bolivia. A fairly large species, easily distinguished from other Brazilian species of the group by the slender longitudinal line on the thorax.

The larvae are found in grassy rainpools near well wooded areas. The species occurs all along the Brazilian coast in regions suitable for its development.

Aedes (Ochlerotatus) hastatus Dyar.

Recorded to date only from Costa Rica and Panama. The adult is much smaller than *serratus* but otherwise greatly resembles this species. The larvae were found associated with those of *serratus* (Bahia, Brazil).

Aedes (Ochlerotatus) crinifer (Theobald), 1903.

All records for this species are based on specimens from Pará, southeastern Brazil, and northwestern Argentina. The adults have a fairly broad longitudinal stripe on the thorax, extending as far back as the wing bases. The larvae have been found in grassy rain-pools.

Aëdes (Ochlerotatus) nubilus (Theobald), 1903.

Extends from the West Indies to Argentina. The male has a slender thoracic stripe but the female differs from the other Brazilian species of the group in having the mesonotum entirely dark scaled. The species appears to be strictly a forest inhabitant. Adults have been collected in Pará and in Bahia (Brazil).

The American subgenera and species of *Mansonia*, Blanchard.

The American fauna consists of three subgenera, *Coquillettidia* (North American), *Rhynchotaenia*, and *Mansonia* (tropical; subtropical in Argentina).

Subgenus COQUILLETTIDIA.

Proboscis with a broad median pale area; proepimeron uniformly clothed with scales and bearing about 12 setae; post-spiracular setae absent; mesepimeron with anterior four setae and a patch of scales; femora without a distinct subapical white ring but hind femur with a preapical black ring; basitarsus with a median white ring, the other rings located basally on the segments; mesonotal scales appressed; first abdominal tergite with a small, inconspicuous patch of dark scales; wing scales moderately broad, black and white intermixed; halteres pale.

Subgenus RHYNCHOTAENIA.

Proboscis dark, with a well defined median white ring and a smaller ring (distinct in all but *albicosta*) just before the tip; proepimeron with or without scales (when present consisting of a small patch) and with 2 to 6 setae; post-spiracular setae reduced in number and size (at least one or two always present); mesepimeron with one or two anterior setae and with or without a patch of white scales; femora with a subapical pale spot, or (usually) ring; tarsal white rings involving both ends of the segments; first abdominal segment with a very small median patch of dark scales; mesonotal scales appressed; halteres pale.

Subgenus MANSONIA.

Proboscis clothed with intermingled dark and pale scales, with or without a median white ring, and without the preapical white ring; proepimeron uniformly clothed with scattered scales and bearing 6 to 12 setae; post-spiracular setae well developed; mesepimeron with 3 to 5 anterior setae and a few scales intermixed with the upper setae; first abdominal tergite with a conspicuous patch of pale scales; mesonotal scales above wing bases semi-erect; femora with intermingled dark and pale scales and without a subapical white ring; tarsal white rings basal on the segments; wings scales broad, dark and pale intermixed; knobs of halteres dark.

Key to Species.

1. Basitarsus with a median white ring (North American)........................ *Man.* (*Coq.*) *perturbans* Wlk.
   Basitarsus without a median white ring..2.
2. Tarsal white rings involving both ends of the segments; femora with a subapical pale spot, or (usually) ring........................(*Rhynchotaenia*) 3.
   Tarsal white rings located basally on the segments; femora with intermingled dark and pale scales, without a distinctive pale spot............ (*Mansonia*) 10.

3. Mesonotum with only dark brown scales through the middle; white markings on thorax, legs, etc., with a distinct metallic silvery lustre......4.
   Mesonotum with a central pattern composed of golden or brassy scales; white markings without a silvery tinge......5.
4. Prothoracic lobes and sides of mesonotum with distinct silvery white spots......*lynchi*, sp. nov.
   Prothoracic lobes and sides of mesonotum with very inconspicuous patches of small brassy scales......*arribalzagae* Th.
5. Costa entirely dark scaled; hind tibia and usually the others without a series of light spots on outer surface......6.
   Costa white scaled at base (always ? see note on *fasciolatus*); all tibiae with a series of yellowish spots on outer surface; mesepimeron with a patch of white scales......8.
6. Wing scales entirely dark; fore and mid tibiae with a large white spot at outer third, hind tibiae with a white ring (Panama)......*nigricans* Coq.
   Wings with white markings, at least near the base......7.
7. First vein white scaled basally (i. e., a white line present at the wing base just behind the costa which covers the stem vein and continues onto the basal portion of the first vein); fore and mid tibiae with a slender pale line along outer surface, hind tibia with a large white spot at outer third; the upper sternopleural patch of white scales extending onto the mesepimeron......*albicosta* Chagas.
   First vein with a small white spot just beyond tip of stem vein; tibiae dark, save for the white spot at apex; mesepimeron without scales......*chrysonotum*.[1]
8. Tibiae with a large spot at outer third; wing with scattered white scales anteriorly (Argentina)......*araozi* S. & Del P.
   Tibiae without this spot......9.
9. Wing with anterior portion inconspicuously mottled with patches of pale scales; fifth and sixth veins completely dark scaled......*fasciolata* L. A.
   Wing with intermingled, rather broad black and white scales; present also on fifth and sixth veins......*justamansonia* Ch.
10. Proboscis with a fairly distinct short white ring beyond the middle; mesonotum without a definite pattern......11.
    Proboscis without this ring......12.
11. Palpi about one-third the length of proboscis; wing scales decidedly broad......*titillans* Wlk.
    Palpi about one-fourth the length of proboscis; wing scales moderately broad......*indubitans* D. & S.
12. Mesonotum covered with dull golden scales anteriorly, mainly dark on posterior third......*amazonensis* Th.
    Mesonotum as shown but with the anterior golden marking broadly divided by a dark stripe......*humeralis* D. & K.
    A large brownish species; the wings with broad scales only......*pseudotitillans* Th.

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[1]Costa Lima (1930) calls attention to the fact that *M. chrysonotum*, although placed as a synonym of *Man. amazonensis* by Dyar, is a distinct species.

Mansonia lynchi sp. nov.

Proboscis with a conspicuous white median ring, a much smaller one basad of the labellae; palpi one-fourth length of proboscis, tips silvery; upper lateral margins of occiput silvery scaled, those patches converging and passing forward between the eyes; remainder of occiput with sparse erect dark scales and setae. Prothoracic lobe with silvery patch above; mesonotum dark brown, three very small and inconspicuous patches of white scales on anterior margin, a small but very conspicuous patch of silvery scales above the mesothoracic spiracle, a similar patch close to base of wings and also on median scutellar lobe; two similar and widely separated patches on sternopleura and a large one on mesopleura; mesopleura with two anterior median setae; all femora dark, with silvery apices and a rather small patch on upper side beyond middle; tibiae dark, the front pair tipped with silver; fore tarsi with two incomplete rings; mid tarsi with spot at base of first and at base of second segments; hind tarsi with a fairly large spot at base of first segment, a ring at base of the second, third, and fourth segments, the fifth entirely pale (shading from silver to cream yellow); abdomen dark above, silvery spots on side of tergites, also on sternites; halteres partly silvery; wing with a single silvery spot, located just beyond tip of "stem" vein.

Mansonia arribalzagae Th.

Differs from *M. lynchi* as follows:

General color more reddish brown; occiput with small, rather widely scattered (more grouped at apex) brassy scales; the silvery patches on mesonotum, prothoracic lobes, and scutellum replaced by much less conspicuous patches of brassy scales, except that the patch near the wing base is black; a dark yellow ring on fore femur beyond the middle; legs otherwise very similar; wing without the silvery spot.

Figures of the terminalia of both species are shown on plate 9. The principal differences are shown by structure of the phallosome and of the clasper.

Types (male holotype, female allotype) to be deposited in the U. S. National Museum. Paratypes: One male, one female. Type locality: Pará, Brazil (April, 1930, hand captures in woods, N. C. Davis collector).

Numerous specimens of *M. arribalzagia* were collected at the same time.

I am indebted to Mr. F. W. Edwards for comparing a description of the new species with the type of *M. arribalzaga* (in the British Museum) and confirming the fact that it is a new species.

V. NOTE ON THE "SPECIES" OF CHAGASIA (*Anophelini*).

Three species have been described under the genus *Chagasia: C. fajardoi* (Lutz), 1904, *C. bonneae* Root, 1923, and *C. bathanus* Dyar, 1928.

C. bonneae was distinguished from *fajardoi* chiefly on the basis of apparently highly satisactory characters present in the pupa and male genitalia. *C. bathanus* was distinguished from *bonneae* chiefly by certain color differences in the adult, and by pupal characters. The known distribution of the three forms would, ordinarily, likewise indicate them to be distinct, southeastern Brazil, Surinam, and Panama respectively.

During a trip into the interior of the state of Bahia (Bomfim), a fairly mountainous region with swift flowing streams, Dr. N. C. Davis and the writer found a number of larvae, pupae, and adults (the latter attacking horses at dusk).

Both types of pupae as described, for *fajardoi* (without a flap-like projection on the breathing trumpet) and for *bonneae* with a flap-like projection), were found. However, each type of pupa produced both types of male, i. e., males with but two spines on the sidepiece (*fajardoi*) and males with about ten spines (as described for *bonneae*).

Admittedly the situation is most unusual, i. e., to have two apparently distinct types of pupae and two equally distinct types of adults in a given species from the same locality. However, we are forced to the conclusion that *C. fajardoi* and *C. bonneae* are but a single species. This being the case, it is highly probable that *C. bathanus*, which differs but slightly from *bonneae*, is likewise a synonym of *fajardoi*.

VI. THE SUBGENUS STETHOMYIA (*Anophelini*).

The group which is here termed a subgenus of the Anophelini, presents a number of remarkable features when compared with the remainder of the American fauna of the tribe, indicating that it constitutes a very distinct stock. To emphasize this in the adult stage, a special dicotomy has been included in the key to the tribes and genera given above. Even more striking features are present in the larvae and male genitalia (Shannon and Davis, 1930). If the American fauna only were considered, it should be accorded generic rank. Several Old World species, however, possess the peculiar larval characteristics of *Stethomyia*, as well as the more typical *Anopheles* characters. Should they be found to be definitely allied to *Stethomyia*, the group will, in all probability, have to retain its subgeneric rank.

The Species of Stethomyia (*Anopheles*).

Until recently it has been thought that *Stethomyia* contained but a single American species. Theobald figured the terminalia of the type species, but apparently, owing chiefly to lack of material, no further study was made of these organs until Bonne and Bonne-Wepster described them in 1926. They named the material before them *S. nimba* Theobald, but it now appears that their specimens belong to a different species.

Shannon and Davis (1930) described also under *S. nimba* Th., the larvae and male of a species found in Bahia, Brazil. The characteristics of the terminalia of the Bahian specimens are similar to those shown in the figure given by Bonne and Bonne-Wepster.

Edwards (1930), basing his study on material from Venezuela and Panama, states: "The Venezuelan specimen agrees with Theobald's rather rough figure of his type from Brazil; the Panama specimen agrees rather closely with the figure given by Bonne and Bonne-Wepster. These two specimens show such marked differences that they almost certainly represent distinct varieties, if not species." To the Panama specimen he gives the name *A. nimbus*, var. *kompi*.

In view of the abundance of our material from Bahia, which as stated above agrees with the figure given by Bonne and Bonne-Wepster, we can confirm with certainty that the material studied by Edwards represents two distinct species.

This year, Davis collected several females of *Stethomyia*, in Pará, the type locality of *S. nimba*. We were able to distinguish these specimens from the Bahian form on the basis of external characters and considered them to be specifically distinct. However, we have recently obtained in the vicinity of Bahia, several females and a single male (all hand captures), which are quite indistinguishable from the specimens from Pará. The terminalia of the male are radically distinct from our common species, presumably *S. kompi*, but although they closely approach the type possessed by *S. nimba*, as illustrated in Edwards' publication, there are several well-marked differences which serve to distinguish them. It is therefore proposed to describe the species as new.

It is of considerable interest to note that the photographs given by Costa Lima (1929) illustrating the terminalia of *Stethomyia* (very probably from Brazil but the exact source of origin is unknown) appear to represent yet another species. It is impossible to distinguish details, but from general appearances it approaches *S. nimba* as described by Edwards.

Stethomyia lewisi, new species.

Adults: probably indistinguishable from *S. nimba* on the basis of adult characters (at least from the specimens we have from Pará which may be the true *nimba*). However, it is fairly easily distinguishable from *S. kompi* by the long silvery-white scale-like setae which project far forward and overhang the large basal antennal joints (in *kompi* these setae are normal and not grouped together, the white spot at the vertex of the head being composed chiefly of scales); by the three white lines of the mesonotum being strongly defined (the lateral ones in *kompi* are rather indefinite); and by the presence of one or two prealar setae (absent in *kompi*).

Male terminalia: Similar to *S. nimba* in having the strong spine remote from the base of the side-piece (it being at the same level as the internal spine) and in having the clasper distinctly longer than the side-piece. They differ from the *nimba* type chiefly in the structure of the claspette. Plate 10 shows figures of the three species whereby direct comparisons may be made.

The obvious differences are: The more elongate condition of the larger arm of the claspette (short and broad in *nimbus*), the elongate and trough-like intermediate arm (broad with an inner point in *nimbus*), and the shorter and stouter spine of the inner arm.

Figure 2 gives the normal dorsal aspect of the left processes of the claspette and the internal lateral aspect of the right side.

Costa Lima speaks of the ostrich-head-like appearance of the large arms of the claspette (the outline is reproduced in figure 12). These bear a general resemblance to the corresponding arms in *nimbus* as illustrated by Edwards (reproduced in figures 10 and 11).

Male holotype and female allotype to be deposited in the U. S. National Museum. One female paratype.

Type locality: Rio Cururipe (near the city of Salvador), Bahia, Brazil.

Named in honor of Dr. Paul A. Lewis.

VII. THE LARVA OF SABETHES CYANEUS (Fabricius), 1805.

Dyar (1928) states that a specimen of *Sabethes cyaneus* was bred from a tree-hole in Panama, but no larvae were obtained.

The only larva known for the genus is that of *S. bipartipes* Dyar and Knab. This is described as having the air-tube conically tapered, densely spicular, with a few weak hairs; lateral comb on a narrow transverse plate. Found in tree holes and fallen banana leaves.

Davis, while at Pará (April, 1930), obtained larvae of *cyaneus* from bamboos from which a male and three females were reared.

The larva differs from that of *bipartipes* chiefly in having the comb-scales separated.

It is of interest to note that, although the genus *Sabethes* apparently has been derived from *Sabethoides*, the larvae of the two *Sabethes* now known in the larval stage lack the dorsal hooks on the seventh segment, which, as far as is known, are unique to the genus *Sabethoides*.

Plate 11 gives the larval characters (figures 1, 2 and 3) and the genitalic characters (figures 4–7).

Acknowledgment.

The writer is pleased to take this opportunity to thank Dr. Nelson C. Davis for his assistance in the course of this work.

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List of Plates and Figures.

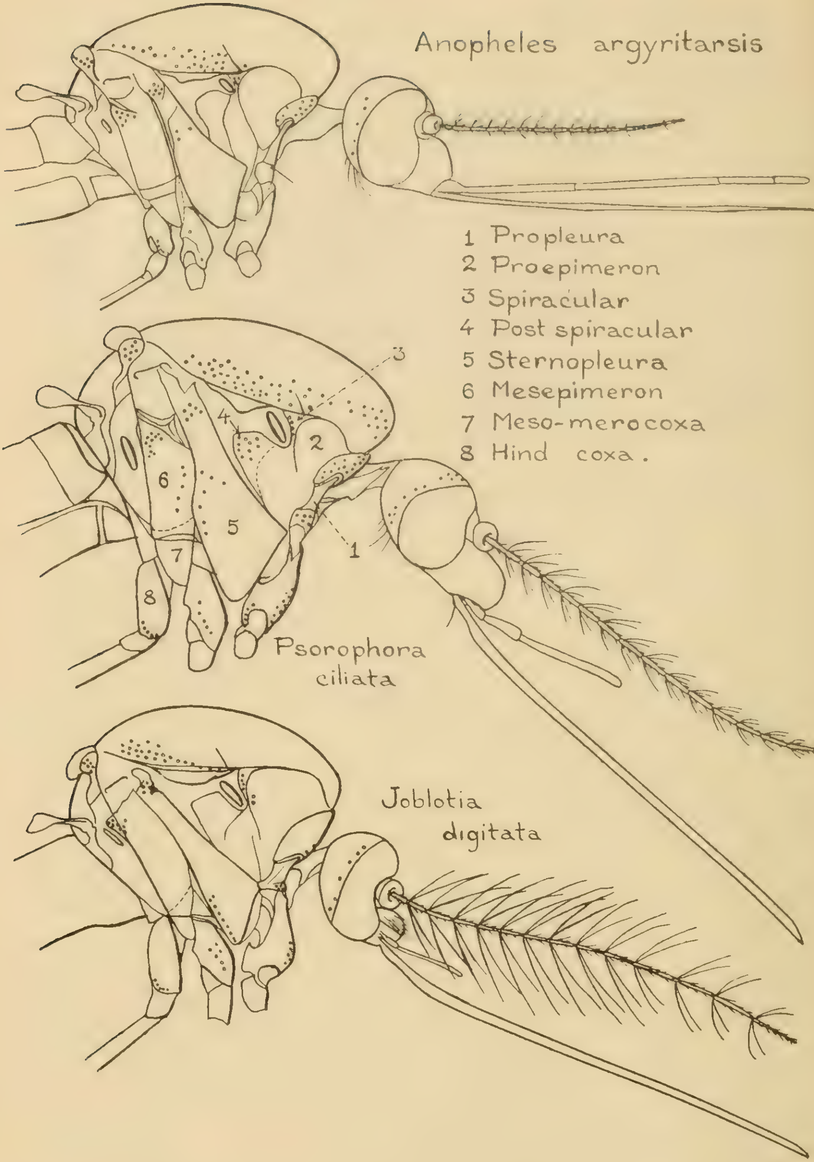
Plates 5, 6, and 7. Figures of representatives of various genera to show the general form of the head, development of clypeus, distribution of thoracic setae, size of the hind coxa and its relation to the meso-merocoxa. Also the wing venation of *Uranotaenia geometrica.*

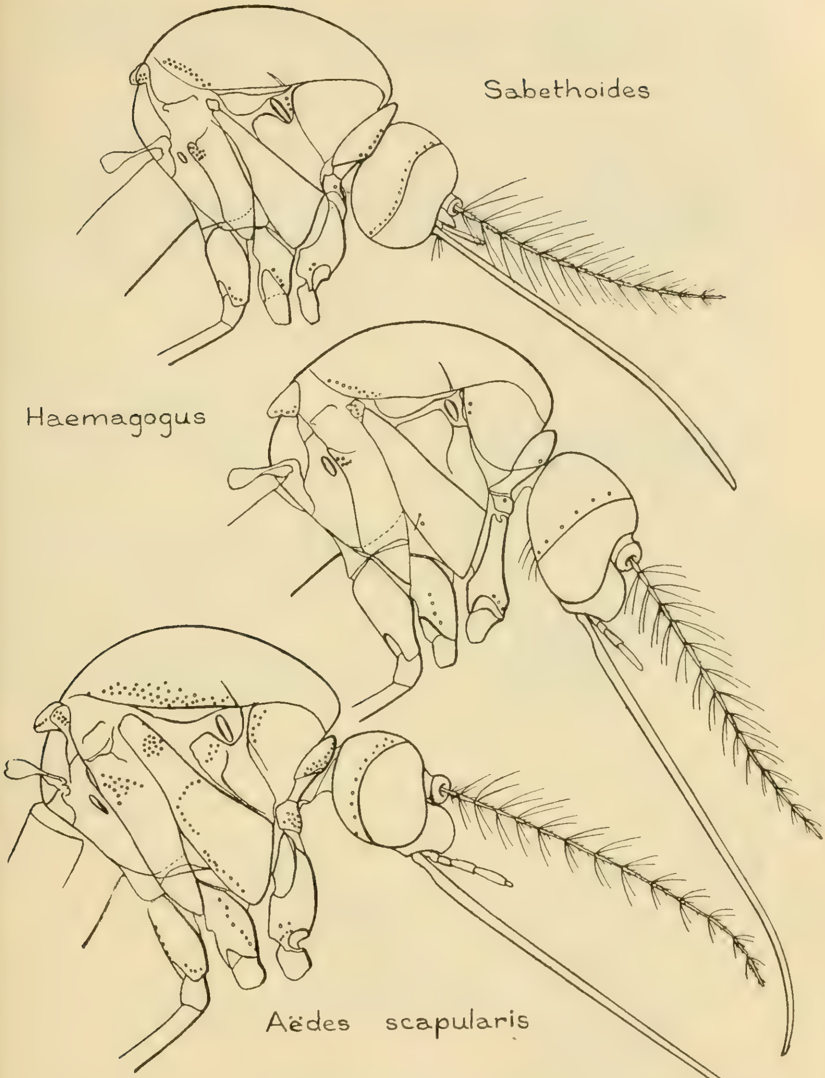
Plate 8. Wings of *Mansonia fasciolata* and *Aëdes taeniorhynchus*, to show the development of the scales on the sixth vein. Also the comb scales of the larvae of various species of *Aëdes*.

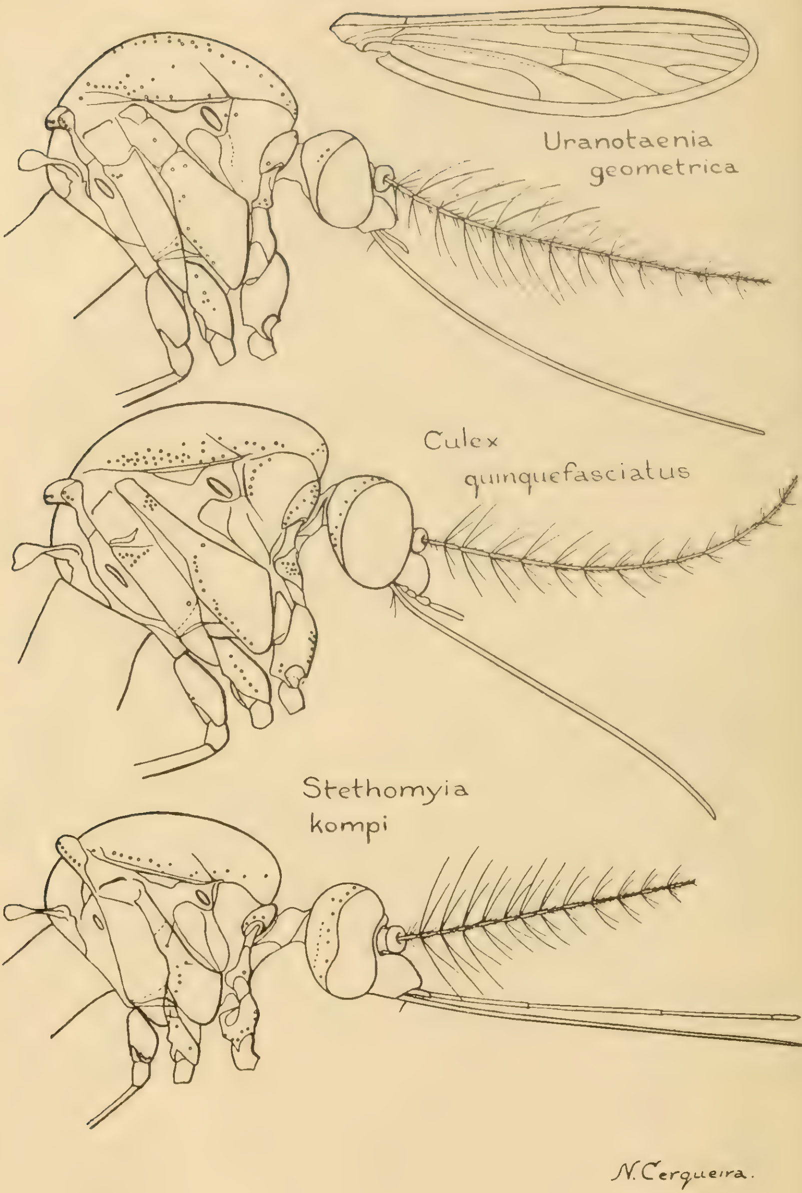
Plate 9. Terminalia of *Mansonia lynchi* n. sp. and *M. arribalzagae* Th.

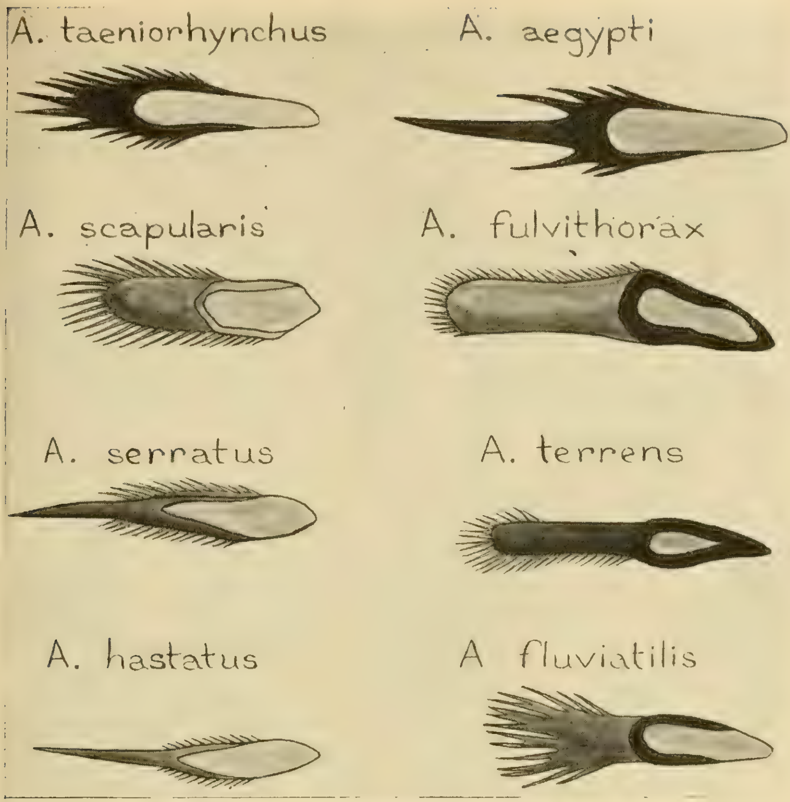
Plate 10. Comparison of the terminalia of the species of *Stethomyia* (*Anopheles*).

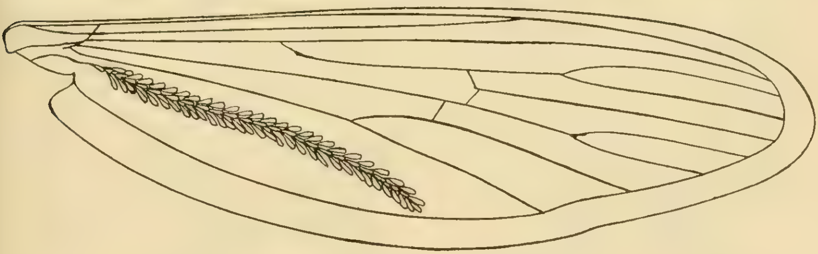
Plate 11. Larval and terminalia details of *Sabethes cyaneus.*


Anopheles argyritarsis
1 Propleura
2 Proepimeron
3 Spiracular
4 Post spiracular
5 Sternopleura
6 Mesepimeron
7 Meso-merocoxa
8 Hind coxa.
3
4
2
6
5
1
7
8
Psorophora ciliata
Joblotia digitata

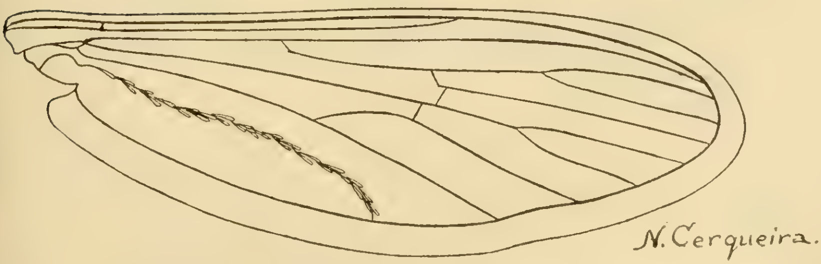

Sabethoides
Haemagogus
Aëdes scapularis


Uranotaenia
geometrica
Culex
quinquefasciatus
Stethomyia
kompi
N. Cerqueira.





Mansonia fasciolata

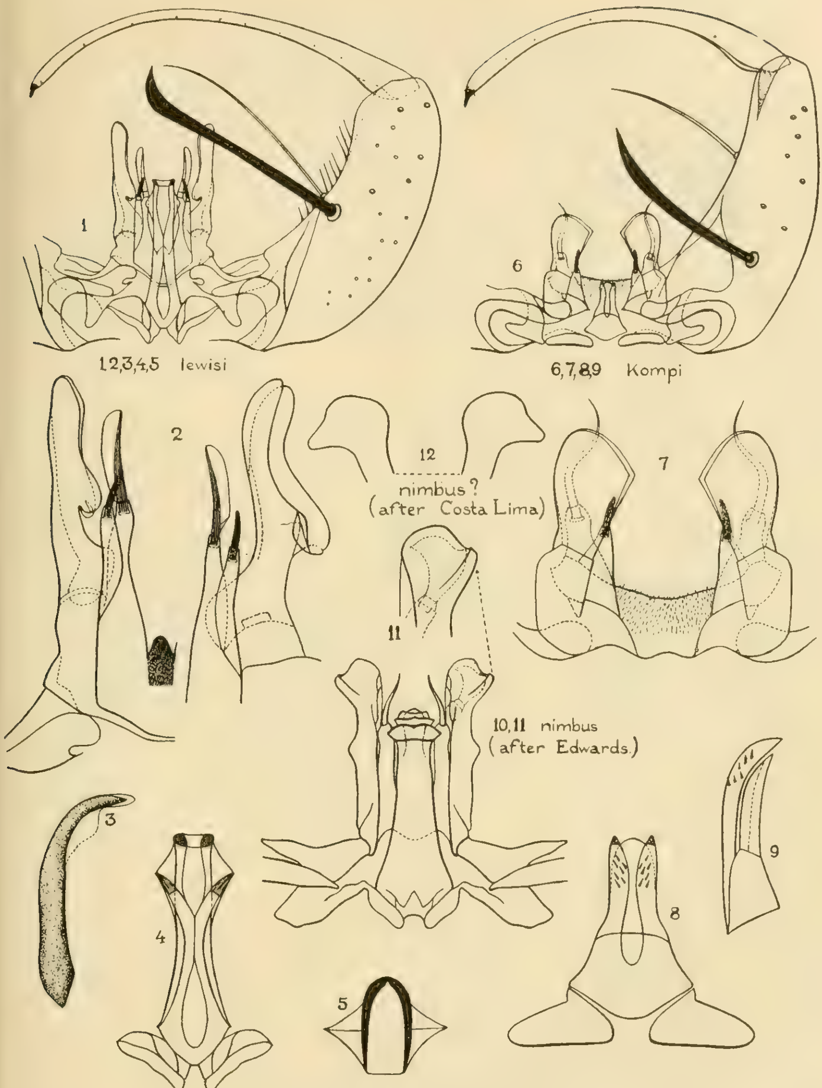


Aëdes taeniorhynchus

Mansonia lynchi Shn. M. arribalzagae Th.

1, 2 & 3 4, 5 & 6

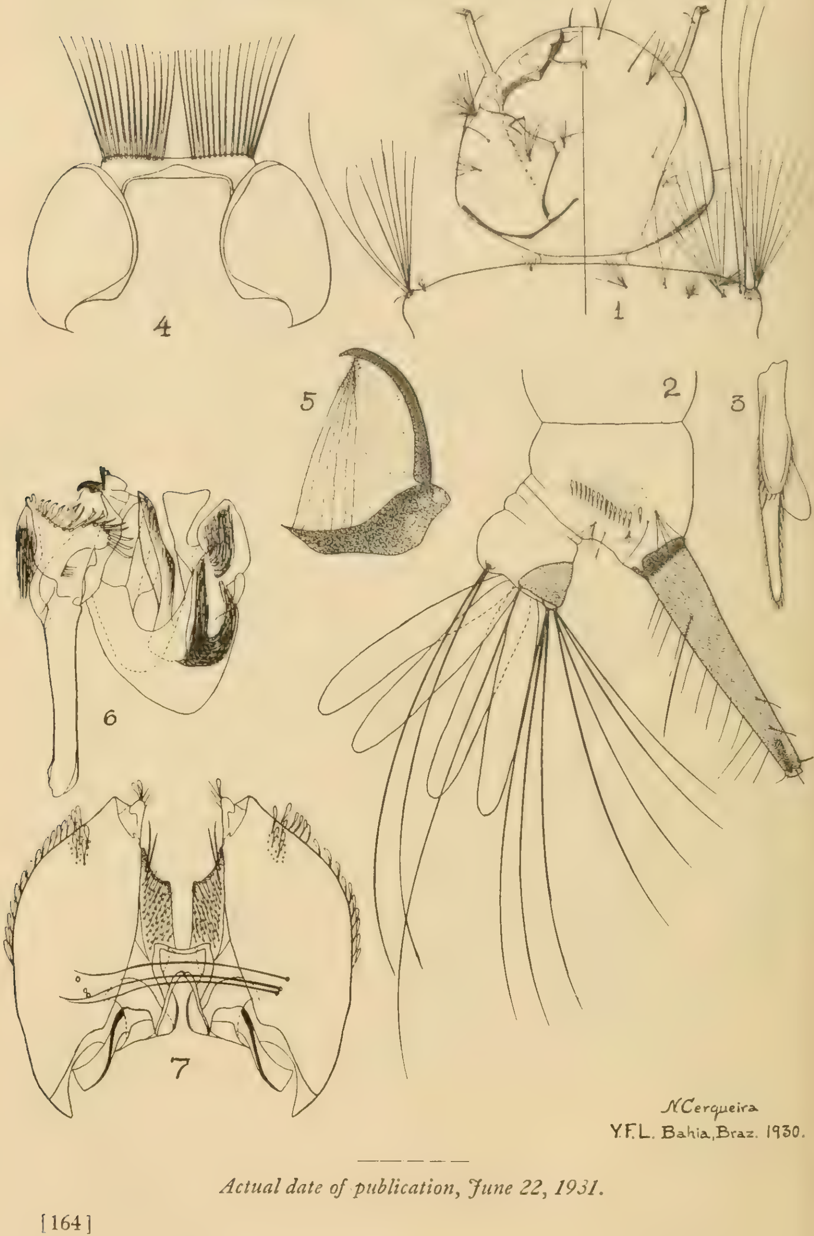
Y.F.L. Bahia, Brazil Sept. 1930. N. Cerqueira.



Species of Stethomyia (Anopheles)

Y.F.L. Bahia Braz. Sept. 1930
N. Cerqueira.

Sabethes cyaneus Fabr.



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CONTENTS

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A NEW SPECIES OF SAWFLY OF THE SUBGENUS ZADIPRION WITH A DESCRIPTION OF THE MALE OF N. (Z.) VALLICOLA ROH. AND A KEY TO THE SPECIES OF THE SUBGENUS.

By William Middleton,

Entomologist, Branch of Forest Insect Investigations, Bureau of Entomology, U. S. Department of Agriculture

The following descriptions are of a new species of the subgenus *Zadiprion* of the genus *Neodiprion*,[1] (*Neodiprion* (*Zadiprion*) *rohweri*) and of the male of *Neodiprion* (*Zadiprion*) *vallicola* Roh., respectively.

The new species is a very interesting one and differs in color quite strikingly from the other three species assigned to this subgenus, viz, *N.* (*Z.*) *grandis* (Roh.), *N.* (*Z.*) *townsendi* (Ckll.), and *N.* (*Z.*) *vallicola* Roh. These differences include the particular color markings which Rohwer used as part of his characterization of the subgenus. This sawfly, however, is distinctly congeneric with those mentioned on structural characters and tends thus to support the taxonomic value of the group Rohwer treated as the subgenus *Zadiprion*. The stability of the morphological characteristics of the group indicate that it is a true biological division of this subfamily, easily recognized regardless of the rank given to it. This species was collected by Dr. H. E. Burke of the U. S. Bureau of Entomology, feeding on pinyon pines in California and Colorado.

Neodiprion (Zadiprion) vallicola Roh., was described by Rohwer from a single female from Meadow Valley, Mexico. During 1930, workers of the Mexican Plant Protection Service collected sawfly larvae feeding on pine in Michoacan and reared the adults. Four of these, two females and two males, were sent to Mr. Rohwer for identification by Dr. A. M. Dampf and were recognized by Rohwer as his species *N.* (*Z.*) *vallicola*. Since the male of this species is undescribed, it seems desirable to include a description of it herewith.

[1]Subfamily Diprionianae, Family Tenthredinidae, Superfamily Tenthredinoidea, Suborder Chalastogastra, Order Hymenoptera.

Key to the Species of the subgenus Zadiprion.

Inasmuch as the subgenus *Zadiprion* contains only four species, and since these are represented in the collection of the U. S. National Museum by female types in all four species and by males in three species, the following key to the subgenus is given.

1. Males: Antennal joints 4 to at least 18 strongly biramose with the basal external rami longer than the length of the postocellar area; the terminal four or five joints of the antennae uniramose or not ramose and swollen; the abdomen keeled middorsally and with the dorsal surface of the tergites finely granular or finely rugosely striate; prevailing color for the entire body black; ocellocular line as long or longer than the postocellar line........2.
   Females: Antennal joints 4 to 18 not strongly biramose, rami no longer than the joints; the abdomen keeled middorsally but not always strongly keeled; ocellocular line as long or longer than the postocellar line........4.
2. Pleural regions of the abdominal tergites with yellow spots; prescutum and scutum densely punctured and not highly polished........3.
   Pleural regions of the abdominal tergites without yellow spots; prescutum and scutum highly polished and with fine, well separated punctures........*rohweri n. sp.*
3. Basal plates, clypeus, supraclypeal area, and first parapteron yellow.... *grandis* (Roh.)
   Basal plates, clypeus, supraclypeal area, and first parapteron black.... *vallicola* Roh.
4. Abdominal tergites distinctly, finely, rugosely striate or finely granular in texture; at least some tergites black; the thorax largely brown........5.
   Abdominal tergites polished, if at all granular or rugosely striate in texture it is difficult to determine; entire abdomen, thorax, and head yellowish-green........*rohweri* n. sp.
5. Mesoscutellum not densely punctured, few punctures in the anterior portion........*grandis* (Roh.)
   Mesoscutellum densely punctured over entire surface........6.
6. Mesoscutellum mostly black; basal plates with black and very little yellow........*vallicola* Roh.
   Mesoscutellum mostly yellow, brown posteriorly; basal plates largely yellow........*townsendi* (Ckll.)

Neodiprion (Zadiprion) rohweri, n. sp.

This sawfly is distinctly a species of the subgenus *Zadiprion* of Rohwer. It agrees nicely with the other species of *Zadiprion* in structure, including the structural characters used by Rohwer in erecting and defining the subgenus. It differs remarkably in coloration, however, by wanting the yellow-banded black abdominal tergum in the female and the yellow-spotted black abdominal tergum in the male. It is evident also that the pale green color of the specimens is not due to death in immaturity, since in a letter discussing this, Dr. H. E. Burke, who collected and reared the material, states: "All of the specimens were reared in the laboratory and kept on pine foliage until they died. I think that their present color is the mature color."

Female.—Body length 8.5 to 10 mm.; head width 2.9 to 3.5 mm.; height about 2.3 to 3 mm. Head pale yellowish green except for the compound eyes, which are blackish, and where otherwise noted; antennae of 22 (both right and left) or 23 joints, noticeably longer than width of head, at least 4 mm. long, joint 3 longer than 4 or 5 but not twice the length of joint 2, and shorter than joint 1; apical half of mandibles deep blackish-brown, basal half pale yellowish green and with many pale hairs on exterior part of the base; labrum pale yellowish-green, shining, with long pale hairs, especially at the apex, where they form a fringe, width about twice median length, anterior margin rounded, about parallel with mandible curve but not symmetrical, the right side somewhat larger, with an apical dent; clypeus but little more polished than labrum, pale yellow with long pale hairs, with very few punctures and hairs and almost the entire clypeus convex in its slope toward the labrum, thus lacking the transversely depressed and highly polished apical clypeal area of the subgenus *Neodiprion*, anterior margin broadly and shallowly emarginate for about the width of the labrum; supraclypeal area bulging, usually faintly divided longitudinally and with a deep groove separating it from the adjacent portion of the antennal socket; lower and interior portion of antennal socket ring raised abruptly; face shining, with but very few punctures or hairs, mostly pale yellowish green, more yellowish between ocelli and antennae, with small black triangular marks interiorly and dorsad of the lateral ocelli and with an inverted black V above the median ocellus; ocellar area not very much raised and not well defined; postocellar line distinct and shorter than the ocellocular line; postocellar area shining and with a few punctures, not distinctly defined laterally, neither prominent nor divided, and longer than half its width; antennae brown, basal three joints very slightly lighter with yellowish green.

Thorax: Pronotum pale yellowish green, shining, with sparse, indistinct, shallow punctures and few hairs; proepisternum pale yellowish green, shining, with sparse indistinct punctures and few hairs; prescutum pale yellowish green, shining, almost hairless, with a few indistinct punctures of two sizes, those in the anterior median portion more regular, lateral and median longitudinal sutures distinct, frequently darkened, especially the latter; tegulae yellowish green and distinctly but finely punctured; scutum pale yellowish green, shining, with few punctures of two sizes, the smaller ones more abundant and rather evenly dispersed, distinctly separated from the scutellar plate by an obtuse inverted V-shaped suture, the anterior three-fifths of which on each side is deeply impressed to form a groove and is blackened; mesoscutellar plate distinctly broader than long, concolorous with the rest of thorax and head, with coarse punctures, especially posteriorly and at the sides, anterior angle obtuse, posterior margin truncate; lateral arms of scutellum pale yellowish green; first parapteron pale yellowish green, with a few distinct punctures and a few hairs; mesepisternum pale yellowish green, lateral aspect densely and coarsely punctured, ventral aspect more finely punctured; metanotum pale yellowish green, the metascutellar plate with a distinct suture separating it from the rest of the metanotum and appearing finely rugulose towards the center; legs pale yellowish green with apex of tibiae and tarsi brownish; wings hyaline, the venation blackish, most of costa and stigma yellowish, cross vein usually wanting in the anal cell.

Abdomen pale yellowish green, including the basal plates, with the posterior lateral expansion of the ninth tergite and the apical portion of the sheath somewhat brownish; last distinct sternite completely divided longitudinally by a membranous wedge-shaped area extending cephalad from the base of the sheath; rods and pads of the apical portion of the sheath very thick, practically touching, almost entirely obscuring the median ridges, pads as long as the rods and together shorter than the large plates of the basal portion of the sheath which are rolled in on their interior ventral margin to form a kind of groove.

Male.—Body length 8 mm.; head width 2.6 mm., height 2 mm. Head black except where otherwise noted; antennae of 24 or 25 joints, the apical five uniramose and swollen, the basal joint of the five somewhat divided, antennal joints 4 to 19 distinctly biramose, the rami shortening towards the apex of the antenna and the exterior rami longer than the interior ones, joint 3 uniramose, the prong broadened basad of the middle; mandible brown at apex, black at base and with a yellow area before the apical brown, with yellow hairs exteriorly at the base; labrum yellow and shining, with long yellow hairs projecting ventrally and forming a fringe around apical margin; apical margin curved, somewhat more full and rounded on the right side and without a median dent; clypeus shallowly emarginate for the width of the labrum, posterior margin parallel and well defined for the width of the supraclypeal area, usually black at the sides and center but with a pale mark diverging from the supra-clypeal area towards the lateral margin of the labrum at each side, the entire clypeus convex and sparsely and irregularly punctured; supraclypeal area convex, rather evenly punctured, black, distinctly separated by a groove from the ventral interior margins of the antennal socket; interior and lower margins of antennal sockets raised, area between antennal sockets rugose; upper portion of face glistening, rather evenly punctured, and with a few hairs; face between lower halves of compound eyes with many long yellow hairs; ocellar area punctured and elevated, depression defining it laterally not abrupt and distinctly divided by a low transverse ridge opposite the upper third of the compound eye; postocellar line a distinct, deeply impressed groove, shorter than the ocellocular line; postocellar area bulging, glistening, and sparsely punctured but not distinctly defined at the sides and not divided, punctures of two sizes, the majority smaller than those on the face; head with a yellow spot between compound eye and postocellar area.

Thorax black except as otherwise noted; pronotum black with yellow along the margins, especially the dorsal and lateral margins, coarsely and densely punctured and with dense, long, pale hairs; prescutum shining, evenly and finely punctured, and with a few coarse punctures posteriorly, hairs not prominent; scutum similar to prescutum; mesoscutellar plate coarsely and densely punctured, the punctures of at least two sizes; first parapteron yellowish and punctured; mesepisternum evenly and coarsely punctured, less coarsely on the venter, and with long pale hair; metanotum black, plate of metascutellum densely coarsely punctured, and with long pale hairs; legs with coxae, at least part of the trochanters, and the basal under half of the femora black, rest of legs pale yellow, claws long, the inner tooth extremely short, about half way down the claw and separated from the apical hook by more than the length of the apical hook; wings hyaline, almost perfectly clear, slightly iridescent, veins dark smoky but not black, costa and stigma nearly clear.

Abdomen black except apical portion of hypandrium, genitalia, and the ninth tergite, which are yellowish green; basal plates elongated, granular or rugosely finely striate at the sides and with large close punctures immediately behind the metascutellum and the cenchri; remaining tergites finely granular or finely rugosely striate and keeled middorsally; sternites and hypandrium and pleural portion of the tergites evenly and coarsely punctured, and finely haired.

Type locality.—Swartout Valley, San Bernardino, Calif.

Paratype locality.—Mesa Verde National Park, Colo.

Described from 6 (1 type) females and 3 (1 allotype) males from the type locality and 17 females from the paratype locality. One imperfect male came from the paratype locality and was reared with the females, but since it was not entirely male in its characters and was abnormal in its development, it was not placed in the paratype series. This material was all reared by Dr. H. E. Burke from larvae feeding on pinyon pine (*Pinus monophylla*) at Swartout Valley, Calif., and *Pinus edulis* at Mesa Verde, Colo., and is recorded under Bureau of Entomology Hopk. U. S. note numbers as follows:

Swartout Valley, San Bernardino, Calif. Hopk. U. S. 17915a–a2–a6–a6a.

Mesa Verde National Park, Colo. Hopk. U. S. 18075a–a3–a4–a5.

Type, *allotype*, and *paratypes*.—Cat. No. 43467 U. S. National Museum, all deposited in the U. S. National Museum collection, Washington, D. C.

This species is named in honor of S. A. Rohwer, to whom the writer is very much indebted for encouragement and assistance in his studies of the sawflies.

Neodiprion (Zadiprion) vallicola Roh.

When Rohwer described *N.* (*Z.*) *vallicola* (Proc. Ent. Soc. Wash., Vol. 20, No. 4, Apr., 1918, p. 84), he had but a single female specimen, collected at Meadow Valley, Mexico, by C. H. T. Townsend. Since that time four specimens (two females and two males) have been received from Dr. A. M. Dampf, Head of Research, Plant Protection Service, San Jacinto, Mexico, which were reared from larvae collected at Erongaricuaro, Michoacan, Mexico, from *Pinus acacahuate*. Rohwer indentified these recent females as his species, and since the males were reared with them the following description of the male should serve to assist in the recognition of the species and in increasing the information available on the subgenus.

Male.—Body length 7.5 to 8 mm.; head width 2.4 to 2.6 mm., height 1.9 to 2 mm. Head black except as otherwise noted; antennae of 25 or 26 joints, the apical four uniramose and swollen, joints 4 to 20 biramose, the exterior rami longer than the interior, joint 3 uniramose, the prong broadened basad of the middle; mandibles brown with base and apex black, long yellowish-brown hairs on the exterior part of the base; labrum yellowish, polished, and with a few long brown and a number of shorter yellow hairs, rather strongly convex, apical margin rounded without a median dent, almost symmetrical; clypeus entirely black, not strongly convex but without the transversely depressed polished and unpunctured apical clypeal area of the subgenus *Neodiprion*, coarsely and rather evenly punctured, strongly and narrowly emarginate, apically the emargination less wide than the width of the labrum, the lateral portions of the apical margin as long as the width of the emarginated median portion, distinctly separated from the supraclypeal area by an impressed line; supraclypeal area black and evenly punctured, punctures finer and denser than on clypeus, more strongly convex than clypeus, distinctly separated from the ventral interior margins of the antennal socket by a shallow groove; interior and ventral margins of the antennal sockets raised, area between antennal sockets and above interantennal line rugose and with a rather distinct pit; face distinctly, evenly, and coarsely punctured, lower portion with a number of long yellowish hairs; ocellar area slightly elevated, punctured to rugose, and slightly depressed below the median ocellus, the lateral slopes defining the area not abrupt and not distinctly divided by a transverse ridge extending toward upper third of compound eye; postocellar line a rather distinct groove, shorter than the ocellocular line; postocellar area not bulging, not glistening, and very densely and coarsely punctured, not distinctly defined laterally but about four times as wide as median length; vertex with a faint brownish area posterior to compound eye.

Thorax black except as otherwise noted; pronotum black, densely and coarsely punctured and with long, fine, whitish hairs; prescutum very densely and evenly punctured with punctures of one size which, while moderately coarse, are distinctly smaller than those on face; scutum even more densely punctured than prescutum, hairs not prominent on either scutum or prescutum; mesoscutellar plate coarsely, densely, and evenly punctured, all punctures of about the same size and somewhat but not greatly larger than those on scutum; first parapteron black and densely punctured; mesepisternum evenly and coarsely punctured, the punctures on the lateral areas somewhat more coarse and close together than those on the venter, with rather long whitish hairs; legs with coxae, trochanters, and basal three-fourths of femora black, apex of femora, tibiae and tarsi yellow; wings hyaline, almost clear, iridescent and with veins brownish, base of stigma black, center of stigma almost clear.

Abdomen black, except ninth tergite, pleural spots, sternal spots, and apex of hypandrium, which are yellowish; hypandrium coarsely and evenly punctured, other sternites with a few punctures and a surface somewhat like that of the tergites, either finely granular or finely rugosely striate; basal plates with a few coarse punctures immediately behind the metascutellar plate and the cenchri.

TWO NEW SPECIES OF SAWFLIES OF THE SUBGENUS NEODIPRION.

By William Middleton,

Entomologist, Branch of Forest Insect Investigagions, Bureau of Entomology, U. S. Department of Agriculture

The following descriptions are of two new species of sawflies[1] that are of economic importance as defoliators of pine. *Neodiprion* (*Neodiprion*) *swainei* n. sp. has been abundant in western Quebec, Canada, where it has been infesting jack pine (*Pinus banksiana*). *Neodiprion* (*Neodiprion*) *burkei* n. sp. has been attacking lodgepole pine (*Pinus contorta*) in the vicinity of West Yellowstone, Montana. Both species are described now in order to permit the use of the names of the insects in economic entomological literature within a short time.

Neodiprion (Neodiprion) swainei, n. sp.

This species is nearest to *Neodiprion* (*Neodiprion*) *dyari* Roh., but differs from it in the following respects.

The female of *dyari* has the posterior angle of the prescutum rounded, while it is sharp in *swainei;* posterior lateral margins of prescutum almost unpunctured in *dyari*, distinctly and rather coarsely punctured in *swainei;* anterior margins of scutellum forming a sharper angle (a right angle) in *dyari*, more obtuse than a right angle in *swainei;* antennae of 19 or 20 joints in *dyari*, of 16 or 17 joints in *swainei*.

Female.—Body length 7 mm.; head width 2 mm., height 1.7 mm. Antennae of 17 joints (both right and left), length of antennae about 1¾ mm. (slightly less long than the head is wide), joint 3 longer than joint 4, black, base of joints 1 and 3 and apex of joint 2 usually brownish; mandibles dark brown, tip black, base light brown, with long golden hairs on the exterior at the base; labrum yellowish brown, anterior margin rounded, the curve only slightly greater than that of outer margin of the mandible, with a dense apical fringe of long golden hairs; clypeus more polished than labrum, lighter brown than the face between the compound eyes, anterior margin broadly and shallowly emarginate, anterior one-half to one-third unpunctured and depressed transversely, basal portion raised transversely, punctured like the face and with hairs; supraclypeal area shining, less distinctly and coarsely punctured than the face, separated from the antennal sockets by grooves, somewhat convex; face shining, distinctly and coarsely punctured, and with golden hairs, slightly concave immediately above the interantennal line, darker brown below the postocellar line than above; postocellar area almost twice as wide as long, moderately convex, postocellar

[1]Both species belong to the subgenus Neodiprion, genus Neodiprion, subfamily Diprioninae, family Tenthredinidae, superfamily Tenthredinoidea, suborder Chalastogastra, order Hymenoptera.

line distinctly impressed, longer than the ocellocular line, margins of the post-ocellar area and the antennal furrows very dark brown to blackish.

Thorax: Pronotum yellow to yellowish brown, punctured rather densely and evenly, the punctures almost as large as those on the face, shining, and with short golden hairs; proepisternum dark yellowish brown to almost black, shining but densely punctured; prescutum usually blackish and usually as dark as the lateral lobes of scutum, the posterior lateral margins less black; prescutum polished and shining, rather evenly punctured, the punctures toward the median line and anteriorly finer, those along the posterior lateral margins coarser, the posterior angle sharp, not rounded, the median line distinct but not heavy, faintly impressed except for the posterior sixth where it becomes a slight carina; tegulae yellowish, shining and punctured; scutum blackish, the posterior-lateral marginal ridge yellowish, polished and shining; scutum rather evenly punctured, those anteriorly and laterad less coarse, the posterior-lateral marginal ridge unpunctured; mesoscutellar plate distinctly wider than long, posterior margin rounded, anterior margin an obtuse angle with the anterior three-fifths of this margin on each side deeply impressed and the posterior two-fifths (where plate joins posterior-lateral marginal ridges of scutum) distinct but not deeply impressed; mesoscutellar plate yellow, shining, with a moderate number of very coarse punctures; lateral portions of the scutellum black, shining and smooth; first parapteron dark yellowish brown, densely punctured and with golden hairs; mesepisternum yellowish brown, often darker to blackish ventrally and shining, evenly, densely, and very coarsely punctured laterally and with golden hairs, highly polished and with fewer, finer punctures on the anterior and venter; metanotum black, the metascutellar plate somewhat less black at the lateral angles and the plate with a few coarse punctures; legs pale brown, frequently the bases of the tibiae and the trochanters paler, almost whitish; wings hyaline, vitreous (with a marked reddish iridescence), venation blackish, most of costa and center of stigma pale.

Abdomen: Basal plates very dark brown, rest of dorsum of abdomen black, the pleural regions of the tergites to the eighth pale with a greenish tinge ventrad from above the spiracle, the ninth dark yellowish brown; sternites of abdomen pale, whitish to yellowish brown, with a greenish tinge apparently due to the color of the contents of the abdomen; sheath with basal portion yellowish brown, apical portion darker brown to almost blackish, pads thin but presenting a ventral surface about thrice as long as wide and separated from each other by about half their length.

Variations of six of the female paratypes (measurements in millimeters).

Body length	6.3	6.8	6.3	6.8	6.5	6.2
Antennae, right, left	1.5–1.5	1.5–x	2–1.9	1.9–x	1.9–x	x–1.8
Head width	1.8	1.8	1.9	1.9	1.9	1.8
Head dorsad-ventrad height	1.6	1.7	1.7	1.7	1.6	1.6
Antennal joints, right, left	17, 17	16–x	17, 16	17–x	17–x	x–17

x = Complete antennae wanting.

Agree with type (except one specimen with a malformed clypeus,) with the following variations: Proepisternum dark yellowish brown to very dark brown; plate of metascutellum often entirely black; basal plates sometimes practically no lighter than rest of dorsum of abdomen; pads on the sheath sometimes separated by more than one-half their length but hardly by their full length.

Male.—Body length 5.5–6 mm.; head width 1.9 mm., height 1.4 mm. Head black except where otherwise noted; antennae of 19 or 20 joints, the apical three joints appearing fused, the ultimate bead-like, the next two uniramose, the remainder to joint 3 at the base biramose, joint 3 uniramose with the prong crooked, joints 1 and 2 without rami; mandibles dark brown, the base blackish and with curved pale hairs on the exterior of the basal portion; labrum yellow, polished, with an apical fringe of long hairs projecting ventrally, apical margin distinctly rounded; clypeus reddish brown apically and at middle, black at the lateral basal margins, apical margin broadly and shallowly emarginate, apical third highly polished and transversely depressed, basal two-thirds prominent and with coarse punctures, more coarsely punctured and rougher than the supraclypeal area, distinctly separated from the supraclypeal area by a straight impressed line; supraclypeal area convex and finely punctured; face densely and coarsely punctured; ocellar area raised and very rough, punctures coarse and usually more dense than on the face, median ocellus in a longitudinal depression; width of postocellar area three or four times its median length, faintly divided, often not distinctly defined laterally and more sparsely or indistinctly punctured than the lower face; postocellar line distinctly impressed and longer than the ocellocular line.

Thorax: Black; pronotum densely punctured, the punctures finer than those on the face and slightly coarser than those in the median and anterior area of the prescutum; prescutum evenly and finely punctured on the median and anterior surface, coarsely and irregularly punctured along the posterior lateral margins; tegulae almost entirely yellow and punctured; scutum somewhat coarsely punctured on the median surface, more finely punctured on the anterior and lateral portions; mesoscutellar plate large, distinctly wider than long, anterior angle obtuse, deeply, coarsely, distinctly, and rather evenly punctured, punctures deeper and coarser than those on the face; mesepisternum coarsely and evenly punctured laterally and finely or almost unpunctured on the venter; metanotum black, the metascutellar plate and the area immediately behind the cenchri coarsely punctured; legs reddish brown, coxae with black; wings hyaline, veins for the greater part colorless.

Abdomen: Tergites black, polished, and almost entirely unpunctured; sternites, including the hypandrium, reddish with shallow punctures and short hairs, apical margin of hypandrium sometimes with a shallow median emargination.

Type locality.—Mont Laurier District, Quebec.

Described from nine females (one type) and seven males (one allotype) from the type locality The material was collected and reared by M. Dunn. The larvae fed upon *Pinus banksiana.*

Type, allotype, and *paratypes.*—Cat. No. 43468 U. S. N. M. Three female and two male paratypes deposited with the Canadian Entomological Branch, the remainder in the U. S. National Museum collection in Washington, D. C. This species is named in honor of Dr. J. M. Swaine, Associate Dominion Entomologist, of the Entomological Branch of the Department of Agriculture of Canada, who has directed the studies in forest entomology of the Dominion through which this species was discovered.

Neodiprion (Neodiprion) burkei, n. sp.

This species is nearest to *Neodiprion (Neodiprion) scutellatus* Roh., but differs from it chiefly in the female having the abdomen dark and the abdomen and the mesoscutellum darker than the head. It also differs in the female possessing antennae with 18 or 19 joints and in the female having the ventral, interior margins of the basal portion of the sheath strongly rolled so that the margins about touch midway between the basal articulation of the sheath and the point of origin of the rods of the posterior portion of the sheath. The ventral-interior margins of the basal portion of the sheath thus present a long, wide-curving, basal V and also curve away from each other after they about touch each other midway of their length. The male of *N.* (*N.*) *scutellatus* Roh. is not known.

Female.—Body length 7.5 mm. (paratypes with body length ranging from 6.5 mm. to 8 mm.); head width 2 mm., height 1.6 mm. Color yellow except as otherwise noted; antennae of 18 joints (both right and left), (in the paratypes the joints of the antennae range from 16–19), length slightly more than 2 mm., blackish, base of first joint and dorsum of joint 3 somewhat yellowish or brownish; mandibles brownish, basal portion yellowish and with yellow hairs on the exterior; labrum yellow, shining, and with a dense apical fringe of yellow hairs, apical margin from rounded to a bluntly rounded angle; clypeus yellow, apical margin shallowly emarginate for about the width of the labrum, apical third distinctly transversely depressed, polished and unpunctured, basal two-thirds somewhat convex, shining but moderately punctured and with yellow hairs, clypeus distinctly separated by a brown suture from the supraclypeal area; supraclypeal area yellow and strongly convex, not punctured, separated from the antennal sockets by grooves diverging ventrally; face yellow, less distinctly punctured opposite compound eyes than above the eyes, with long yellow hairs below antennae, dark brown in the short groove or furrow immediately above each antenna, this groove or furrow not connected with the groove laterad of the lateral ocelli; groove of the median ocellus, the postocellar groove, and the grooves and the portions of the ocellar area immediately adjacent to the lateral ocelli dark brown; ocellar area frequently punctured, raised but not distinctly separated from the face midway between the lateral ocelli and the antennal sockets, the median ocellus usually situated in a slight depression formed by a distinct inverted U or V shaped groove, a shallow median pit just above and between the antennal sockets; postocellar area well defined laterally and anteriorly with darkened sutures, prominent, not deeply or coarsely punctured but with rather even, shallow, coarse punctures, punctures less distinct and frequent than those on the adjacent facial areas; postocellar line distinct and impressed.

Thorax: Pronotum yellow white, paler than the head, with shallow, coarse punctures and whitish hairs; prescutum dark brown, sometimes less dark along the lateral margins and in the posterior angle, with sparse yellow hairs and faintly evenly punctured, the punctures less distinct along the lateral margins and in the posterior angle; tegulae white and unpunctured; scutum paler brown than the prescutum, punctures indistinct, especially on the median and posterior areas; mesoscutellar plate about as long as wide, anterior angle somewhat acute or a right angle (not obtuse), posterior margin rounded and somewhat produced medianly, plate unpunctured and with some hairs; first parapteron pale yellowish white and with possibly a few indistinct punctures and hairs; mesepisternum yellowish, with fine punctures and yellowish hairs; metanotum (including the metascutellar plate) black, plate unpunctured; legs entirely yellowish; wings hyaline, veins blackish, the costa and stigma pale brown.

Abdomen: Tergites black, basal plates black, pleurum pale yellowish with a few faint punctures, pleurum of the ninth tergite yellowish to slightly brownish; sternites yellowish, the last before the sheath somewhat brownish; sheath with the basal portion yellowish, the apical portion brownish, the ventral-interior margins of the basal portions strongly rolled inwards and almost touching about midway of their length, forming a long curving V between the halves of the sheath basad of the point where they almost touch, the apical portion of the sheath brown with the rods equal to or slightly longer than the pads, the length of the pads three times their width, the pads hardly separated from each other by their width.

Male.—Body length 6 mm.; head width 1.9 mm., height 1.4 mm. Black except as otherwise noted; antennae of 21 joints, the apical joint a bead, the next to the apical joint uniramose, the third joint from the base uniramose with the prong somewhat crooked, joints 4 to 19 biramose, the rami on the exterior longer; mandibles brown, black at the base and with yellowish hairs at the base on the exterior; labrum brown, somewhat shiny but with many yellow hairs forming an apical fringe, apical margin rounded or curved (curve parallel with curve of mandible); clypeus black, apical margin shallowly emarginate, apical half unpunctured, transversely depressed and polished, basal half punctured, convex but not strongly so, separated at base from the supraclypeal area by a straight line not deeply impressed; supraclypeal area black, convex but not strongly so, and not distinctly punctured, separated from the antennal sockets by broad shallow depressions; face rough and punctured below a line through the antennae and rather smooth and punctured above, hairs yellowish and rather sparse; ocellar area raised, rugose rather than punctured, lateral margins rather well defined and the postocellar line a deeply impressed groove, the pit of the middle ocellus with distinct lateral grooves; postocellar area well defined, prominent or bulging, width about three times median length, punctures finer than those on adjacent areas of face, and with a distinct depression of the postocellar line occurring laterad of each of the anterior lateral angles of the postocellar area.

Thorax: Black except as otherwise noted; pronotum with long pale hairs, roughened by shallow almost confluent punctures; prescutum finely and rather evenly punctured, punctures in the posterior angle very faint; tegulae brownish to black, without punctures; scutum finely and rather evenly punctured, the punctures anteriorly and at sides most distinct; mesoscutellar plate practically unpunctured except for a few fine punctures posteriorly, anterior angle about a right angle and the length of the plate about equal to the width, the posterior margin rounded and somewhat produced medianly; metanotum black and with the metascutellar plate unpunctured; legs with coxae blackish, trochanters mostly dark, remainder of legs yellow; wings hyaline, almost clear, somewhat iridescent, veins brown.

Abdomen: Tergites black to the ninth which varies from black to brownish, basal plates somewhat punctured; genitalia yellowish brown; sternites and pleurum of the tergites dark brownish to blackish and punctured, hypandrium blackish and evenly punctured.

Type locality.—West Yellowstone, Montana.

Described from 20 females (one type) and 27 males (one allotype) from the type locality. The material was collected June 6, 1925, and the larvae fed upon *Pinus contorta.*

Type, allotype, and *paratypes.*—Cat. No. 43469 U. S. N. M. All are deposited in the National Museum collection at Washington, D. C.

This species is named in honor of Dr. H. E. Burke, who collected the specimens.

NEW AND LITTLE-KNOWN DIAPRIIDAE FROM BRITISH COLUMBIA (HYMENOPTERA).

By Oscar Whittaker.

The following descriptions and notes are made from material collected in western British Columbia by the writer. Except where otherwise stated all this material remains in the writer's collection.

BELYTA Jurine.

Of this genus I have taken five species, four of which are described below as new, and as far as can be ascertained no other species of the genus have been recorded from this province before.

Belyta longicollis, Fouts.

I have taken both sexes of this species at Hollyburn on various dates between 7 July and 24 October, 1928–30. I am indebted to my friend Mr. Robert M. Fouts for kindly comparing several of my specimens with the type. The type material consists of a single female from Pennsylvania. The male is now described for the first time.

Male.—Coloration as in the female, the flagellum somewhat darker. Head globular, ocelli in an equilateral triangle, lateral ocelli nearer together than to the eyes; the occiput with a carina surrounding the neck. Antennae a little longer than head, thorax and petiole combined; scape about four and one-half times as long as thick, as long as joints 3 and 4 combined; pedicel subglobular, a little longer than thick; joint 3 nearly three times as long as pedicel, two and one-half times as long as thick, moderately excised on basal half, the side opposite the excision curved; joint 4 two-thirds as long as joint 3, about twice as long as thick; joints 4–13 gradually shorter; joint 13 about three-quarters as long as joint 4; apical joint conic-ovate; nearly one and one-half times as long as preceding joint. Thorax twice as long as wide. Pronotum, seen from above, wider than usual in this genus, gradually narrowed anteriorly (not bulging out in front of tegulae, as in the female), the sides almost straight, anteriorly rugoso-punctate, with a deep median depression, the sides smooth, the neck longitudinally sulcate. Forewings two and one-quarter times as long as their greatest width. Abdomen, including petiole, longer than head and thorax combined; exclusive of petiole, a little more than twice as long as wide.

An examination of twelve males and six females shows this to be a somewhat variable species. The dorsum of the propodeum in both sexes may be almost smooth with only a very slight irregularity of surface or, more often, with distinct, irregular, transverse, raised lines. The median carina of the propodeum in one female is bifurcate for only one-quarter its length, while in two males it is bifurcate for nearly its entire length. The petiole in one female is only one and three-quarter times as long as wide. The length varies in the male from 2.7 to 3.5 mm. and in the female from 3.5 to 4.0 mm.

Belyta sanguinea, new species.

Female (*Type*).—Head, thorax and petiole black; scape black, the radicula and apex yelowish, pedicel and flagellum yellowish-red, apical joint dark brown; legs, including coxae, reddish-yellow, base of hind coxae blackish; basal two-thirds of second tergite reddish, rest of abdomen brown; wings faintly fumose; tegulae and venation brown. Head smooth and shining, rounded behind the eyes, as wide as long; eyes remote from occiput; ocelli in an equilateral triangle, lateral ocelli slightly nearer together than to eyes, twice as far from the occiput as from one another. Antennae with long, pale pubescence, flagellum proximally submoniliform, becoming moniliform distally, almost as long as head, thorax and petiole combined; scape four times as long as thick, as long as following four joints combined; pedicel short, less than one-quarter as long as scape, slightly longer than joint 4; joint 3 about one and one-half times as long as pedicel and about one and one-half times as long as thick, thickest at the apex; joint 4 about as thick as long; following joints about as long as joint 4, becoming gradually thicker; joint 14 very slightly thicker than long; apical joint as long as joint 3, one and one-half times as long as thick; flagellum three times as long as scape. Thorax about twice as long as wide. Pronotum short, produced in a short, irregularly, sulcate neck. Mesonotum wider than long, flat, with distinct, percurrent notauli. Scutellum flat, basal fovea transverse, shallow. Propodeum with the dorsum smooth but somewhat uneven, hind margin straight, carinate, the median carina bifurcate for more than half its length. Forewings narrow, about three times as long as their greatest width; first abscissa of radius oblique, much shorter than marginal vein; radial cell one and one-half times as long as marginal vein; cubitus, discoideus and brachius present as faint, fuscous streaks; cubitus short, straight, directed towards the basal nervure. Petiole a little less than one and one-half times as long as wide, widest at the hind margin; front margin feebly sinuous, the sides almost straight, hind margin straight, longitudinally striate, feebly rugulose between the striations. Abdomen highly polished, somewhat depressed, elongate oval; including petiole, as long as head and thorax combined; exclusive of petiole, twice as long as wide; second tergite with a few, very short striae at the base, slightly less than one and one-half times as long as wide, about two and one-quarter times as long as rest of abdomen; following tergites very short, the last longer. Dorsum of mesonotum and scutellum and sides of these, propodeum and petiole with long, scattered, pale hairs.

Male (*Allotype*).—Similar to female but differing as follows. Antennae blackish-brown, except apical half of scape, base of pedicel and basal half of joint 3, which are reddish; legs slightly darker than in the female, the tarsi, except basally, inclining to brown; venation also darker than in female. Head a little more than one and one-half times as wide as long. Antennae slender, filiform, pubescent, longer than head, thorax and petiole combined; scape slightly more than four times as long as thick, a little longer than joint 3; pedicel globular; joint 3 excised on basal half, three times as long as its greatest width; joint 4 about two and one-half times as long as thick, as long as joint 3; following joints gradually shorter; joint 13 twice as long as thick and two-thirds as long as joint 4; apical joint as long as joint 4. Petiole two and one-half times as long as wide, sides almost straight, hind margin slightly wider than front margin, with two fine, longitudinal striae on dorsum and two lateral striae visible from above. Forewings with the radial cell twice as long as the marginal nervure; first abscissa of radius oblique, shorter than marginal nervure. Abdomen, including petiole, about as long as head and thorax combined; exclusive of petiole, twice as long as wide; second tergite one and one-half times as long as wide, four times as long as rest of abdomen.

Length, 3.0–3.6 mm; *expanse*, 4.2–6.5 mm.

Described from one male, 3rd September, 1929, and six females, 24th August to 19th October, 1930, taken at Hollyburn.

Variation.—The color varies slightly in depth and one specimen has the penultimate as well as the apical flagellar joint dark brown. Two females have the petiole dorsally smooth and in one female the median carina of the propodeum is almost obsolete, its position beyond the basal portion being indicated by an elongate, triangular, smooth, raised area; the posterior marginal carina is almost obsolete.

Paratypes sent to the U. S. N. M., Dr. A. A. Ogloblin and Mr. Robert M. Fouts.

Belyta boreale, new species.

Female.—Black, shining; scape and pedicel brown, flagellum darker brown, legs brownish-yellow, hind coxae, except apically, dark brown; wings faintly fumose; tegulae and venation brown. Head nearly one and one-half times as wide as long, rounded behind the eyes; ocelli in a triangle with a depression before front ocellus and external to the lateral ocelli; lateral ocelli about as far apart as from the eyes. Antennae pubescent, moniliform beyond joint 4, as long as head, thorax and petiole combined; scape robust, about four times as long as thick, one-third as long as rest of antenna, as long as following four joints combined; pedicel one and one-half times as long as thick; joint 3 two and one-half times as long as thick, one and one-half times as long as pedicel, as long as joints 4 and 5 combined; joint 4 very slightly longer than joint 5; joints 5–14 subequal, joint 14 very slightly thicker than long, one-half as long as joint 3; apical joint conic-ovate, one and one-half times as long as thick. Thorax about one and three-quarter times as long as wide. Pronotum short, produced in a stout, sulcate neck. Mesonotum somewhat convex, with distinct percurrent notauli; scutellum with a shallow, transverse, basal fovea. Propodeum smooth and shining; the hind margin nearly straight; median carina bifurcate for one-quarter its entire length. Head and thorax with long, fairly dense, pale hairs. Forewings broad, about twice as long as their greatest width; first abscissa of radius somewhat oblique, nearly as long as marginal nervure; radial cell three times as long as marginal nervure; cubitus, discoideus and brachius present as faint fuscous streaks, the cubitus straight, directed towards the basal nervure. Petiole one and one-half times as long as wide, front and hind margins straight, the sides feebly sinuous, hind margin a little longer than front margin, dorsum and sides longitudinally rugoso-striate. Abdomen highly polished, convex; including petiole, about as long as head and thorax combined, exclusive of petiole, oval, about one and three-quarters times as long as wide; second tergite about one and one-third times as long as wide, three times as long as rest of abdomen, longitudinally striate at base, the median sulcus not conspicuously longer than the others, shorter than hind margin of petiole; segments 3–6 gradually shorter; 6 one-half as long as 3; 7 slightly longer than 3. Petiole and abdomen with long, pale hairs, longest on sides of petiole, scattered on dorsum of second tergite, closer on sides and on following segments, except in the centre.

Length, 2.5–2.8 mm; *expanse*, 4.8 mm.

Described from three females taken at Hollyburn, 25 August, 1928, 30 September, 1929, and 10 October, 1930.

Paratype sent to Mr. Robert M. Fouts.

In one paratype the antennae are paler than in the type.

Belyta anthracina, new species.

Female.—Black, shining; antennae dark brown; scape, except apex, black; legs yellowish-brown, base of hind coxae dark brown; wings faintly fumose, tegulae and venation brown. Head smooth and polished, as long as wide, rounded behind eyes, occiput surrounded by a carina; ocelli in an equilateral triangle, lateral ocelli nearer together than to the eyes, twice as far from occiput as from each other. Antennae robust, pubescent, moniliform, nearly as long as head, thorax and petiole combined; scape one-third as long as rest of antenna, about four times as long as thick, as long as following four joints combined; pedicel one and one-third times as long as thick; joint 4 slightly longer than pedicel, one and one-half times as long as thick, as long as following two joints combined; joints 5–14 subequal, joint 5 as long as thick, joint 14 very slightly thicker than long, only very slightly longer and thicker than joint 5; apical joint ovate, one and one-half times as long as thick, one and one-half times as long as preceding joint. Pronotum laterally very narrow, with a few shallow punctures in front, the median one larger and deeper, produced in a broad, logitudinally sulcate neck. Mesonotum and scutellum flat; mesonotum with deep, percurrent notauli; scutellum with a shallow, transverse, basal fovea. Propodeum with the median carina fine, bifurcate for more than one-half its length; the dorsum smooth, rugulose between the branches of the median carina and along the lateral carinae and hind margin; hind margin almost straight, carinate, the hind angles not produced. Forewings about two and one-half times as long as their greatest width; first abscissa of radius oblique, shorter than the marginal nervure, radial cell nearly twice as long as marginal nervure; cubitus, discoideus and brachius present as faint, fuscous streaks, the cubitus almost obsolete, directed towards the basal nervure. Petiole cylindrical, twice as long as wide, front margin slightly emarginate, hind margin and sides straight, the dorsum feebly rugulose, with inconspicuous, longitudinal striations which are obsolete in the middle. Abdomen highly polished, convex; including petiole, as long as head and thorax combined; exclusive of petiole, a little more than twice as long as wide; second tergite one and two-fifths as long as wide, about three times as long as rest of abdomen, with short striae at the base, the median sulcus much longer than the others, extending for two-fifths the length of the tergite, about as long as petiole; tergites 3 to 5 about equal, the sixth about as long as 4 and 5 combined; the seventh about equal to the sixth; the entire body with scattered, long, pale hairs.

Length, 3.1 mm.; *expanse*, 4–8 mm.

Described from a single specimen taken at Hollyburn, 15 June, 1930.

Belyta excavata, new species.

Female.—Black, shining, antennae brownish-yellow, becoming darker on the apical half; legs brownish-yellow, base of hind coxae dark brown; wings faintly fumose, tegulae and venation brown. Head as wide as long, rounded behind eyes, occiput surrounded by a fine carina; ocelli in a triangle, lateral ocelli nearer together than to eyes or occiput. Antennae as long as head and thorax combined; flagellum proximally filiform, distally moniliform; scape robust, a little less than four times as long as thick, as long as following five joints combined; pedicel about one-quarter as long as scape, slightly longer than thick; joint 3 a little longer than pedicel; joint 4 slightly more than one-half as long as joint 3; following joints very gradually longer; joint 14 one and one-half times as long as joint 4, slightly thicker than long; apical joint conic-ovate, one and one-half times as long as preceding joint and one and one-half times as long as thick. Thorax twice as long as wide, somewhat flattened. Pronotum short, produced in a short, stout neck. Mesonotum with distinct, percurrent notauli; basal forea of scutellum shallow. Propodeum with the hind margin deeply emarginate, straight in the centre, the hind angles considerably produced; median carina bifurcate for nearly its entire length, dorsal areas smooth, laterally and posteriorly with irregular, punctate depressions. Forewings narrow, nearly three times as long as their greatest width; first abscissa of radius very oblique, about one-half as long as marginal nervure, second abscissa of radius short, continued as a very faint, hardly visible, fuscous streak to the costal margin, the enclosed area about as long as marginal nervure; cubitus, discoideus and brachius present as very faint, fuscous streaks, the cubitus directed towards the discoideus. Petiole one and one-half times as long as wide; front and hind margins straight, the latter considerably longer than the former, sides convex; irregularly, longitudinally striate, the surface between the striae somewhat uneven. Abdomen, including petiole, as long as head and thorax combined; exclusive of petiole elongate-oval, twice as long as wide; second tergite one and one-half times as long as wide, four times as long as rest of abdomen, base shortly striate, the median sulcus extending for about one-sixth the length of the tergite; segments 3–5 about equal, sixth segment longer. Entire body with scattered, pale hairs, sparsest on dorsum of second tergite.

Length, 3.5 mm.; *expanse*, 4.5 mm.

Described from five females taken at Hollyburn on various dates between 6 June and 2 October, 1929–30.

Paratype sent to Mr. R. M. Fouts.

Variation.—The antennae may have the basal half of the scape dark brown and the flagellum darker than in the type, the apical joints being very dark. The length varies from 2.75–3.5 mm. and the expanse from 4.0–5.5 mm.

PROPSILOMMA Foerster.

Propsilomma columbianum, Ashmead.

(=**Psilomma columbianum,** Ashm.)

I have taken a couple of males of this species, one at Hollyburn, 18 July, 1929, and one at Galiano, 24 June, 1930.

DIPHORA Foerster.

Diphora nearctica, Whitt.

(*Proc. Ent. Soc. Wash., Vol. 32, p. 74.*)

The type material is stated to contain both sexes. This is an unfortunate error, as they are all females. I was misled through mistaking the peculiar ovipositor (which is short and bent into a hook at the apex) for the uncus. In working through my collection I have found twelve specimens which are undoubtly males of this species. It is possible that this genus is synonymous with *Pantoclis* Foerster.

Male.—In color and general appearance similar to the female. Antennae slender, filiform, longer than the entire body; scape four times as long as thick; pedicel globular; joint 3 as long as scape, four times as long as thick, excised, but not deeply, on basal one-fourth; joint 4 shorter than joint 3; joints 3–13 gradually shorter; joint 13 two-thirds as long as joint 4; apical joint about one and one-fourth times as long as preceding joint. Petiole one and one-third times as long as wide. Abdomen, including petiole, about as long as head and thorax combined; exclusive of petiole, twice as long as wide; second tergite one and one-half times as long as wide; fourth and fifth tergites each about one-half as long as the preceding tergite.

Length, 2.2–2.8 mm.

Taken at Hollyburn, 11 June–20 September, 1928–30.

SEASONAL HISTORY AND MORPHOLOGICAL NOTES ON POLYSCELIS MODESTUS GAHAN.

By C. C. Hill and H. D. Smith,
U. S. Bureau of Entomology, Cereal and Forage Insect Investigations.

INTRODUCTION.

The general life history of this species was published by P. R. Myers[1] in 1924. At that time, it was thought to be a rare parasite of the Hessian fly, but in 1928 it was found by the authors to be parasitizing, in considerable numbers, the fall generation of the Hessian fly during the very early spring days. It is the purpose of this paper to call attention to this latter occurrence and also to present some additional morphological details which were lacking in the earlier account by Myers.

EXTENT OF PARASITISM.

In the spring of 1928 adults of *Polyscelis modestus* were found in two wheat fields that were heavily infested with the Hessian fly. One was located near Carlisle, Pa., and the other about 8 miles south of Carlisle near Mt. Holly Springs, Pa. On May 7, by which time the period of oviposition of *P. modestus* was past, a sample of 100 Hessian fly puparia was secured from the field at Mt. Holly Springs, and dissection showed 33 per cent of them to be parasitized by *P. modestus*.

OVIPOSITION.

Hessian fly puparia containing both larval and pupal stages were found to be parasitized indiscriminately. As the season advanced, pupae in all stages of development were found which

[1]Jour. Agr. Research, Vol. XXIX, No. 6, p. 289–295, 1924.

had been oviposited upon by this parasite. The parasitic egg was always found loosely placed on the surface of the Hessian fly larva or pupa within the puparium. The egg (fig. 1), which is normally ovate, was sometimes found bent near its smaller end as though it had been lodged in a restricted position between the host and the wall of its puparium. The appearance of the egg shell after hatching is shown in Figure 2.

The female apparently stings her host before ovipositing. Hosts taken in the field bearing eggs of *P. modestus* were always found in a paralyzed condition, and there were always present one or more black spots in the epidermis where the ovipositor of the parasite had punctured the tissue. Captive females were observed to insert their ovipositors through the wall of a puparium of the host several times before finally ovipositing. It usually took about 24 hours for the point through which the ovipositor was thrust to appear as a black spot. The dark area was found to penetrate a slight distance into the host's body. In only one instance was the female observed to place her mouth to the point pierced by the ovipositor as though to feed on host material.

MORPHOLOGY.

In the publication by Myers previously mentioned, descriptions were given of the egg, primary larva, mature larva, prepupa, pupa, and adult, together with figures of the egg, mature larva, front view of head, and mandibles of the same stage, and the pupa. Since further studies on this parasite have afforded the opportunity to make additional morphological observations, there are included in the present paper descriptions of the stages which were previously lacking, together with more detailed morphological descriptions of some of the other stages than were given by Myers. The figures of the egg and pupal stages are reproduced from Myers for the sake of continuity and in order to illustrate more clearly the morphological changes undergone during the growing period.

The larva was found to pass through five instars. These may be distinguished by the size and appearance of the mandibles (figs. 3–7). Measurements of the mandibles from apex to exterior margin of the condyle showed the following differences: instar I, 0.015 mm.; instar II, 0.027 mm.; instar III, 0.033 mm.; instar IV, 0.047 mm.; instar V, 0.053 mm. The first-instar larva (fig. 8), besides being smaller, differs conspicuously from the other instars by the large size of its head and thorax as compared with the rest of the body, and by the sharpness with which the abdomen tapers to the caudal extremity. It has well defined antennae and its mouth parts (fig. 9) are capable of considerable protrusion. Spiracles are present on the mesothorax and first three abdominal segments.

The second, third, and fourth instars appear essentially the same as the last instar except in size and minor details. In these instars spiracles are found on the mesothorax, metathorax, and first seven abdominal segments. The lateral seta located near each side of the mouth is conspicuous in the second instar but in subsequent instars decreases in length relative to the increase in size of the body. The ventral view of the head of the full grown larva is depicted in Figure 10, showing the position of the mouth parts, setal arrangement, and antennae. The shaded area shows the position of the mandibles, duct of the silk gland, and supporting chitinous structure, all of which are hidden more or less beneath the surface. The antenna of the full-grown larva is 0.01998 mm. long and is shown in Figure 11. The lateral aspect of the larva is shown in figure 12 and the setal arrangement on its caudal extremity in Figure 13. Ventral aspects of the prepupal and pupal stages are shown in figures 14 and 15.

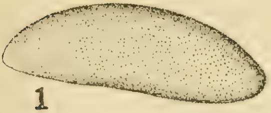
EXPLANATION OF PLATE.

Figures drawn by C. C. Hill.

1. Egg (length 0.38 mm.) (After Myers.)
2. Eggshell after hatching (length 0.35 mm.).
3. Mandible of first-instar larva (distance from apex to outer margin of condyle 0.015 mm.).
4. Mandible of second-instar larva (distance from apex to condyle 0.027 mm.).
5. Mandible of third-instar larva (distance from apex to condyle 0.033 mm.).
6. Mandible of fourth-instar larva (distance from apex to condyle 0.047 mm.).
7. Mandible of full-grown larva (distance from apex to condyle 0.053 mm.).
8. First-instar larva, lateral aspect (length 0.2736 mm.).
9. Ventral aspect of head of first-instar larva showing position of mouth parts, setae, and antennae (head width 0.1225 mm.).
10. Ventral aspect of head of full-grown larva showing position of mouth parts, setae, and antennae. The shaded area is chitinized tissue beneath the surface and reveals the mandibles, silk-gland duct, and supporting chitinous structure (head width 0.60 mm.).
11. Antenna of full-grown larva (length of inside area shown by dotted line 0.01998 mm.).
12. Full-grown larva, lateral aspect (length 1.65 mm.).
13. Caudal extremity of full grown larva, ventral aspect, showing position of setae (greatly enlarged).
14. Prepupal stage, ventral aspect (length 1.8 mm.).
15. Pupal stage, ventral aspect (length 1.8 mm.) (After Myers.)

Abbreviations.

a, antenna
bc. buccal cavity
lbi, labium
lbr, labrum
m, mandible
slgld, common duct of silk gland
s, sensorial spine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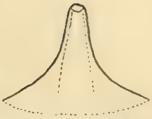
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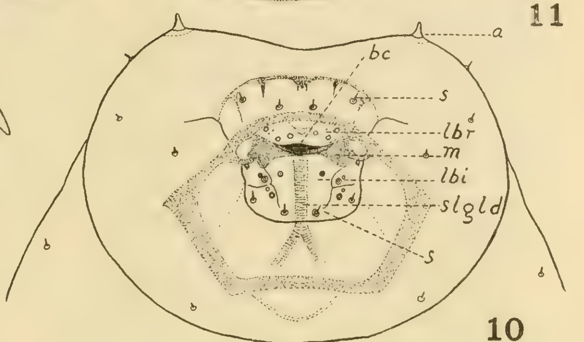

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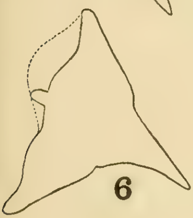
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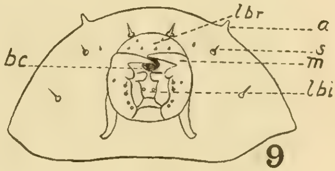

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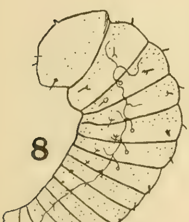
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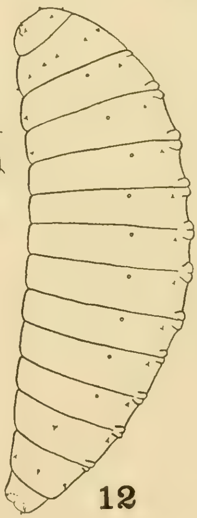
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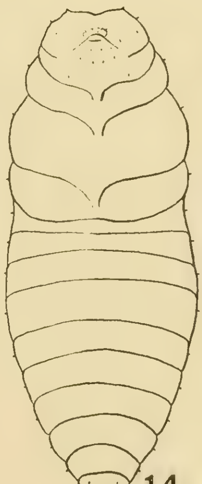
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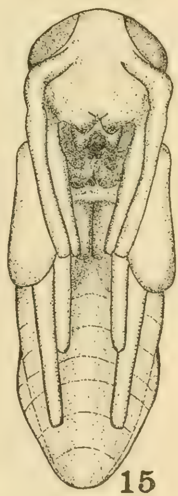
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PAPER WASPS (POLISTES) IN BIRD HOUSES.

By W. L. McAtee.

In these Proceedings (Vol. 31, No. 7, Oct. 1929, p. 136) the writer reported experience for the year 1928 with *Polistes* in connection with a cooperative bird-attraction project at Bell, Maryland. It was then stated that tearing down the nests was the most practicable way of discouraging the wasps. When nests were torn down, the wasps present were killed so far as possible, but in most cases part of them escaped.

The amount of such discouragement necessary can now be shown as a result of four years' operations; see following table:

Year	*Number of times nests removed*							*Total number of bird houses having Polistes nests in them*
	1	*2*	*3*	*4*	*5*	*6*	*7*	
1928	20	12	4	2	....	....	....	38
1929	24	2	1	....	....	....	....	27
1930	28	13	3	1	....	....	....	45
1931	20	8	6	1	....	....	1	36
Totals	92	35	14	4	....	....	1	

The total number of bird houses available was 98, of which in various years from 27 (27.5 per cent) to 45 (45.9 per cent were occupied by *Polistes*.

The persistency of the wasps in rebuilding is remarkable, in one case enduring through seven removals, but in general it is not so great as to condemn the method adopted as the most useful one of controlling the insects. Thus in 92 cases out of a total of 227, a single removal sufficed to free the nest box from the wasps for the season. In other words, one clearing out reduced the infestation 40.5 per cent. Two removals did away with an additional 31.5 per cent of the wasp colonies, while three contributed 18.5 per cent more.

The few bird houses usually concerned in individual efforts to attract birds can easily be freed of *Polistes* by manual methods applied preferably during the coolest periods available, as the insects are very sluggish then. Thorough cleaning out not only of interlopers such as the wasps, but of old nesting material after every brood, is essential to continued success in bird attraction.

THE BUTTERFLY BOOK (new and thoroughly revised edition), W. J. HOLLAND. *Doubleday Doran & Co., Inc., $10.00.*

Students of the Rhopalocera, as well as nature lovers the world over, will welcome with enthusiasm the appearance of this completely revised, much enlarged and, in many ways, more beautiful edition of Doctor Holland's invaluable work.

The original edition which appeared in December, 1898, has met a demand in excess of 65,000 copies and in its day satisfied a need not supplied by any other single publication. It contained 382 printed pages and 47 plates in color reproduced by the half-tone process.

In this new edition, the size of the printed page has been increased by about an inch each way, thus permitting the inclusion of nearly twice as much textual matter as appeared in the original, within the space of but 424 pages. In addition to these advantages, there are 77 ful-page plates, all but four of which are in color. The 29 new plates are quite the equal of, if not superior in quality, to those originally printed and the entire format is exceptionally fine.

The reader will recognize as a distinct improvement the rearrangement which places all of the plates, save the frontispiece, in numerical sequence at the end of the volume, a plan that serves the convenience of the reader for reference purposes.

In discussing this new edition with me, Doctor Holland has said, "I have endeavored to figure on the plates every species that is known on the continent from the Arctic Circle to the tip of Florida and the borders of Mexico, and I have used in the making of plates in a large majority of cases, types or paratypes, many of them lent to me by the U. S. National Museum, the American Museum in New York, my friends in Ottawa, and other possessors of types and paratypes of named species. I have endeavored to omit nothing from this new edition which is of interest to lepidopterists." After examining the volume, one is convinced that the author has attained his objective.

Those who are familiar with the older edition of this work will be more than pleased to discover that in the course of extensive revision, no part of that philosophic humor and poetic feeling which set Doctor Holland's original work quite apart from the ordinary book on entomology, has been sacrificed.

Dedicated as it was on the genial Doctor's eighty-second birthday and presented as a "farewell offering to the rising generation of entomologists in America," it is safe to predict that this book will be received with the grateful appreciation that it highly deserves and the general wish that its author may experience many happy returns of the day.—W. R. WALTON.

MINUTES OF THE 429th REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 429th meeting of the Entomological Society of Washington was held Thursday, May 7, at 8 P. M., in Room 43 of the new building of the National Museum. Dr. A. C. Baker, President, presided. There were present 46 members and 31 visitors. The minutes of the previous meeting were read and approved. There was no preliminary business.

The first communication on the regular program was presented by Prof. Wm. E. Hoffmann, Head of Department of Biology, Lingnan University, Canton, China, and was entitled "Remarks on Entomological Work in China Including an Account of an Expedition to the Interior of Hainan Island." He gave an historical account of entomological exploration in China during the last one and a quarter century and called attention to the major entomological works resulting therefrom. He reviewed the present status of entomological science in the country, including a statement as to the outlook for future work. Individuals engaged in entomological work as well as institutions and publications featuring entomology also were discussed in detail. Lantern slides of Lingnan University, including pictures illustrative of the biological work at that institution, were shown. The latter part of the talk was devoted to an account of a biological expedition to the little-known Island of Hainan. Insects from this island were exhibited. Mr. Hoffmann and the members (all Chinese) of the expedition lived (in the same houses) with the Aborigines (Wild Loi) in the mountains and learned much of these interesting but little-known people. Difficulty was experienced in penetrating to the interior of the island, which is an inhospitable land and has frequently brought death to those who would explore it. In fact, most of the members of the expedition were taken seriously ill with fever to which, unfortunately, one member succumbed. Professor Hoffmann is at present planning a further extensive expedition to the island. (Author's abstract.) A considerable number of lantern slides, panoramic views, periodicals and specimens were shown. Due to the lack of time there was no discussion of this paper.

The second communication on the program was by W. J. Nolan of the Bureau of Entomology, and was entitled "Recent Developments in Apiculture—With a Demonstration of the Artificial Insemination of Queen Bees." The artificial insemination of queen bees has long been a subject for investigation. Huber's work of over a century ago is a classic example. In spite of various reports of success in this field, the recent work of Dr. L. R. Watson at Cornell University along this line is the only such work which has been satisfactorily verified. The Watson method, which makes use of a micro-syringe in transferring the sperm from the drone to the queen bee, has been used successfully by others in the United States, Canada, and Russia. The first verification of Watson's method apparently was made in the U. S. Bureau of Entomology. (Author's abstract.) An informal demonstration of the subject matter was presented and explained in detail.

The meeting adjourned at 10.30 P. M.

J. S. WADE,
Recording Secretary.

Actual date of publication October 16, 1931.

VOL. 33 NOVEMBER, 1931 No. 8

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ENTOMOLOGICAL SOCIETY

OF WASHINGTON

CONTENTS

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PROCEEDINGS OF THE

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FOUR NEW SPECIES OF MYMARIDAE FROM BRITISH COLUMBIA (HYMENOPTERA).

By OSCAR WHITTAKER.

The following descriptions are based on material collected by the author in western British Columbia. A paratype of each species has been placed in the United States National Museum. I take this opportunity of expressing my thanks to Dr. Gahan for supplying me with much valuable information on certain species of the genus dealt with below.

OOCTONUS, Haliday.

Ooctonus fuscipes, new species.

Female.—Black; scape and pedicel very dark brown, paler at extremities and beneath, flagellum black; legs dark brown, trochanters and extremities of femora and tibiae paler; tarsi brownish yellow, the apical two joints darker; petiole brownish yellow; wings subhyaline. Head about one and one-half times as wide as long, slightly wider than thorax, frons separated from vertex by a straight, transverse ridge; ocelli in a triangle, lateral ocelli further apart than from the eyes; occiput emarginate; vertex feebly sculptured, the sculpture in front of anterior ocellus very fine, behind the ocelli coarser and somewhat granular, frons smooth. Antennae two-thirds as long as forewings; scape about as long as pedicel and joints 3–5 combined; pedicel about one-quarter as long as scape; joint 3 very slightly shorter than pedicel; joints 4–9 subequal, as long as pedicel; joint 10 one and one-quarter times as long as preceding joint, about twice as long as thick; apical joint (club) slightly longer than preceding three joints combined, three and one-half times as long as wide. Thorax one and three-quarter times as long as wide. Pronotum, viewed from above, very short, appearing as a transverse, gently arcuate carina, invisible at the sides, produced in front in a tapering neck. Mesonotum with scaly-reticulate sculpture. Scutellum with a transverse, impressed, curved line, convex towards the base, the sculpture similar to that of the mesonotum posterior to the transverse line, finer in front of it. Metanotum smooth, the hind margin carinate. Propodeum smooth and polished, with a median carina which divides into two widely-divergent branches a short distance from the base and which, after running for about one-half the length of the propodeum, are obtusely angled and then converge but do not meet; on each side there is a lateral carina, these converge until reaching the angulation of the branches of the median carina, with which they are connected by a short transverse carina, and thereafter diverge; hind margin of propodeum carinate. All pleurae smooth and polished. Mesopleura with a deep depression on its upper anterior part from which a deep groove runs to the base of coxa. Forewings two and one-half times as long as their greatest width, apically subtruncate, the marginal nerve reaching one-third the length of the wing, longest marginal cilia about one-seventh the wing's greatest width, the discal cilia in about twenty-eight rows. Hindwings about three-quarters as long as forewings, measured from hamuli to tip about ten times as long as wide, cilia on hind margin longer than the width of wing, those on the front margin shorter, with two irregular rows of cilia on the disc. Petiole subcylindrical, widest posteriorly. Abdomen highly polished.

Length, 1.25–1.3 mm.; *expanse*, 3.0–3.25 mm.

Described from four specimens from Hollyburn, 27th Aug.–19 Sept. 1928–30.

Ooctonus auripes, new species.

Female.—Black; scape and pedicel brown, the extremities paler; flagellum dark brown; petiole and legs, including coxae, yellow, apical joint of all tarsi dusky; wings hyaline. Head one and one-half times as wide as long, wider than thorax, narrowed behind eyes; occiput deeply emarginate; eyes large, remote from occiput; ocelli in a triangle, lateral ocelli further apart than from the eyes; vertex separated from frons by a transverse ridge, with inconspicuous, irregular sculpture, more distinct and transverse-linear between front ocellus and frontal ridge; frons smooth. Antennae about three-quarters as long as forewings; scape three and one-half times as long as pedicel, nearly as long as following four joints combined; pedicel and joints 3–5 equal, joints 6–8 about two-thirds as long as joint 3; joints 9 and 10 equal to joint 3, joint 10 nearly twice as long as thick; apical joint (club) as long as preceding three joints combined, nearly three times as long as wide. Thorax comparatively short and broad, one and one-third times as long as wide. Pronotum, viewed from above, very short, appearing as a gently arcuate, transverse carina, invisible at the sides, produced in a tapering neck; mesonotum and scutellum with alutaceous sculpture, the latter with the usual transverse, curved line; propodeum very short, smooth, with carinae as in *fuscipes*, the basal portion of median carina very short; all pleurae smooth and polished; upper part of mesopleura with a longitudinal groove, widened anteriorly. Forewings rather narrow, three and one-half times as long as their greatest width, the apex subtruncate; the marginal vein reaching about one-third the length of the wing; marginal cilia about one-seventh the wing's greatest width, discal cilia short, in about eighteen rows; hindwings two-thirds as long as forewings, measured from hamuli to tip nine times as long as wide, cilia on hind margin longer than the width of the wing, those on the front margin shorter, with two irregular rows of cilia on the disc. Abdomen highly polished.

Length, 0.90 mm.; *expanse*, 1.9–2.0 mm.

Described from two specimens from Chilliwack, 4 September and 15 October, 1926.

Ooctonus canadensis, new species.

Female.—Black; scape brownish-yellow; pedicel brown; flagellum darker brown, becoming black distally; petiole and legs, including coxae, yellow; wings subhyaline. Head one and one-half times as wide as long, a little wider than thorax; eyes large, remote from occiput; ocelli in a triangle, lateral ocelli further apart than from the eyes; occiput emarginate; vertex and frons separated by a transverse ridge; vertex before front ocellus almost smooth, the sculpture very fine and indistinct, with a fine, curved, impressed line running from the front ocellus to the eyes, behind which the sculpture is a little coarser. Antennae about three-quarters as long as the forewings; scape a little more than three times as long as pedicel, about as long as joints 3 and 4 combined; pedicel about three-fifths as long as joint 3; joint 3 half as long as scape; joints 4 and 5 equal, a little longer than joint 3; joints 6 and 7 each a little shorter than the preceding joint; joints 8 and 9 equal, a little shorter than joint 7; joint 10 three-quarters as long as joint 9, twice as long as thick; apical joint (club) as long as preceding two joints combined, three and one-half times as long as wide. Thorax twice as long as wide; pronotum plainly visible from above, front margin gently curved, carinate, humeral angles fairly prominent; mesonotum with fine, reticulate sculpture becoming somewhat linear on posterior part of median lobe, with a fine but distinct, longitudinal median, impressed line which becomes obsolete on the sloping anterior part; scutellum with the usual curved, transverse line, with very fine, irregular sculpture; metanotum smooth, hind margin carinate; propodeum long, smooth and polished, with carinae as in *fuscipes*, the undivided basal portion of median carina of considerable length; all pleurae smooth and polished; mesopleura with a shallow, longitudinal, impressed line on the upper part. Forewings about two and one-half times as long as their greatest width, the apex subtruncate, marginal nervure not quite reaching one-third the length of the wing, marginal cilia short, about one-eighth the wing's width, discal cilia short, in about thirty rows. Hindwings three-quarters as long as forewings, measured from hamuli to tip about eleven times as long as wide, cilia on hind margin longer than width of wing, those on front margin shorter, with three irregular rows of discal cilia. Petiole long, widest posteriorly. Abdomen highly polished, nearly as long as thorax, twice as long as wide, the apex obtusely conical, ovipositor exserted.

Length, 1.4 mm.; *expanse*, 3.3 mm.

Described from two specimens from Hollyburn, 31 August and 7 September, 1930.

Ooctonus occidentalis, new species.

Female.—Black; scape yellow, pedicel and joint 3 brownish-yellow, remaining flagellar joints dark brown, becoming black distally; petiole and legs, including coxae, yellow, pulvilli dusky; wings subhyaline. Head one and one-half times as wide as long, wider than thorax; occiput emarginate; eyes large, remote from occiput; ocelli in a triangle, lateral ocelli further apart than from the eyes; frons smooth and polished, separated from vertex by a transverse ridge; vertex feebly wrinkled before front ocellus, behind this with the sculpture somewhat granular.

Antennae three-quarters as long as forewings; scape as long as following three joints combined; pedicel a little less than one-quarter as long as scape; joint 3 one and one-half times as long as pedicel; joints 3–7 subequal; joints 8 and 9 very slightly shorter; joint 10 very slightly shorter than joint 9, about one and one-quarter times as long as pedicel, twice as long as thick; apical joint (club) slightly more than three times as long as wide, nearly as long as preceding three joints combined. Thorax one and three-quarter times as long as wide; pronotum distinctly visible at the sides, separated from the long neck by a gently arcuate carina; mesonotum with fine but distinct alutaceous sculpture, without a median, impressed line as in *canadensis;* scutellum with the usual, transverse, curved line, with similar sculpture to that of the mesonotum, that on the basal area a little finer than that on the distal area; metanotum smooth, hind margin carinate; propodeum long, smooth and polished, with a median bifurcate carina and lateral carinae, the basal part of median carnia fairly long, the lateral carinae meeting the branches of median carina without connecting transverse carinae; all pleurae smooth and polished; mesopleura with a fine, longitudinal, impressed line on the upper part. Forewings two and one-half times as long as their greatest width, apically subtruncate; marginal nervure reaching about one-third the length of the wing; marginal cilia about one-eighth the wing's width, discal cilia in about thrty two rows. Hindwings about two-thirds as long as forewings, measured from hamuli to tip nine times as long as wide, cilia of hind margin a little longer than width of wing, those on front margin shorter, with three irregular rows of discal cilia. Petiole about four times as long as wide, widest posteriorly. Abdomen somewhat shorter than thorax, twice as long as wide, apex obtusely conical, ovipositor exserted.

Length, 1.5 mm; *expanse*, 3.5 mm.

Described from two specimens from Hollyburn, 18 July, 1928 and 31 August, 1930.

Key to Nearctic species of Ooctonus.

1. Varicolored; forewings with a dusky cross-stripe............*morilli* Howard.
   Black; forewings without a cross-stripe............2.
2. Forewings extraordinarily wide............*quadricarinatus*, Girault.
   Forewings not extraordinarily wide............3.
3. Antennal joint 3 not or only a little longer than pedicel............4.
   Antennal joint 3 distinctly longer than pedicel............7.
5. Legs yellow............*auripes*, Whitt.
   Legs dark............5.
5. Antennal joint 3 distinctly longer than joint 4............*silvensis*, Girault.
   Antennal joint 3 subequal to joint 4............6.
6. Antennal joint 6 considerably shorter than joint 5; joints 7 and 8 still shorter............*americanus*, Girault.
   Antennal joints 5–8 subequal............*fuscipes*, Whitt.
7. Mesonotum with a fine, longitudinal, impressed line, obsolete anteriorly............*canadensis*, Whitt.
   Mesonotum without such line............*occidentalis*, Whitt.

A NEW SPINNING MITE ATTACKING RASPBERRY IN MICHIGAN.

By E. A. McGregor,
Of the Bureau of Entomology, United States Department of Agriculture.

During the past few years, at various times Prof. R. H. Pettit of Michigan State College has sent to the writer specimens of mites attacking raspberry in southwestern Michigan. Two species have been involved, a Paratetranychus and a Tetranychus. The latter proves to be new to science, and is herein described.

Tetranychus mcdanieli, new species.

Female.—General body color deep amber, with blackish spots distributed chiefly around body margin; legs about same color as body. A single pale eye cornea on each side, behind and outward of subfrontal bristles. Body oval, in length averaging 0.40 mm.; width, averaging 0.24 mm. Dorsal body setae 26, pale, roughly in four rows. Mandibular plate rounded anteriorly with no noticeable emargination. "Thumb" of palpus fully as wide as long, bearing at its tip a strong "finger" whose base is nearly half the width of "thumb" at tip; on its upper distal corner are two pin-shaped pseudo-fingers; on upper side hardly midway to base is a "finger" or sensilla much smaller than terminal "finger," and between this and base are two strong setae somewhat exceeding the sub-basal "finger"; a strong hair arises latero-ventrally half way from tip to base of "thumb." Claw on the penultimate joint of palpus less hooked than usual, hardly reaching subbasal "finger." The forelegs are about three-fourths the length of the body. Femur about three times as long as thick, just equalling the tarsus; tibia about one-fifth longer than petella, which is nearly twice as long as trochanter. Relative lengths of joints as follows: Coxa, 21±; trochanter, 11; femur, 35; patella, 19; tibia, 23; tarsus, 35. Tip of tarsus bearing a claw which is bent downward at about right angles at a point one-quarter outward from base; basal portion uncleft, but distal portion made up of six component, subequal, straightish spurs. The usual series of four tenent hairs arise in pairs by the side of the claw base. The collar trachea is of the orthodox Tetranychus type, in the shape of a U with one long and one short arm.

Male.—Body more wedge-shaped than female, in length much smaller: legs proportionately longer. Penis with inner lobe probably rod-like (extremely difficult to observe); basilar lobe rudimentary; shaft about twice as long as its basal thickness, bent abruptly upward and forward about 330° from axis of main shaft, then bent sharply backward as a sickle-shaped acuminate point, the distal portion thus forming a double or S-shaped hook.

Type slide.—Cat. No. 1029, U. S. N. M.

The type material is from Bridgman, Michigan, June 19, 1930, from cultivated raspberry foliage, Lot 1533, Sub. 49, Dept. of Entomology, Michigan State College. The same species has been received from the same host from Byron Creek, Michigan

(Lot 1533, Sub. 50). Professor Pettit informs me that the mite appears at berry-picking time during dry seasons and that the epidemics are so severe as nearly to wipe out the raspberry crop in southwestern Michigan. Since the raspberry crop is attacked during ripening time, it is impractical to apply insecticides to the crop at this time. Professor Pettit describes the damage as follows: "The leaves turn brown, curl somewhat, and during the latter part of the picking season the fruit fails to develop properly. The new growth is webbed together, the leaves being bound together by silken webs. The mites work on both the under and upper surfaces of the leaves." Professor Pettit states that the damage amounts to many thousands of dollars during epidemics and that the pest has been reported for 10 or 12 years. The mites usually disappear soon after the crop is harvested.

The present species is possibly closest to *T. bimaculatus* Harv., from which it may be distinguished as follows:

T. bimaculatus. Female: Color usually brick or ferruginous red; mandibular plate with slight median anterior notch; femur noticeably exceeding tarsus. Male: Penis with strongly developed basilar lobe, shaft bent upward at about 90°, ending in a very blunt barb.

T. mcdanieli. Female: Color usually deep amber; mandibular plate with no anterior emargination; femur equalling tarsus. Male: Penis with almost no basilar lobe, shaft bent upward and forward about 330° from axis of shaft, then bent sharply backward as a sickle-shaped acuminate point, the distal portion thus forming an S-shaped hook.

The Paratetranychus, also occurring on raspberry in Michigan, appears to be *P. ilicis* McGregor. This species was originally described from holly (*Ilex opaca*) from South Carolina.

EXPLANATION OF PLATE.

Tetranychus mcdanieli.

Fig. 1. Tip of tarsus showing appendages (viewed laterally).

Fig. 2. Tip of tarsus (viewed ventrally).

Fig. 3. Collar trachea (viewed laterally).

Fig. 4. Distal portion of palpus with terminal appendages (viewed laterally).

Fig. 5. Foreleg (viewed laterally).

Fig. 6. Penis (viewed laterally).

(All drawings made with assistance of camera lucida, using oil-immersion lens for Figs. 1, 2, 3, 4 and 6.)


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A NEW PINE MOTH FROM CONNECTICUT.

By Carl Heinrich,
Bureau of Entomology, U. S. Department of Agriculture.

Eucosma gloriola, new species.

A small coppery-red species with two shining, metallic, lead gray transverse fasciae; and (in male) with rolled-over costal fold extending to middle of fore wing and enclosing a hair pencil.

Palpus dark gray; inner side paler, with a patch of yellowish white scales at end of second joint. Head yellowish cream white. Thorax dull silvery gray with some copper scaling on anterior half of tegula. Fore wing coppery red, somewhat darker along costa and toward base and with a rather broad coppery ocherous shade along termen; a faint transverse lining of metallic leaden scales near base; from basal third of costa and extending to mid-dorsum a pale transverse fascia, consisting of two rather broad parallel lines of shining leaden-metallic (mixed with some white) scales and separated by a line of the red ground color; beyond this a similar narrower fascia extending from costa just beyond middle toward tornus, thinning out and fusing into the coppery-ocherous terminal area at tornus; extreme edge of costa black; cilia grayish with a fine black subbasal line, the latter broken in some female specimens by white dashes. Hind wing dark grayish fuscous, rather coarsely scaled; cilia pale grayish with a darker basal band.

Genitalia (male and female) as in *sonomana* Kearfott, but much smaller.

Alar expanse, 12–15 mm.

Type and paratypes.—Cat. No. 43654 U. S. N. M.

Type locality.—Stamford, Conn.

Food Plant.—White pine (*Pinus strobus*).

Described from male type and two male and three female paratypes all from the type locality. These specimens were received from Dr. E. P. Felt, who states that they were reared from larvae feeding in the tips of white pine twigs.

The moths issued May 1, 4, 7, and 12, 1931, from larvae collected on July 9, 1930.

The species is very similar and closely related to the western *sonomana* Kearfott. It differs chiefly in size and a few details of pattern. In *sonomana* the outer fascia of the fore wing is more irregular and has a white inner line where it fuses into the tornal ocherous patch; this is entirely lacking in *gloriola.* Kearfott's species also has the coppery-ocherous band along termen deeply angulated. In *gloriola* this is of nearly equal width from apex to tornus. The genitalia of *gloriola* are about half the size of those of *sonomana.* It is barely possible that *gloriola* is a food-plant and eastern local race of Kearfott's species, but this is extremely doubtful. It resembles nothing else in the family except, superficially, some of the smaller *Rhyacionia,* from which it is at once distinguished by its costal fold and different genitalia.

The larva is sordid white with pale yellow thoracic and anal shields. Skin coarsely and evenly scobinated. Head yellowish brown with a round blackish spot at incision of lateral hind margin. Ninth abdominal segment with paired setae II on separate pinacula; VI well separated from IV and V and on a separate pinaculum. Proleg crochets small, uniordinal (10 to 12), arranged in a complete circle weakened or partially broken outwardly.

NEW CACTUS BEETLES, III.[1]

By W. S. Fisher, *U. S. Bureau of Entomology.*

This is the third paper on the beetles received in connection with the prickly-pear insect investigations that are being conducted by the Commonwealth of Australia at Uvalde, Texas. The specimens were sent for identifications by Ronald C. Mundell, who is anxious to have names for the new species to use in papers dealing with cactus insects.

Moneilema (Collapteryx) crassipes, n. sp.

Male.—Moderately large, elongate, strongly convex, subopaque, glabrous, and uniformly black.

Head feebly, broadly depressed between the antennal tubercles, with a narrow, longitudinal groove extending from epistoma to occiput, vaguely, finely, rather densely punctate, with a few coarse, irregularly distributed punctures intermixed, and rather densely clothed with short, recumbent, inconspicuous, black pubescence; clypeal suture entire, and rather strongly impressed. Antenna about two-thirds as long as the body, rather robust, gradually tapering to the apex, uniformly clothed with inconspicuous pubescence, and the joints not annulated with white pubescence; first joint long, robust, gradually expanded to apex, which is truncate, and the surface finely, inconspicuously punctate, with a few coarse, vague punctures intermixed.

Pronotum distinctly wider than long; sides strongly sinuate anteriorly, feebly expanded at middle, strongly constricted along basal third, and armed on each side just behind the middle with a short, obtuse tubercle; surface with a vague, longitudinal, median groove on basal half, rather densely, obsoletely punctate, with a few inconspicuous, irregularly distributed, coarse punctures intermixed, a transverse row of coarse, deep punctures along the base, and rather densely clothed with short, recumbent, inconspicuous, black pubescence.

Elytra nearly twice as long as wide, widest at middle, oblong-oval, strongly convex, the flanks rather abruptly deflexed and vertical; sides broadly rounded at humeral angles, and broadly, transversely subtruncate at apices; surface rather densely clothed with short, recumbent, inconspicuous, black pubescence,

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[1]I. Proc. Ent. Soc. Wash., vol. 28, 1926, pp. 214–217.

II. Proc. Ent. Soc. Wash., vol. 30, 1928, pp. 1–7.

and coarsely, deeply, sparsely, irregularly punctate basally, the punctures becoming sparser toward the apices.

Abdomen slightly convex, sparsely clothed with short, recumbent, black pubescence (longer and semierect on last segment), rather densely, obsoletely punctate, with a few coarse punctures intermixed, especially on the last segment, which is entirely black, and rather deeply, broadly, arcuately emarginate at apex. Mesosternum nearly flat between the coxae. Legs robust, and the femora strongly expanded toward the apices, and the surface with a few scattered, coarse punctures; first joint of posterior tarsus with a large, triangular, pubescent, pad on each side at apex, and the second and third joints with a pubescent pad covering the entire surface.

Female.—Differs from the male in having the last abdominal segment broadly rounded at apex, the femora more slender, and the elytra smooth, sometimes longitudinally wrinkled, but without coarse punctures.

Length, 15–22 mm.; width, 5.5–10 mm.

Type locality.—Palmillas, Tamaulipas, Mexico.

Type, allotype, and paratypes.—Cat. No. 43673, United States National Museum. *Paratypes* returned to Mr. Ronald C. Mundell.

Described from thirty-two examples, twenty-five males (one type), and seven females, collected at the type locality, August 10, 1930, and June 15, 1931, by Ronald C. Mundell.

This species shows considerable variation in size. In some examples the mesosternum is nearly flat between the coxae, whereas in other examples it is deeply, longitudinally grooved. In some of the examples there is a small spot of dense, whitish pubescence on each of the middle and posterior coxae, but these spots are denuded in most of the examples examined. There is considerable variation in the sculpture on the elytra, some of the examples having the surface smooth (punctate in the males), whereas in most of the examples examined the surface is more or less longitudinally wrinkled.

This species is allied to *crassa* LeConte, but it differs from that species in having the sides of the elytra more abruptly deflexed, the joints of the antennae not annulated with white pubescence at bases, and the first joint of the posterior tarsus not entirely covered by the pubescent pad.

Moneilema (Collapteryx) aterrima, n. sp.

Male.—Rather small, elongate, strongly convex, subopaque, uniformly black, and the elytra variegated with whitish pubescence.

Head feebly, broadly depressed between the antennal tubercles, with a narrow, longitudinal groove extending from epistoma to occiput, vaguely, densely, finely punctate, with a few inconspicuous, coarse punctures intermixed, sparsely clothed with short, recumbent, inconspicuous, whitish pubescence, which is denser behind the eyes; clypeal suture feebly impressed. Antenna about two-thirds as long as the body, rather robust, gradually tapering to the apex, uniformly clothed with short, recumbent, brownish pubescence, and the third and fourth joints clothed with more or less distinct whitish pubescence on the underside; first joint long, robust, gradually expanded to the apex, which is truncate, and the surface finely, inconspicuously punctate, with a few coarse, vague punctures intermixed.

Pronotum slightly wider than long; sides nearly parallel, slightly sinuate, vaguely expanded at middle, and armed on each side just behind the middle with a short, obtuse tubercle; surface feebly, narrowly, transversely depressed along base, finely, obsoletely punctate, with a row of coarse, deep, irregularly distributed punctures along the base and anterior margin, and sparsely clothed with short, recumbent, inconspicuous, whitish pubescence.

Elytra nearly twice as long as wide, widest at middle, oblong-oval, strongly convex, the flanks rounded and not very abruptly deflexed; sides broadly rounded at humeral angles, and broadly subtruncate at apices; surface sparsely clothed with short, recumbent, inconspicuous, brownish pubescence, variegated with whitish pubescence, more or less longitudinally rugose basally, and coarsely, deeply, sparsely, irregularly punctate, the punctures more or less arranged in single rows between the rugae.

Abdomen rather strongly convex, finely, obsoletely punctate, sparsely clothed with short, recumbent, whitish and yellowish pubescence, giving the surface a variegated appearance; last segment feebly, broadly, arcuately emarginate at apex. Mesosternum deeply, narrowly grooved in its entire length. Legs robust, the surface with a few scattered, coarse punctures, and the femora strongly expanded toward the apices; first joint of posterior tarsus with a large, triangular pubescent pad on each side of apex, and the second and third joints with a pubescent pad covering the entire surface.

Female.—Differs from the male in having the upper surface uniformly clothed with short, recumbent, inconspicuous, brownish pubescence, not variegated with white pubescence, last abdominal segment broadly rounded at apex, and the femora more slender.

Length, 13 mm.; width, 5 mm.

Type locality.—San Luis Potosi, Mexico.

Type, allotype, and paratype.—Cat. No. 43674, United States National Museum. *Paratype* returned to Mr. Ronald C. Mundell.

Described from four examples, three males (one type), and one female, collected on *Opuntia* sp. at the type locality, during May, June, and July, 1930, and May 20, 1931, by Ronald C. Mundell, who reports the species extremely rare.

There is scarcely any variation in the examples examined, except that the two paratypes are larger than the type or allotype, measuring 19 millimeters in length and 8 millimeters in width.

This species is allied to *variolare* Thomson, but it differs from that species in having the pronotum punctured only along the base and anterior margin, the surface of the elytra longitudinally rugose, and the punctures more or less arranged in single rows between the rugae.

Moneilema (Collapteryx) mundelli, n. sp.

Male.—Large, robust, strongly convex, subopaque, uniformly black, and ornamented with distinct, irregular, white pubescent markings.

Head broadly, rather deeply concave between the antennal tubercles, with a narrow, longitudinal groove extending from epistoma to occiput, vaguely, finely, densely punctate, with numerous shallow, coarse punctures intermixed, rather densely clothed with short, recumbent, inconspicuous, blackish pubescence, and ornamented with a V-shaped, brownish-white pubescent fascia between the antennal tubercles; clypeal suture feebly impressed, and abbreviated at the sides. Antenna about two-thirds as long as the body, robust, gradually tapering to the apex, uniformly clothed with short, recumbent, inconpsicuous, blackish or brownish pubescence, the third and fourth joints vaguely annulated with white pubescence on the underside at bases; first joint long, robust, gradually expanded to the apex, which is truncate, the surface finely inconspicuously punctate, with a few coarse, vague punctures intermixed.

Pronotum distinctly wider than long; sides nearly parallel, feebly sinuate, vaguely expanded at middle, and armed on each side near middle with a short, obtuse tubercle; surface finely, densely, obsoletely punctate, with numerous coarse, irregularly distributed punctures intermixed, densely clothed with short, recumbent, inconspicuous, black pubescence, and ornamented with distinct, irregular, white pubescent markings.

Elytra nearly twice as long as wide, widest near middle, oblong-oval, strongly convex, the flanks broadly rounded but not abruptly deflexed; sides broadly rounded at humeral angles, and conjointly, broadly rounded at the apices; surface sparsely, coarsely, irregularly punctate basally, the punctures becoming sparser toward the apices, more or less longitudinally wrinkled, densely clothed with short, recumbent, inconspicuous, black pubescence, and ornamented with white pubescent markings similar to those on the pronotum.

Abdomen slightly convex, finely, densely, obsoletely punctate, with a few coarse punctures intermixed, sparsely clothed with short, recumbent, inconspicuous, black pubescence, with a few small spots of white pubescence toward the sides of the segments; last segment broadly, deeply, arcuately emarginate at apex. Mesosternum broadly, deeply grooved in its entire length. Legs robust, the surface with a few scattered, coarse punctures, somewhat rugose, and the femora strongly expanded toward the apices; first joint of posterior tarsus with a pubescent pad covering the apical half, the second and third joints with a similar pad covering the entire surface.

Female.—Differs from the male in having the last abdominal segment broadly rounded at the apex, and the femora more slender.

Length, 18–23 mm.; width, 8–10 mm.

Type locality.—Gonzalez, Tamaulipas, Mexico.

Other localities.—Villa Juarez and Tampico, Tamaulipas, Mexico.

Type, allotype, and paratypes.—Cat. No. 43675, United States National Museum. *Paratypes* returned to Mr. Ronald C. Mundell.

Described from fourteen examples, nine males (one type), and five females, all of which were collected by Ronald C. Mundell, who writes that this species is not restricted to any particular form of cactus. The type, allotype, and three paratypes collected at the type locality, April 21, 1931, seven paratypes collected at Villa Juarez (southeast of Ciudad Victoria, on the new Pan-American Highway), April 15, 1931, and two paratypes collected at Tampico, April 16, 1931.

There is a slight variation in the size, but the white pubescent markings are rather constant. In a few of these examples these markings are slightly wider, and in one of the paratypes from Tampico the markings are more or less confluent.

This species resembles *ulkei* Horn and *albopictum* White. From the former it differs by both sexes having the white pubescent markings on the elytra, and from *albopictum* in having the flanks of the elytra broadly rounded, and not abruptly deflexed as in that species.

This species is named in honor of Ronald C. Mundell, through whose careful and energetic collecting our knowledge of the species of *Moneilema* of Mexico has been very greatly increased.

A PECULIAR PANGURGINE BEE FROM ARIZONA.

By T. D. A. Cockerell.

On Sept. 1, 1930, Mr. P. H. Timberlake collected four small black bees at flowers of *Sideranthus gracilis* (Nuttall), also called *Aplopappus gracilis*, at Prescott, Arizona. Examining them he was surprised to see immediately above each eye a rounded shining prominent tubercle, while the ocelli were placed on the front of a large shining elevation. As the bee belongs to the genus *Pseudopanurgus*, in which I have been specially interested, Mr. Timberlake has very kindly transmitted the specimens to me for description.

Pseudopanurgus timberlakei n. sp.

♀. So closely related to *P. fraterculus* (Ckll.) that at first it seemed to be a mere local race of that species. There are, however, enough characters to indicate a distinct species.

The facial foveae are broader and longer; the region above them is shining, and not strongly punctured. (In *fraterculus* the foveae are shorter and rather narrower, the upper end about level with the lower side of supraorbital tubercle, while the region just above each fovea is strongly punctured.)

The supraorbital tubercles and ocellar elevation are more developed than in *P. fraterculus*.

The clypeus has no median groove, or if a groove is indicated, it is punctured like the rest of the surface. (In *fraterculus* the clypeus has a narrow shining median groove.)

The basal area of metathorax has distinct but very fine plicae or raised lines all over. (In *fraterculus* it is without such plicae, and is very sparingly punctate.)

The wings have the basal half hyaline, the apical half or less grayish-brown. (Wings strongly reddened throughout in *fraterculus*.)

Both have a pale spot at base of anterior and middle tibiae; both have the tegulae with an anterior depressed, darkened punctate portion, and a large convex, impunctate, light brown posterior portion, the light brown also extending anteriorly along the sides.

In *P. scaber* (Fox) the area of the metathorax is plicate, and the wings are darkened apically, but there is no mention of cephalic tubercles, and the clypeus has a longitudinal depressed line. *P. mexicana* (Cress.) differs by the apex of the flagellum testaceous beneath and the thorax coarsely and much more closely punctured. *P. rugosus* (Rob.), from Illinois, has no impressed line on clypeus, but is otherwise distinct from *P. timberlakei*. The other species, *P. aethiops* (Cres.) (*fuscipennis* Crawf.), *P. pectidellus* Ckll., *P. cameroni* (Baker), and *P. andrenoides* (Smith), are quite distinct. These insects belong to the restricted and true genus *Pseudopanurgus*, as I understand it.

In *P. timberlakei* the labrum has a dense brush of long golden hair at its apex; the first joint of labial palpi is longer than the other three united. Of the four specimens, the holotype goes to the U. S. National Museum, one is retained by Mr. Timberlake, one remains in my collection and one goes to the British Museum.

Type No. 43582, U. S. N. M.

THE TYPE LOCALITY OF DIASTATA ALBIBASIS MALLOCH.

By T. D. A. Cockerell.

The type of the species (described in Proc. U. S. Nat. Mus. 78, art. 15, 1931, p. 30) is said to have been collected by myself "Near Ledoux, N. M." I fear my writing on the label was not clear, but at my request Dr. Aldrich has looked at it, and it is "Near Lea Lake, N. M." The place is not far from Roswell, in the Pecos Valley.

REVIEW OF WILLIAMS'S "THE INSECTS AND OTHER INVERTEBRATES OF HAWAIIAN SUGAR CANE FIELDS."

By J. S. Wade.

"Handbook of the Insects and Other Invertebrates of Hawaiian Sugar Cane Fields," compiled by Francis X. Williams, et al., Experiment Station of the Hawaiian Sugar Planters' Association, Honolulu, Hawaii. Octavo, cloth, 400 pages, 190 figs., 41 pls., bib., 1931.

This handbook is mainly a compilation. The introduction was written by the late Dr. F. A. G. Muir, and there are chapters on the fauna of sugar cane fields; on nematodes attacking sugar cane roots, by R. H. Van Zwaluwenburg; and a chapter on records of introduction of beneficial insects into Hawaiian Islands, by O. H. Swezey. According to the "Foreword," data have been obtained chiefly from local publications and from records on sugar cane insects and other insects, prepared by Albert Koebele, R. C. L. Perkins, G. W. Kirkaldy, D. L. Van Dine, O. H. Swezey, F. Muir, F. W. Terry, D. T. Fullaway, J. F. Illingworth, P. H. Timberlake, C. E. Pemberton, R. H. Van Zwaluwenburg, and others.

The extensive reference collection of insects at the experiment station has been found to be of great assistance in preparation of this work, while much miscellaneous information has been gathered from text books on entomology and from various publications treating of sugar cane insects in other parts of the world. While a portion of the illustrations have been take from other publications, a number have been prepared for the present work by W. Twigg-Smith, illustrator for the experiment station, and by James Yamamoto.

In addition to the introductory matter, there are subdivisions covering treatment of sugar cane insects that are or have been serious pests; of some sugar cane insects that are pests of less importance, and of the relation of invertebrates to sugar cane in Hawaii. The general structure and development of insects include quite a full discussion of all of the various orders of insects under consideration, occupying pages 39–308, with numerous illustrations. Attention also is given to enemies of the nut grass, *Cyperus rotundus;* the Myriapoda; the soil fauna of sugar cane fields; nematodes attacking sugar cane roots, as already mentioned, and summary of introduction of beneficial insects into the Hawaiian Islands. A bibliography of 13 pages is appended. It is believed that this publication will be useful for the purpose for which it has been prepared and will be of service as the compilers hope, to "serve as a basis for future work that will make our knowledge of sugar cane entomology in Hawaii more complete."

LINGNAN SCIENCE JOURNAL, VOL. 7, JUNE, 1929, *Lingnan University, Canton, China.*

The entomological portion of this volume contains some 431 pages of matter relating to insects. The articles deal with a variety of subjects but the general trend of the publication is toward the taxonomic phases of the science. Some ten orders of insects are discussed, with the Coleoptera in the majority. There are, however, several extensive and interesting papers treating other orders of insects. Notable among these are: "Gall Midges or Gall Gnats of the Orient, by E. P. Felt, comprising about 60 pages; Termites and Man's Fight Against Them, by T. E. Snyder, 50 pages; The Cricket-Locusts (Gryllacrids) of China by H. H. Karny, 36 pages, the last two being fully illustrated.

Biology, morphology and the economic aspects of Oriental insects share in the discussions and the volume ends with a paper entitled "The Life History of Rhyncocoris Humeralis Thunb. (Hemiptera, Pentatomidae)" by William E. Hoffmann, head of the biology department in Lingnan University, who is most pleasantly remembered by many members of this society as a visitor of the past year. —W. R. W.

MINUTES OF THE 430th MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, JUNE 4, 1931.

The 430th meeting of the Entomological Society of Washington was held at Takoma Park, Md., Laboratory of the U. S. Bureau of Entomology, on June 4, 1931. Dr. F. L. Campbell and staff members of the laboratory invited the membership of the Society and their guests to come at 6 P. M. and attend a picnic supper. The formal meeting began at 8 P. M. Dr. A. C. Baker, President, presided. Those in attendance who registered comprised 48 members and 62 visitors.

Under the heading "Reports of Committees," Mr. S. A. Rohwer presented a resolution endorsed by the committee on Nomenclature. In addition to being endorsed by the nomenclature committee of the Entomological Society, the resolution also was endorsed by the committee for the Biological Society of Washington, the Geological Society of Washington, the American Ornithologists' Union, the Helminthological Society of Washington, the American Society of Mammalogists and the American Society of Parasitologists, and by a single member of the group appointed by three national societies: The American Malacological Union, American Association for the Advancement of Science, Sec. F, and American Society of Zoologists. The resolution dealt with the action taken at the International Zoological Congress at Padua, Italy, in the summer of 1930. This action, in the judgment of the committee, establishes a precedent which jeopardizes the stability of zoological nomenclature. The resolution, endorsed by the committee, follows: "We, the undersigned, members of the committees on nomenclature of the various scientific societies listed below, view with alarm the action taken on the Horn Resolution at the International Zoological Congress held in Padua, Italy, in 1930, and consider that this action establishes a precedent which seriously jeopardizes the stability of zoological nomenclature. The adoption of the Horn Resolution by the Congress was contrary to the 1901 agreement, which provided that proposals regarding the international rules of zoological nomenclature would not be submitted to the Congress without the unanimous recommendation of the International Commission on Zoological Nomenclature. We believe that the passage of the Horn Resolution was unparliamentary, contrary to the methods of procedure approved by the International Commission on Zoological Nomenclature, and, consequently, invalid. We, therefore, reaffirm our adherence to the international rules of zoological nomenclature as constituted under the 1901 agreement. Edward A. Chapin, Hartley H. T. Jackson, Gerritt S. Miller, Harry C. Oberholser, Biological Society of Washington; J. Bridge, W. P. Woodring, Geological Society of Washington; A. C. Baker, Carl Heinrich, Harold Morrison, Entomological Society of Washington; T. S. Palmer, Charles W. Richmond, American Ornithologists' Union; Benjamin Schwartz, Eloise B. Cram, Helminthological Society of Washington; Arthur H. Howell, American Society of Mammalogists; G. Steiner, American Society of Parasitologists; and Paul Bartsch, American Malacological Union, American Association for the Advancement of Science, Sec. F, American Society of Zoologists." Mr. Rohwer moved that the Society confirm the action of its committee on nomenclature and adopt the resolution. The motion was seconded. In debate Dr. Aldrich asked the speaker to outline the action taken by the Zoological Congress which the committee looked upon with so much alarm. In response, Mr. Rohwer briefly reviewed the principles endorsed at the International Congress held in 1901 which provided that no questions of nomenclature would be brought before the general Congress for vote until they had the unanimous endorsement of the International Commission of Zoological Nomenclature. This action was believed to be sound and logical because it prevented the general session of the Congress which was dominated by the zoologists of the country in which the individual congress was held from acting on questions of nomenclature until the commission had fully considered the question. The International Commission of Zoological Nomenclature, although selected by the Congress, is composed of representatives of all the larger countries. Members of the Commission are selected because of their knowledge of the subjects, are supposed to, and actually do consider questions of zoological nomenclature from the legal aspect, as well as the wishes of the members of the zoological profession of the country which they represent. Questions of nomenclature can not be settled by off-hand decisions. They require intensive study, are often of far-reaching importance and affect systematic zoology throughout the world. He pointed out that at the various Congresses it was impossible to have representatives from all the countries and that the purpose of having an international commission was to give the zoologists of all countries an opportunity to express through their representatives their opinions on zoological questions. This method provided to the zoologists of the world ample opportunity to debate questions of nomenclature, and when the commission was unanimous it was at least reasonably certain that the action recommended would have the endorsement of the zoologists as a whole. The resolution adopted at the International Congress in Padua, while in itself of comparatively little moment, broke a precedent inasmuch as the general Congress considered a matter of nomenclature which did not have the endorsement of the Commission. Doctor Aldrich dissented from the explanation of Mr. Rohwer and read a translation of the actual motion proposed by Dr. Horn and adopted at Padua by the Section of Nomenclature and the Congress, as follows: "The Congress may determine that only those publications shall be accepted as agreeing with the principles of binary nomenclature, in which the use of a single word for a genus name and a single word for a species name is consistently carried out."

Inasmuch as the Congress did not so determine, the Code and opinions remain just as before. The speaker stated that he had sent a copy of Science containing Dr. Stiles's article on the Padua incident to Horn, Jordan and Poche, inviting them to write him their views on the matter for presentation at our Society when the present resolution should be offered for adoption. The time has been so short that he was able to present only a letter from Dr. Jordan, which contained however an outline of the Padua incident. Dr. Jordan wrote that Dr. Bather had sent a letter to Science, which also expressed his own views, answering Dr. Stiles's article. The time had been so short that this was still unpublished.[1] As a matter of courtesy to our European colleagues, and in order that our members might better understand their position before voting on the resolution, Dr. Aldrich moved that the consideration of the resolution be postponed until our next meeting, which was seconded.

The President, Dr. Baker, spoke briefly, explaining that when the resolution was presented at a recent meeting of the membership of all of the committees who had met to consider the action taken at the Zoological Congress, it was pointed out that it would be highly desirable that early action be taken inasmuch as many of the Societies would hold their meetings in late summer or early autumn. For that reason those who had endorsed the resolution would be glad to have it given early consideration. He asked Dr. Howard whether he wished to discuss the motion. Dr. Howard spoke briefly on the manner in which zoological congresses transact their business and urged the immediate adoption of the resolution. Dr. Aldrich's motion to postpone action had been seconded, was lost, and a vote taken on the original motion—i. e., the endorsement of the action taken by the Society's committee on nomenclature—resulting in the adoption of the motion with one dissenting vote, that of Dr. Aldrich.

The first paper on the regular program was given by Dr. Howard and was entitled, "The Sort of Talk you would Naturally Expect from a Surviving Founder." Dr. Howard stated that the Entomological Society of Washington at its first meeting, called by Professor Riley, Mr. Schwarz and himself, had only 9 people present and that only 25 signed the constitution. These included

[1]Published in Science for June 5—see "Is an International Zoological Nomenclature Practicable?", Science, vol. 73, no. 1901, June 5, 1931, pp. 612–613.

men from Washington, Baltimore and the surrounding country. Of these 25 he had saved contemporary pictures of 15 and he placed in the hands of the secretary a brief statement of his recollections of the 10 of whom he did not have photographs. The statement is as follows: "Memorandum concerning original members of the Entomological Society of Washington of whom no photographs are in the Bureau collection. (a) T. Eugene Oertel. He was a young man, slightly interested in an amateurish way, who left Washington after a year or so and went to Georgia; and none of us have ever heard of him since. (b) Laurence C. Johnson. Judge Johnson was a man of over 50 who had been an agent of the Entomological Commission and afterwards of the Division in the study of the cotton caterpillar in Mississippi. He lived at Holly Springs and was much interested in entomology. At the time of the founding of the Society he was on a visit to Washington. (c) John Murdock. He was a small man, in his early thirties I should say, a graduate of Harvard, who had gone to Point Barrow, Alaska, for the U. S. Signal Service and made extensive entomological and anthropological collections up there. At the time of the founding of the Society he was working in the Smithsonian Institution, writing up his reports. Later he became Librarian of the Smithsonian, and at one time held the chair of Zoology in the University of Wisconsin while E. A. Birge was in Japan. Later he became assistant in the Boston Public Library, and died there ten years or more ago. (d) W. S. Barnard was a tall, slender, blond man, at least six feet three in height and with a full beard. He had been a professor in Iowa, an inspector at Pennikese under Agassiz, and had Comstock's chair at Cornell while Comstock was in Washington. At the time the Society was founded he was working under C. V. Riley on machinery for the distribution of arsenical poison on the cotton caterpillar. He was the inventor of the so-called cyclone nozzle, later known in Europe as the Vermorel nozzle. (e) B. Pickman Mann. An eccentric man, graduate of Harvard, a former editor of *Psyche*, who came to Washington in 1880 to work on a bibliography of economic entomology. There was some trouble between him and C. V. Riley later and he was forced to resign. He then got a position in the Patent Office, where he worked for many years, dying some years ago. (f) Alonzo H. Stewart. Although only a boy he was chief of the pages in the Senate. Probably he was 18 or 19 years old. He was greatly interested in insects and often brought in interesting specimens. He made a large collection of insects attracted by the light in the dome of the Capitol. (g) R. S. Lacey. Captain Lacey was a patent lawyer, who had a farm in Virginia and was interested strictly in economic entomology. (h) Edward S. Burgess. Professor Burgess was teacher of natural history in one of the high schools—I think the Central High School. He was a botanist by preference, but had an interest in insects. I believe he never read a paper before the Society. (i) R. W. Shufeldt. Doctor Shufeldt was an army surgeon and greatly interested in comparative osteology. He had collected some insects and helped the Society but never attended more than one or two meetings. (j) H. F. Riley. I regret that I have totally forgotten this man."

The following is a list of those who "We, the undersigned, hereby subscribe ourselves as members of the Entomological Society of Washington, under the Constitution entered on the preceding pages: Theo. Pergande, T. Eugene Oertel, Lawrence Bruner, E. A. Schwarz, J. G. Morris, L. O. Howard, Laurence

C. Johnson, John Murdock, W. S. Barnard, John B. Smith, C. V. Riley, Albert Koebele, P. R. Uhler, B. Pickman Mann, Alonzo H. Stewart, R. S. Lacey, Edward S. Burgess, R. W. Shufeldt, Geo. Marx, Charles Richards Dodge, Otto Heidemann, Otto Lugger, H. G. Hubbard, Th. L. Casey, H. F. Riley." He then showed on the screen in order the 15 photographs and told something about each man, somewhat as follows: 1. Theodore Pergande, a native of Silesia, of whom it was stated rather whimsically that he came to this country because the girls bothered him so much and because he disliked prayer meetings. On his arrival at New York he wandered into a railway station, and, as the man ahead of him at the ticket window bought a ticket to Syracuse, N. Y., he also bought a ticket to that place. On arrival there he found no one who spoke German and while wandering through the streets disconsolately saw a number of people entering a public building, and upon following them discovered that he was again in a German-Lutheran prayer meeting. A youth sitting beside him in a back seat invited him to his lodging place that night. The very next morning they encountered a recruiting station, and Pergande enlisted and served through the four years of the Civil War, making entomological collections over the various battlefields. Later he was employed in a gun factory in St. Louis and subsequently came to Washington with Riley. While an uneducated man, he made practically all of the notes of the Bureau for many years, and when Doctor Howard, just out of college, joined the staff and noting Pergande's difficulties with the English language, he recommended that he study the masterpieces of English literature to cultivate his style of writing. Very soon thereafter the notes were being written in the style of Edmund Spencer's "Fäerie Queene" and similar masterpieces in English literature! 2. Lawrence Bruner. The photograph shown was that of Bruner while on his wedding trip from Lincoln, Nebraska, to Washington. His bride was much impressed with Washington and stated that she "did not know before that houses could grow so close together." Some time later word was received from their home in Lincoln, Nebr., that a daughter had been born to them, and Doctor Howard wired if they named the child Psyche the whole Division of Entomology would stand godfather. After many months it was learned that the child actually had been named Psyche, whereupon the Division employees passed around the hat. She is now wife of the entomologist, Harry Smith. 3. E. A. Schwarz, remembered in terms of greatest affection by all who knew him. A learned, cultured man of kind sympathetic soul, modest and self-effacing, who did a great deal of good without ostentation, and who also had a rare wit. 4. The Rev. J. G. Morris, of Baltimore, author of some very excellent papers on Lepidoptera, notably "Catalogue of the Described Lepidoptera of North America," published in 1860 by the Smithsonian Institution. 5. Doctor Howard himself, in 1884, when the Society was founded. 6. John B. Smith, a Brooklyn boy, who studied law until entomology got the upper hold. He first studied beetles, and later Noctuid moths. He came to Washington in the early eighties, and was for a time Assistant Curator of Insects in the National Museum. He later took an entomological position in New Jersey and died there. He did admirable work in economic entomology, and especially on mosquitoes. 7. C. V. Riley, who was at that time about 44 years of age, of English birth, but, from his name, of

Irish descent, and whose career is so well known to all entomologists everywhere that it needed no discussion. 8. Albert Koebele as he looked when he first came to Washington. He later attained an international fame as an entomologist, particularly in connection with the introduction from Australia of parasites for control of scale insects in California, and for other valuable work performed on the Pacific Coast. 9. Philip Reese Uhler, of Baltimore, for a long time Librarian of the Peabody Library and author of many valuable works on Hemiptera-Heteroptera. During a visit to Baltimore in 1881, Uhler showed Doctor Howard with great pride a large manuscript comprising a monograph of the Capsidae. Upon inquiring why Doctor Uhler did not publish this work, he said "I am adding a few touches to make it perfect." He continued to do this for nearly 40 years until his death, and the manuscript was never published. 10. George Marx, famous spider specialist. Two slides shown, one at the time the Society was founded, the other is published with his obituary years later. A very fine man and an extremely witty one. Once when Herbert Osborn asked him if he had any children, he said "No, but I have some spiders." 11. Charles Richard Dodge, a graduate of Yale of the class of 1874 and assistant for a long time to Townend Glover, the first U. S. Entomologist. Dodge married an artist and she induced him to wear his necktie in the flowing way indicated in the portrait. He became very artistic indeed, and once showed a lot of pictures to a group of visitors, including Doctor Howard, calling attention to the excellencies, and asked for comment. One of the visitors told him the frame was the most beautiful he ever saw in his life, whereupon the disgusted artist said, "You are all a pack of darn fools." 12. Otto Heidemann, a token in his communistic days. In his early life he was a rabid communist, although the mildest, sweetest, most self-effacing fellow in his later days. He was originally a skilled wood-engraver, who became interested in entomology through doing work for the Bureau, and eventually became especially skilled in the Heteroptera. 13. Otto Lugger. A photograph showing him in the woods, collecting. He was an admirable entomologist; was Riley's assistant in Missouri during the early days. He had left Missouri and worked in Baltimore as Curator of the Maryland Academy of Sciences. He joined Riley's force again in Washington in the early 80's. He later became State Entomologist of Minnesota, where he died. 14. Henry G. Hubbard, for many years a very close personal friend of Doctor Schwarz—a friendship comparable to that of David and Jonathan, or of Damon and Pythias. A graduate from Harvard in the class of 1874; an entomologist of exceedingly high rank, and who finally died of tuberculosis. Two photographs: one on graduation from Harvard; the other about 1884. 15. Thomas Lincoln Casey, a graduate of West Point. Two pictures: one, just as he came to Washington in 1885; and the second taken shortly before his death. His very extensive collection of Coleoptera was willed, with his library, to the U. S National Museum. Following these 15 portraits, the speaker showed a striking portrait of Henry Ulke, who joined the Society in its second year. He was an artist, a portrait painter of unusual merit and skill, and a skilled pianist. An eager and assiduous collector of Coleoptera. He formed during his lifetime one of the largest collections of beetles in this country, which is now in the Carnegie Museum in Pittsburgh. Author of "Catalogue of the Coleoptera of the District of Columbia." An extremely interesting character. At the conclusion of his remarks Doctor Howard produced a manuscript which he stated comprised a "bit of doggerel" recently discovered in the Society's archives and read at its 100th meeting, and which, after rereading by him, could be returned to the archives or turned over to the prohibition authorities. Apropos of certain passages in the "doggerel" he stated that Doctor Marlatt had always been unusually temperate, not consuming more than two or three mugs of beer, and that his name had been used "merely because it was necessary to have a name that rhymes with Pratt." The lines are as follows:

Ninety-nine meetings passed away,
Our hundredth meeting held to-day.
Think of discussions long and dry,
Of dissertations now gone by,
On transformations, malformations,
Bites and stings and on migrations,
Synonymous and species new,
Genera and families too,
Geographic distribution,
Insects almost Lilliputian,
Others of proportions great,
How they live and how they mate,
Wasps and ants and bees and bugs,
Caterpillars, beetles, slugs,
Lice and Lepidoptera,
Flies and Coleoptera,
Colors, marking punctuation,
Points of clothing and venation,
An endless mass of information,
Helping differentiation.

Think of this my friends and ponder;
Then think of something else and wonder.
This something else, I breathe it low,
Is how like fun the beer doth flow
After these dry talks on bugs,
Beer in bottles, beer in mugs,
Crackers, cheese and pretzels too,
Tobacco smoke till all is blue.
Argument and stories long,
Rarely some one starts a song.
Through it all however beer,
Six more there and ten more here.
Empty bottles stand in rows.
No one watches how time goes.
Gill and Riley hold the floor
Till Weismannism becomes a bore.
Then Marx a war-time story tells
So good that everybody yells.

False parasites are talked about
By Stiles until his breath gives out,
And Ashmead, Fernow, Schwarz and Jones
Become discursive, make no bones
Of fighting one another's views
On science, politics and news.
Meantime that quiet chap Marlatt
And Heidemann, Linell and Pratt
Say little, but not to seem queer,
Are downing mug on mug of beer.
And so we hardly realize
How very rapidly time flies
Till some spoil sport says "time to go,"
The others sadly say "just so,"
And all reluctant say good night.
'Tis worth remark that none are tight.

(*Secretary's abstract revised by author.*)

Due to lack of time, discussion of Doctor Howard's address was omitted.

The second communication on the program was given by Dr. N. E. McIndoo, of the Bureau of Entomology, and was entitled "Responses of blowflies to odors in a wooden olfactometer." In a preliminary report McIndoo briefly described his latest and most satisfactory olfactometer. It consists of a box, 12 inches square by 3 inches deep, which has a screen-wire top and a wooden bottom. In the bottom are inserted two cups, each of which is covered with a perforated disc. The cups connect with two bottles, one to hold the attractive or repellent liquid and the other to hold water as a control. These two bottles are connected with a larger one which in turn is connected with a blower pump. The pump forces air through the bottles and the air carries the odors and vapors through the discs to which the insects, when attracted, are counted at regular intervals. This apparatus is being used chiefly to determine the responses of *Lucilia sericata* and *Calliphora erythrocephala* to odors from fermenting and putrefying substances. Many interesting results, concerning the fundamental principles of attractants and repellents, are being obtained, but since this work is not yet sufficiently advanced a full report will be given later. (Author's abstract.) There was no discussion of this paper.

The next communication on the regular program was presented by Dr. J. W. Bulger and was entitled "Determination of toxicity of stomach poisons." Through the use of lantern slides Dr. Bulger gave a brief description of the apparatus used at the Takoma Park field laboratory for the determination of the relative toxicity of insecticides. Data obtained in 1929 by Dr. Campbell on the relative toxicity of cuprous cyanide, acid lead arsenate, sodium fluosilicate, barium fluosilicate, potassium fluosilicate, creolite, basic lead arsenate and aluminum arsenate were presented. It was pointed out that of these preparations only cuprous cyanide was more toxic to the silkworm than acid lead arsenate, and that acid lead arsenate was several times as toxic as basic lead arsenate. Mention was made of the possibilities of obtaining similar data for other insects than the silkworm. It was stated that preliminary information indicated that at least three or more times as much acid lead arsenate was necessary to kill the tent caterpillar (*Malacosoma americana*) than was necessary to kill the silkworm (*Bombyx mori*). (Author's abstract). There was no discussion of this paper.

A vote of thanks was tendered by the Society to Dr. Campbell and staff for use of the meeting place and for the splendid hospitality shown.

Meeting adjourned at 9:40 P. M.

J. S. WADE,
Recording Secretary.

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PROCEEDINGS OF THE

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DISTRICT OF COLUMBIA DIPTERA: RHAGIONIDAE.

By J. R. Malloch, C. T. Greene, and W. L. McAtee.

The Rhagionidae, long called Leptidae, have recently been revised by Leonard (see bibliography) and the present list follows in general the classification of that author. We exclude the genus *Xylomyia* Rondani, however, referring it to the Stratiomyiidae because of the fusion of the prosternum and pronotum. The prosternal plate in the Rhagionidae is clearly separated from the pronotum on each side by a membranous strip. The possession of a tubercle on the anterior or under surface of the hind coxa is a rather uniform feature of the family Rhagionidae though there is considerable variation in the degree of development, and in the position, of it. There is no tubercle at all in *Coenomyia* nor in the genus *Xylophagus* except in *X. nitidus* Adams, and it is very weak in *Dialysis*.

Systematic notes in this paper are by Malloch, and life history notes by Greene. The latter and McAtee wrote up the family in 1920 but decided to postpone publication until the appearance of Leonard's revision which was unexpectedly long delayed.

Insects of this family have sometimes been called snipe flies, a name no doubt suggested by that of the genotype of *Rhagio*, namely, *Musca scolopacea* L. which in turn seems to refer to the speckled coloration of the insect. Most members of the family have maculate wings and these are particularly noticeable in the genus *Rhagio* as the insects flush from their favorite head-down perches on the bark of trees to which they promptly return. The species of *Rachicerus*, *Dialysis*, and *Chrysopilus* usually are seen perched on foliage in sunny spots, those of *Xylophagus* may be found running over the fallen logs in which they passed their immature stages, while *Symphoromyia* draw attention to themselves by their efforts to bite, which as a rule, however, are not very determined. So far as known the larvae are predacious, and they live in the earth, under bark, in frass, or in decaying logs; a few are aquatic.

We present a table showing the number of species of the family collected in New Jersey (1910 List), New York (1928), and in the vicinity of the District of Columbia (excluding in each case synonyms and the genus *Xylomyia*).

Genus	*N. J.*	*N. Y.*	*D. C.*
Coenomyia	—	1	1
Rachicerus	—	—	3
Arthropeas	—	1	—
Glutops	—	1	—
Arthroceras	—	1	—
Xylophagus	3	3	4
Dialysis	2	1	2
Bolbomyia	—	1	1
Symphoromyia	1	2	2
Atherix	—	1	1
Rhagio	4	7	4
Chrysopilus	6	8	7
Total	16	27	25

Of the local species 19 have been taken on Plummers Island, Md., and all of the others in nearby sections of the Potomac River Valley, facts indicated in the list by the abbreviations, P. I., and V. P. I., when not conveyed by locality records cited in full.

Genus COENOMYIA Latreille.

C. ferruginea Fabricius.—Cabin John, Md., R. M. Fouts; near Jackson's Id., Md., May 30; Plummers Id., Md., June 1, 1902, H. S. Barber; Virginia opposite Plummers Id., May 23, 1914, R. C. Shannon; Glencarlyn, Va., May 30, N. Banks; Rock Creek, D. C., June 9, 1917, C. H. T. Townsend.

Genus RACHICERUS Haliday.

R. fulvicollis Haliday.—Glen Echo, Md., July 16, 1922, Malloch; Maryland, near Plummers Id., July 26, 1916, H. S. Barber; Falls Church, Va., July 13 to 23; Glencarlyn, Va., July 7 to 23, N. Banks; July 8, 1915, Greene; Glencarlyn to Barcroft, Va., July 18, 1915, McAtee.

R. nitidus Johnson.—Plummers Id., Md., July 11, 1915, R. C. Shannon; Great Falls, Va., June 25, N. Banks; June 25 to 29, 1915, June 28, 1917, Greene; Virginia opposite Plummers Id., June 27, 1915, R. C. Shannon. Larvae were collected from a rotten log at Rosslyn, Va., April 25, 1913, by R. C. Shannon, and from a decaying fallen trunk of sycamore at Great Falls, Va., April 12, 1924, by Greene; these pupated May 11 and adults emerged May 25.

R. obscuripennis Loew.—The most numerous of this rather uncommon group; has been taken in Piedmont localities from June 14 to July 18; P. I.

Genus XYLOPHAGUS Meigen.

This genus has been divided by Enderlein but Leonard did not include the divisions in his revision. The species with the first antennal segment twice as long as thick, and a transverse impression of the frons, Enderlein retained in *Xylophagus*, and those with the first antennal segment three times as long as thick and no transverse impression on frons he removed to *Archimyia* Enderlein, with *atra* Meigen as genotype, ranking the segregates as genera. Herein these are treated as subgenera, a new subgenus is described for the reception of *nitidus* Adams, and a revised key to the species is presented. In view of the confusion that obviously has existed in the identification of species of this genus we list records here only of specimens available during preparation of the present paper.

Key to the Species.

1. Hind coxa with a short blunt process on inner side near middle; entire frons gray-dusted and evenly convex in profile at same level as eyes; mesonotum glossy black in front, paler behind, without gray dust, humeri pale yellow; antennae about as long as head, the basal segment not over twice as long as thick nor as long as width of frons at its anterior extremity, the frons in female over twice as long from anterior extremity to anterior ocellus as its width at anterior extremity (*Anaxylophagus* Malloch, new subgenus)..........*nitidus* Adams

   Hind coxa without a process on inner side near middle; frons glossy on at least a portion of its surface except in *gracilis*..........2.

2. Basal segment of antenna not three times as long as second and falling distinctly short of extending to anterior ocellus; scutellum with quite conspicuous pale erect hairs, most evident in the males (Subgenus *Xylophagus*)..........3.

   Basal segment of antenna not less than three times as long as second and extending at least as far as anterior ocellus; scutellum with a few decumbent dark hairs, appearing bare except under a high magnification (Subgenus *Archimyia*)..........7.

3. Frons entirely gray-dusted, less densely so in center near anterior extremity, and in male over twice as long as wide in front of anterior ocellus; metapleura dusted except in front; humeri yellow..........*gracilis* Williston

   Frons gray-dusted above, polished black either in center or anteriorly; humeri not yellow..........4.

4. Sternopleura and metapleura entirely glossy black, the latter microscopically alutaceous on a large part of their surfaces; abdomen in both sexes black; antennae inserted on a very slight elevation (best seen in profile)..........5.

   Hind margin of sternopleura and all of metapleura lightly gray-dusted; abdomen of female with at least the second and third tergites largely orange-red, that of male rarely showing traces of red color on second and third tergites, antennae inserted on a well developed elevation when seen in profile..........6.

5. Upper half of frons densely gray-dusted; posterior portion of meta-

pleurum with a group of closely placed microscopic hairs near upper margin below base of halteres..*lugens* Loew

Frons in front of ocelli glossy black except for the usual narrow line of gray dust along each side; metapleura bare.....................*lugens* Loew, var.

6. Back of head entirely glossy black, without a trace of gray dust.......... *abdominalis* Loew, var.

Back of head entirely but lightly gray-dusted.................*abdominalis* Loew

7. Frons entirely glossy black from anterior ocellus to anterior margin; legs fulvous yellow, extreme bases of hind coxae on posterior side black, hind tibiae dark brown on entire dorsal surface, apical two segments of fore and mid pair dark brown, hind pair more extensively so, but basal segment generally entirely pale; metapleura without trace of hairs ....*decorus* Williston

Frons with a very distinct band of gray or brownish dust in front of anterior ocellus, glossy black in front of that portion except very narrowly on lateral margins...8.

8. Legs black, or brownish-black, the knees narrowly yellowish; posterior portion of metapleurum with a group of microscopic fine hairs; basal segment of antenna extending to beyond anterior ocellus.................... *longicornis* Loew ♀

Legs much more extensively pale, sometimes almost entirely fulvous yellow ....9.

9. Basal segment of antenna not extending beyond anterior margin of anterior ocellus; several stiff hairs on upper posterior portion of the metapleurum; hind tibiae entirely pale or very slightly browned at apices, and only the apical 2 segments of all tarsi dark brown........ *politus* Malloch, new species.

Basal segment of antenna extending well beyond anterior margin of anterior ocellus; no stiff hairs on upper posterior portion of the metapleurum; hind tibia distinctly infuscated on apical third or more, and the hind tarsi darkened from before apex of basal segment to tip...10.

10. Hind coxae distinctly black at bases and the abdomen but slightly shining and finely alutaceous on apical half or more of dorsum........ *longicornis* Loew ♂

Hind coxae not, or very slightly, darkened at bases and the abdomen glossy in both sexes..*rufipes* Loew.

Subgenus ANAXYLOPHAGUS Malloch, new subgenus.

It is remarkable that in this subgenus there is a small rounded tubercle on the anterior side of the hind coxa similar to that found in all species of the genus *Xylomyia* Rondani, but which is lacking in both of the other subgenera dealt with below. Most genera of Rhagionidae have a more or less evident elevation on the same surface of the hind coxa but not as pronounced as in the group described.

Subgenotype *Xylophagus nitidus* Adams; this species is known only from the White Mountains, New Hampshire.

Subgenus XYLOPHAGUS Meigen.

X. abdominalis Loew.—Leonard has used the name *fasciatus* Walker for this species but that term is preoccupied by Say's identical name; both of these were originally combined with the genus named *Xylophagus;* Loew's name appears to be next in priority. We have seen only one local specimen, that from Great Falls, Va., April 20, 1913, R. C. Shannon.

X. lugens Loew.—Plummers Id., Md., April 12, 1915; Dead Run, Va., April 15, 18, 1916, April, 1923, R. C. Shannon.

Subgenus ARCHIMYIA Enderlein.

X. longicornis Loew.—Plummers Id., Md., May 8, 1915, May 7, 1916, May 4, 1919; Great Falls, Va., April 28, 1915; Dead Run, Va., May 8, 23, 1915, May 19, 1916, R. C. Shannon. Leonard states that the male is unknown, but a pair taken in copula (Plummers Id., May 7, 1916, of the preceding records) bears his determination label, the female correctly named, and the male incorrectly as *rufipes* Lw.

Xylophagus politus Malloch new species.—The characters used in the key will suffice for the recognition of this species, which is very similar to large examples of *rufipes* Loew, with the hind coxae very slightly darkened at bases and the hind tibiae entirely pale. Length, 15–18 mm.

Type and two paratypes Burke, Colo., May 12–14, 1904; and one paratype Kokanee Mt., B. C., August 10, 1903 (R. P. Currie). The first three specimens are in the collection of Owen Bryant, the last in that of the U. S. National Museum; it was labelled *decorus* Will, by Leonard.

X. rufipes Loew.—This species is called *reflectens* Walker by Leonard but it would appear better to use Loew's name in the absence of definite information as to the identity of Walker's type specimen which was not seen by Leonard. It may be noted as probable also that many of Leonard's records of males belong under *longicornis* and not in *rufipes*. Local records include: Plummers Id., Md., May 2, 1902, H. S. Barber; Great Falls, Va., April 28, 1915; Dead Run, Va., May 11, 1915; Rosslyn, Va., April 22, 1913, R. C. Shannon.

Genus DIALYSIS Walker

D. fasciventris Loew.—Plummers Id., June 19, 1913, R. C. Shannon; Dead Run, Va., June 23, N. Banks; June 30, 1916, R. C. Shannon. This species is readily distinguished by the presence of hairs on the central portion of the metanotum, a character it shares with the western *disparilis* Bergroth.

D. rufithorax Say.—Common and generally distributed; season of collection of adults, May 21 to July 12; P. I. Small examples have been named *D. elongata* Say, but we have not seen any specimens of that species from the District of Columbia region. It may be recognized by having but two veins emanating from the discal cell, the humeri much paler below and very noticeably white pollinose, the tergites each with a large fuscous triangular mark, and the fore tibiae entirely pale.

Genus BOLBOMYIA Loew.

B. nana Loew.—Originally described from the District of Columbia; Forest Glen, Md., April 28, 1914, Otto Heidemann; Virginia opposite Plummers Id., April 28, 1907, McAtee (this specimen the type of *Misgomyia obscura* Coquillett).

Genus SYMPHOROMYIA Frauenfeld.

S. cinerea Johnson.—This biting species has been taken in a number of localities, but paucity of information about it makes it worth while to cite all of them: Washington, D. C., May 5, 1895; Plummers Id., Md., June 2, 1916, McAtee; May 28, June 3, 1914, R. C. Shannon; Virginia near Plummers Id., June 2, 1916, McAtee; May 18 to 31, 1915, June 1 to 9, 1916, R. C. Shannon; Falls Church, Va., May 16, 1917, Greene.

S. hirta Johnson.—Glen Echo, Md., June 17, 1923, Malloch.

Genus ATHERIX Meigen.

A. variegata Walker.—Riverdale, Md., June, 1916, F. R. Cole; Plummers Id., Md., April, 1908, reared from pupa found in sand, E. A. Schwarz; June 3, 1914, R. C. Shannon; Glencarlyn, Va., May 9, N. Banks; Chain Bridge, Va., April 23, 1922, Malloch. Larvae were collected in Paint Branch, Md., near Beltsville, July 2, 1922, H. S. Barber.

Genus RHAGIO Fabricius.

R. mystaceus Macquart.—Common and generally distributed; dates of collection of adults range from April 20 to May 27; in copula May 9; P. I. Has been bred from pupae found in frass at base of oak tree, Falls Church, Va., April 19, 1919; also from larvae found in a rotten log of sycamore at Great Falls, Va., April 12, 1924, Greene.

R. plumbeus Say.—Beltsville, Md., June 14, 1914; Plummers Id., Md., May 30, 1909, McAtee.

R. punctipennis Say.—Common and widespread; season, May 11 to June 23; P. I.

R. vertebratus Say.—Common in the Piedmont; usual dates of collection of adults extend from May 19 to June 23, but single specimens available are labeled July 7 and Aug. 31; P. I.

Genus CHRYSOPILUS Macquart.

C. basilaris Say.—Fairly numerous—mostly in Piedmont localities; season June 20 to July 24; V. P. I.

C. fasciatus Say.—Common in the Piedmont; dates of collection range from June 2 to July 23; P. I.

C. modestus Loew.—Numerous in the Piedmont; collection dates run from June 16 to July 25, but single specimens are available dated May 16 and August 22; P. I.

C. ornatus Say.—Common and generally distributed; ordinary season from May 30 to July 14, one specimen labelled May 6; P. I.

C. quadratus Say.—Locally this is the most common species of the genus; it is widespread but not so often seen in the Coastal Plain as is *C. ornatus*; its active season is longer than that of the others extending from May 23 to July 25, with single dates of collection also as late as Aug. 9, 28, and Sept. 8; comes to light; P. I. Has been reared from larvae taken in wet frass from a hole in a tree near Dead Run, Va., Greene.

C. rotundipennis Loew.—Fairly numerous; dates of collection range from June 20 to July 30; V. P. I.

C. thoracicus Fabricius.—Very common; known season May 21 to June 20; in copula, May 28, June 4; P. I.

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ADDITIONAL NOTES ON TYPES WITH DESCRIPTION OF A NEW GENUS (HYMENOPTERA : CYNIPIDAE).

By LEWIS H. WELD, *East Falls Church, Virginia.*

At the Zoological Museum in Lund, Sweden, are preserved the Dahlbom and C. G. Thomson collections of Cynipidae. TheThomson collection occupies two museum drawers and contains about 160 species of which about half are his own species. Nine are types of genera. There are two Dahlbom collections: his "museum" collection in two drawers; and his "private" collection in three small red drawers in a separate cabinet. Seven of his species are genotypes.

At the Zoological Museum in Berlin the Reinhard collection is distributed in the regular systematic collection as is also material from Mayr, Schlechtendal, Bassett, Kieffer and some of the Förster species. The von Halfern arrangement of Förster Cynipidae occupies 6 drawers in another cabinet and contains many genotype species. There are 6 additional drawers of unworked Förster material, about 17,000 specimens; most of the genotypes have been taken out but many manuscript names occur. Förster founded 64 genera of Cynipidae, 29 on his own species and of these all but one, *Dilyta subclavata*, have been found in the collection. In the regular collection is type material of most of the Hedicke genotype species. At the Deutsch. Ent. Inst. in Dahlem is a collection of about 100 species, 16 of which, including 3 genotypes, are not represented in the other museum. Including both museums a total of 343 species, including 69 genotypes, will be found in Berlin.

In Vienna the regular collection occupies 119 drawers with 12 more of *inserenda*. It is richest in gall-making species (544) with 93 parasitic, making a total of 637 of which 66 are genotype species.

The Hartig collection of Cynipidae will be found intact in the Zoologische Staatssamlung in Munich. Thirty-four of his species are types of genera.

The Giraud collection is in Paris. Of his species 12 are types of genera. As he exchanged with Mayr, Giraud type material will be found in Vienna also. There are 2 Kieffer genotypes at Paris and 3 specimens of *Oberthürella lenticularis* Saussure which may be the types. The Cameron types are in the British Museum, whose collection totals 268 species of which 53 are genotypes.

Aspicerinae.

OMALASPIS Giraud.

Lambertonia Kieffer Bull. Ent. Soc. France 1901 : 158–9. Synonymy new.

Omalaspis norica Giraud, the genotype of *Omalaspis*, was described as having a closed radial cell. The two Giraud types in Paris have the radial cell open on the margin, a condition for which the genus *Lambertonia* seems to have been erected. The type of *Lambertonia abnormis* Kieffer, the genotype, has not been seen nor is its present location known to me, but there seems to be nothing in the published description that would prevent its being congeneric with *norica* and prevent *Lambertonia* from becoming a synonym of *Omalaspis*.

Figitinae.

ZYGOSIS Förster.

Diceraea Förster Verh. Zool.-Bot. Ges. Wien 19 : Abh. pp. 364, 367. Synonymy new.

In the Dahlbom "museum" collection in Lund were found 18 specimens of *Figites urticeti* Dahlb., the genotype of *Diceraea*, and one of these was selected as a lectotype. Förster established the genus *Diceraea* on the characters "eyes bare and first abscissa of subcosta obsolete," but the type specimens have the eyes hairy, the subcosta normally developed, the two sides of the areolet distinct and all pleurae and scutellum smooth so that they run to *Zygosis* in Förster's own key. The basal region of the subcosta which Dahlbom failed to see is slender but is distinctly present and the membrane in front of it is very transparent.

Through the courtesy of Dr. N. A. Kemner one of the specimens from the Dahlbom "museum" collection was taken to Berlin and compared with a specimen of *Psilogaster heteropterus* Hartig on which Förster founded the genus *Zygosis* and the two were found to be not only congeneric but to be the same species. Later it was compared directly with the Hartig type of *heteropterus* at Munich and this conclusion was confirmed. I conclude that *Psilogaster heteropterus* Hartig, 1843, is a synonym of *Figites urticeti* Dahlbom, 1842 (Synonymy new), and that *Zygosis urticeti* (Dahlbom) is the valid name of the species. *Diceraea* becomes a synonym of *Zygosis* which has page precedence in Förster's key erecting these two new genera.

Anacharitinae.

CALOFIGITES Kieffer.

This monobasic genus was described in the Figitinae. The type of *Calofigites nitidus* Kieffer in Berlin lacks the head and the pin goes through the mesoscutum, but the habitus and particularly the heavy veins of the radial cell and the structure of the scutellum lead me to the conclusion that the genus belongs in the Anacharitinae.

ACANTHEUCOELA Ashmead.

Gonieucoela Kieffer, 1907, Ent. Ztschr. Stuttgart 21 : 112. Synonymy new.

After studying the type of the genotype species, *Gonieucoela bilobata* Kieffer, in Pomona College and *Gonieucoela brevidens* Kieffer in Berlin and paratypes of both now in the U. S. N. M. I conclude that the differences between this genus and *Acantheucoela* (in the sculpture of the posterior part of the disk of the scutellum) are too trivial to warrant maintaining *Gonieucoela* as a separate genus. The genus *Acantheucoela* was not familiar to Kieffer, who included it in Das Tierreich as an unnumbered genus. It was described from Cuba and has been found in Montserrat, Mexico, Brazil, and Bolivia. The two species of *Gonieucoela* are from Belize, Nicaragua, Peru and Bolivia.

Eucoilinae.

EUCOILA Westwood.

Lytosema Kieffer, 1901, Feuille Natural. 31 : 159, 162. Synonymy new.

Ashmead and more recently Hedicke have published that the genotype of *Eucoila* Westwood (not of authors) is a species with bare, non-ciliate wings and that *Psilodora* Förster is a synonym of it, its genotype being congeneric with *Eucoila crassinerva* Westwood.

An examination of the Dahlbom collection in Lund showed that *Eucoila guerinii* Dahlbom, the genotype of *Lytosema*, is also congeneric with *crassinerva* Westwood and therefore *Lytosema* should become a synonym of *Eucoila*.

Guerinii was species number 19 in Dahlbom's table published in 1842 in which the species was figured and the radial cell shown as open. No specimen bearing the name of *Eucoila guerinii* appears in the Dahlbom collection however. In 1846 he published a key to *Eucoila* in which the same number of species occurs and all are the same as in the former paper except that number 19 is here called *scutellaris* and specimens with this name do occur in both his "private" and in his "museum" collections and on one pin the name "Guerin" is written underneath *scutellaris*. He appears to have renamed the species for some reason in 1846 and this has been the Dalla Torre and Kieffer interpretation. These specimens of *scutellaris* agree with the figures of *guerinii* except that I should call the radial cell closed and should put it in *Psilodora* Förster, the only distinction Dalla Torre and Kieffer make between *Lytosema* and *Psilodora* being the open or closed cell. It seems therefore that *Lytosema* should go into synonymy and if species are ever found in this bare and non-ciliate winged group with a radial cell that is actually open a new name can be proposed for them if thought desirable.

BOTHROCHACIS Cameron.

Salpictes Kieffer, 1913, Voyage de Alluaud Hym. 1 : 31. Synonymy new.

The female holotype of the genotype species, *Salpictes rufiventris* Kieffer, is in Paris and when dirt was cleared away from the scutellum the disk was found to be coarsely punctate and truncated behind, the truncated end being slightly hollowed out. There seems to be nothing to separate this from *Bothrochacis* Cameron, a genus with which Kieffer was not familiar and which was described from males only.

KLEIDOTOMA Westwood.

Schizosema Kieffer, 1901, Feuille Natural, 31 : 158, 161. Synonymy new.

Kieffer founded this genus for two species, *Cothonaspis* *emarginatus* Hartig which was described as having "abdomen basi denudatum" and *Pentacrita proxima* Ashmead, whose abdomen was said to be without a ring of hairs at the base. The Hartig holotype male of *emarginatus* at Munich *has* a hairy ring at base of second tergite and the characteristic wing venation, striate disk, and narrow cup of *Kleidotoma* although the obliquely truncate wing can hardly be called emarginate. As it is the genotype of *Schizosema* this genus becomes a synonym of *Kleidotoma*. The type of *proxima* Ashmead has not been examined; it is probably in the British Museum.

EUTRIAS Förster.

The types of the genotype species, *Eucoela tritoma* Thomson at Lund, 5 females and 2 males, have the disk of the scutellum distinctly longitudinally striate, tapering to a blunt triangular point behind the very narrow cup. The wing is very transparent, its surface dotted but bare in the female and with short pubescence in the male. In the male the margin of the fore wing is ciliate but only one of the five females shows any cilia on the margin. The wing is not truncate or emarginate but normally rounded at the end. It seems to me that Dalla Torre and Kieffer are in error in Das Tierreich, Lief. 24 : 111 (1910) in making *Eutrias* a subgenus of *Cothonaspis*. It is more closely related to *Rhynchacis* from which it is separated by the normally rounded wings or to *Eucoila* Westwood (not of authors) (= *Psilodora*) from which it is separated by the narrow cup and striate disk. It seems better to maintain it as a separate genus.

Cynipinae.

Diplolepis centricola (O S).

Cynips quercus-rubrae Karsch, 1880, Zeit. f. Naturw. 53 : 293, Pl. 6, fig. 4, a, b. Synonymy new.

I have compared the two types of *quercus-rubrae* in the Berlin Museum with determined specimens of *centricola* reared from *centricola* galls on post oak at Washington, D. C., the type locality, and find that they are the same. The Karsch galls agree with the *centricola* galls from *Quercus stellata* and I conclude that Karsch redescribed the species which Osten Sacken had described in 1863.

Amphibolips spongifica (O S).

Trissandricus maculipennis Kieffer, 1910, Boll. Laboro. Zool. Portici 4 : 115. Synonymy new.

The four types of *maculipennis*, on which Kieffer founded the genus *Trissandricus*, in the Berlin Museum, belong to the genus *Amphibolips*, an American genus with which Kieffer does not seem to have been familiar. Through the courtesy of the Berlin Museum one of the paratypes was secured by exchange for the U. S. National Museum. It agrees in structure with *spongifica* and certain specimens in a series of *spongifica* reared at East Falls Church, Va., but a few miles from the type locality, agree with it in color; others have the thorax black like the head and are distinctly bicolored. I conclude that both the genus and species should disappear in synonymy.

Callirhytis corrugis (Bassett).

Callirhytis defecta Kieffer, 1910, Boll. Laboro. Zool. Portici 4 : 416. Synonymy new.

One of the two types of *defecta* in the Berlin Museum has both antennae 14-segmented; the other has 14 on one side and 13 on the other with a trace of subdivision on one side of the terminal segment. Through the courtesy of the Berlin Museum one of these was loaned in order that it might be compared directly with the holotype of *Cynips corrugis* Bassett in the Acad. Nat. Sci. in Philadelphia. The antennae of *corrugis* exhibit the condition found in one of the types of *defecta*, namely 14-segmented on one side and 13-segmented on the other. There seemed to be no difference in sculpture and I conclude that *defecta* is a synonym of *corrugis*.

I have taken what seems to be this species ovipositing in the buds of *Quercus velutina* at Washington, D. C., April 20, 1924, and at East Falls Church, Va., on April 18, 19, 20, 1927, April 19, 1928, and April 22, 1930. Some of these have 13-segmented antennae and others 14. Specimens have been compared directly with the type of *defecta* and with the type of *corrugis* and I should consider them all one species. They oviposit on the side of the elongating buds about midway of their length when the buds are from one-half to three-quarters of an inch long, selecting usually the topmost buds on vigorous shoots from stumps. The gall from which they have emerged has not yet been discovered nor has the alternating gall which they produce.

Through the courtesy of the Berlin Museum I am able to describe the following new genus in the Eucoilinae recognized among undetermined material.

PERISCHUS n. g.

This genus and *Zamischus* Ashmead are separated from all the rest of the known Eucoilinae by having a remarkably long and slender body, both the neck of the propodeum and the petiole of the abdomen being unusually elongated. Both have the head massive, broader than the thorax, the antennae arising far above the middle of the eyes, the lateral bars at base of scutellum broad and striate, the mesopleurae aciculate, the wings pubescent and ciliate, and the second tergite bare at the base. Both are neotropical. *Perischus* (name from *peri* and *Zamischus*) differs in having filiform antennae, the neck of the propodeum not reaching as far back as the distal end of hind coxae, a closed radial cell and a transversely sculptured mesoscutum.

Genotype.—*Perischus boliviensis* which is described below. Monobasic.

Perischus boliviensis n. sp. (Fig. 1).

Female.—Black; mandibles, tibiae and tarsi reddish-brown. Head smooth and polished with a few setigerous punctures on face; from above the axial line .65 transfacial, cheeks not broadened behind the eyes, not margined; from in front broader than high, interocular space .47 transfacial and area .9 as broad as high, malar space .4 eye with a fine malar groove, clypeal area higher than broad. Antennae arising high on face, filiform, as long as body, 13-segmented, lengths as (scape) 12 (width 4.5) : 6 : 21 (3) : 23 : 24 : 25 : 24 : 22 : 20 : 18 : 18 : 18 : 20 (4), the third seen from above slightly bent inward, all flagellar segments cylindrical and closely joined. Sides of prothorax produced backward, mostly smooth but striate below, the truncation .4 width of head and not quite half the width of thorax, with deep lateral indentations, shallowly emarginate above.

Fig 1. *Perischus boliviensis* n. sp. Lateral view, dorsal view and antenna.

Mesoscutum somewhat triangular, longer than broad, shining, with about 20 fine sharp transverse ridges, smoother anteriorly where are fine anterior parallel lines, without trace of parapsidal grooves. Scutellum .6 as long as mesoscutum with two small smooth pits at base and broad striate lateral bars, the disk punctate, rounded behind, faintly margined, the cup but slightly elevated, tapering in front into a long polished septum between the pits, its surface flat with coarse confluent punctures, over three times as long as broad, not quite reaching end of disk. Mesopleurae much elongated and separating the middle coxae far from anterior, longitudinally striate, smoother below, the mesosternum with a fine median carina. Metapleurae also striate. Propodeum longer than scutellum, not as long as width of head, its neck with two prominent carinae dorsally, the sides rugose and pubescent. Wings clear but the pubescence and cilia dark like the veins, radial cell closed, 4.8 times as long as broad, the marginal vein prolonged beyond apex of radial cell, cubitus partly formed, areolet absent. Legs long and slender; segments of front leg as (coxa) 18 : 9 : 38 : 26 : 61 (= 26 + 13 + 9 + 5 + 8); of hind leg as (coxa) 29 (9) : 9 : 43 : 61 : 84 (=42 + 17 + 12 + 5 + 8); claws fine, simple. Petiole cylindrical, slightly carinate on sides, dull, longitudinally striate, 11.5 times as long as broad, shorter than rest of abdomen, which is somewhat compressed laterally, second tergite largest, bare at base, without punctures; lengths of tergites along dorsal curvature as (petiole) 69 (6) : 73 : 26 : 2 : 9. Using the width of the head as a base the length of mesonotum ratio is 1.4, wing 5.1, antenna 6.1. Length 3.5 mm. Antenna 3.55 mm. Wing 2.95 mm.

Described from two specimens from Coroico, Bolivia. Type and paratype in the Zoological Museum in Berlin. Wing, antenna and legs from one side of the type in balsam on slide in U. S. N. M.

A NEW SPECIES OF TERMITE, RETICULITERMES ARENINCOLA, FROM THE SAND DUNES OF INDIANA AND MICHIGAN, ALONG THE SHORES OF LAKE MICHIGAN.

By Eugene J. Goellner, *Department of Zoology, University of Chicago.*

The eastern species of termite, *Reticulitermes flavipes* Kollar, had been always considered to occur in the Indiana dunes along the southern shore of Lake Michigan. In 1929 Park[1] reported the western species, *Reticulitermes tibialis* Banks, from this region. A study of the distribution of these two species of termites was undertaken in the fall of 1930. At the very outset of the investigation, the species considered in the past as *Reticulitermes flavipes* Kollar exhibited such morphological differences from the eastern species as to warrant describing it as a new species.

According to present knowledge, *Reticulitermes arenicola* sp. n. appears to be typically an inhabitant of sandy places. It occurs side by side with *Reticulitermes tibialis* Banks in the Indiana sand dunes.

A few records of it were obtained from the dunes of Western Michigan, from the Indiana border to New Buffalo, at Stevens-

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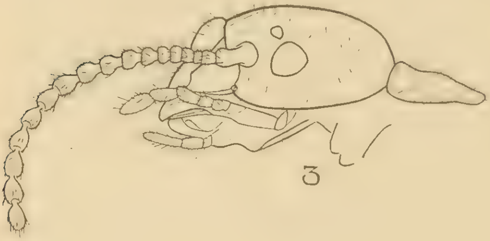
[1]The author is indebted to Dr. Alfred E. Emerson of the University of Chicago, under whom the work was done, and to Dr. T. E. Snyder of the U. S. Department of Agriculture.

ville and Grand Haven. Collecting was carried on in Michigan chiefly to establish the presence of *Reticulitermes tibialis* Banks in that State.

Reticulitermes flavipes Kollar was taken in the dunes only at Saugatuck and Grand Haven, Michigan; but not in the Indiana dunes. It occurred, however, in other localities in Indiana where mesophytism prevailed.

The colonizing flights of *Reticulitermes arenincola* sp. n. occur toward the end of May.



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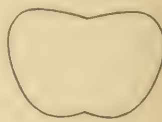

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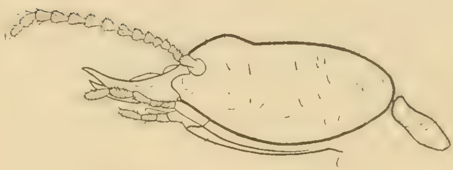

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5c

Fig. 3. Side view of head of sexual alate adult of *R. arenincola.*

Fig. 4. Side view of head of soldier of same species.

Fig. 5a. *R. arenincola*, dorsal view of pronotum of first form reproductive individual. b. *R. flavipes* Kollar, variant from Arkansas, dorsal view pronotum, first form reproductive individual. c, Pronotum typical *R. flavipes*, first form reproductive individual.

Morphology of **Reticulitermes arenincola**, sp. n.

Diagnoses.

Winged imago.—Smaller than *R. flavipes*, ocelli less than their diameter from the eye (in *R. flavipes* ocelli are more than their diameter from the eye); smaller than the variant from Arkansas (2); differs in color and total length from *R. hageni* Banks; these being brown to blackish brown and from 9 to 10 mm. in length for *R. arenincola* sp. n., and pale brownish yellow and 8 mm. in length for *R. hageni* : differs from *R. virginicus* Banks also, in total length and with respect to the distance of ocellus from the eye (length of *R. virginicus* hardly 8 mm..

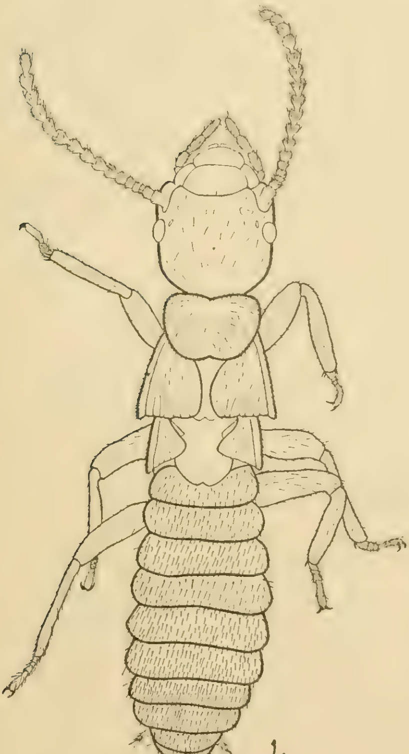
ocellus closer to the eye than in *R. arenincola* sp. n : the shiny black color and dark tibia of *R. tibialis* separate this termite from the new species : the pronotum of *R. claripennis* Banks is relatively wider than that of *R. arenincola* sp. n.; the pronotum of the new species is also relatively narrower than that of the other species. Compare pronotum of *R. flavipes* (Fig. 5c), of variant of *R. flavipes* from Arkansas (Fig. 5b), of *R. arenincola* sp. n. (Fig. 5a).

Soldier.—Smaller than *R. flavipes*, sides of head about parallel (Fig. 2); minimum width of gula much narrower than maximum width; for field characters of the *R. tibialis*, *R. flavipes*, *R. arenincola* sp. n., soldier see Table 1 : resembles the soldiers of *R. virginicus* and *R. hageni* in size.

Worker.—Smaller than *R. flavipes*, whitish, length from 4.12 to 5.02 mm. abdomen and head narrower than in *R. flavipes*, head width from .947 to 1.00 mm. ; length of head and mandibles 1.28 mm.

Description of **Reticulitermes arenincola,** sp. n., winged imago.

Imago.—Vertex and front brownish black, occiput lighter, pronotum a trifle lighter than head; anterior half of clypeus whitish, posterior half yellowish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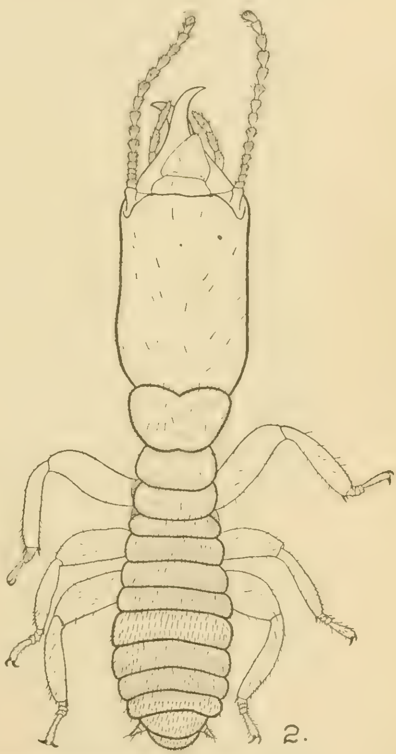
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Fig. 1. Dorsal view, dealated adult of *Reticulitermes arenincola* n. sp. Doellner.
Fig. 2. Dorsal view, soldier of same species.

brown; anterior halves of mesa- and metanotum lighter brown than posterior halves, with a blackish irregular line across the medial constrictions : first five abdominal terga about the color of pronotum, the other darker, shades of color, however, variable; femora almost an olive brown; tibia and tarsi a pale yellowish white; color of wings variable, white to dusky.

Head (Fig. 1) not strongly hairy; sterna strongly hairy with a row of a few large hairs at the posterior margin; pleural membrane of female covered with a thick coat of brownish hair.

Length of hair from posterior margin to clypeal suture a little shorter than width behind eyes; sides about parallel rounding with a broadly convex posterior margin beginning a little behind the eyes.

Sutures of head, except the longitudinal suture, not visible; fontenelle present, not prominent, at about the level of the posterior margin of the eyes.

Labium very pale; labial palpi and first four maxillary palpi slightly browned.

Gula about the color of the pronotum; anterior tip white, about .066 mm. in length; gula longer than wide, slightly narrowing distally at end of pigmented area; surface of gula slightly bulging posteriorly, flat anteriorly.

Clypeus, posterior margin wider than anterior and slightly convex; length measured along the medial line about one half as long as greatest width; suture invisible in the middle of the brownish, posterior part of labrum; posterior pigmented area swollen and higher than anterior limits of frons; pigmented area about .103 mm. in length.

Labrum a little wider than long; greatest width about .08 mm. from proximal end.

Antennae spots visible, less than half their width from the ocelli and slightly crescentic in shape; long axis parallel with width of head; posterior margin rounded.

Ocelli hyaline, less than their diameter from the eye; antero-ventral side flattened, postero-dorsal side rounded.

Eyes triangular in shape with rounded angles; altitude about .199 mm.; sides of triangle tend to be equal in length.

Pronotum slightly narrower than head; anterior margin raised and slightly biconvex; median notch distinct; antero-lateral angles rounded, viewed dorsally; antero-lateral border reflexed; lateral margin not receding strongly toward biconvex posterior margin. T-shaped area clearly visible.

Antennae, 17 segments; first segment longest, over twice as long as broad, widest near distal end; third segment smallest.

MEASUREMENTS OF AN IMAGO, *Reticulitermes arenincola*, sp. n.

Length without wings	4.16 – 5.30 mm.
Length with wings	9.00 –10.00
Width of abdomen	.91 – 1.10
Head, length to clypeus	.770
" width behind eyes	.81 – .90
" length to tip of labrum	1.09 – 1.24
Gula, length	.359
" length of white anterior margin	.066
" width, maximum	.311

Gula, width, minimum anterior	.244
Labrum, length	.311
" width	.355
Clypeus, posterior width	.444
" anterior width	.311
" length measured along medial line	.213
Crescentic antennae spot, width	.06 – .08
" " " distance between tip of the two horns	.133– .155
Ocelli, length	.080
" width	.059
Eyes, altitude of triangle	.199
Pronotum, ant. max. width	.71 – .77
" length	.51 – .56
Antennae, length	2.443
1st segment, length	.222
" " greatest ant. width	.055
3d segment, length	.044
Cerci, length	.044
" " apical segment	.079
Forewing, length to suture	6.720
Hindwing, length to suture	6.400
Forewing, width	1.737

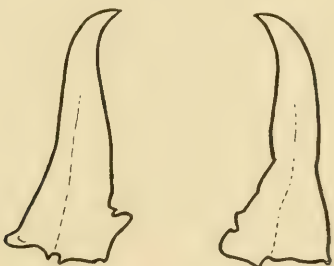

FIG. 6. a b

Fig. 6 a. *R. arenincola*, soldier, left mandible. b. Right mandible of same.

Description of **Reticulitermes arenincola**, sp. n., Soldier.

Head pale yellow, paler beneath, mandibles dark brown, antennae yellowish, pronotum and remainder of body with small brownish yellow hairs.

Hairs of head scattered; head not strongly pilose; abdomen strongly pilose, with a single row of a few large hairs, some erect, near margin of sterna; hairs of tibia directed posteriorly, on distal half more spine-like, three such spines on apical ends of prothoracic tibia, two such spines on the other.

Head elongate, without mandibles less than twice as long as broad, posterior margin broadly rounded, sides parallel, anterior and posterior widths not noticeably different; fontanelle not prominent but distinct; head viewed from side shows frons bulging and sloping toward clypeus; ventral surface slightly convex, gently curving upward to mandibulate articulation; on the whole tends to be parallel with the dorsal surface posterior to fontennelle; frons biconvex with a shallow median depression.

Clypeus overlapping labrum a little (this condition not frequent); broader than long; anterior margin straight; sides posteriorly almost parallel to middle of clypeus, then strongly receding; in others lateral margins slope gently inwardly to the anterior margin.

Labrum narrowing distally to a slightly rounded hyaline tip with two long hairs pointing forward; length of labrum measured from end of clypeus about the size of greatest width near base of labrum.

Eyes and ocelli suggested by round hyaline spots where such organs are located in the first form reproductive individuals.

Antennae: 14 to 16 segments; segments 2, 3, 4, not constant; first segment longest, cylindrical, little less than twice as long as broad, broader anteriorly and posteriorly; second segment a little longer than wide; third segment sometimes smaller than the rest; the remainder increasingly larger to about the eighth segment; segments 2, 3, 4, occasionally approximate one another in size so as to form a rather distinct antennae section; the last segment somewhat ovate and narrower than the preceding.

Gula narrows posteriorly, maximum width more than twice the minimum width.

Mandibles shorter than the length of head, right a little longer than the left; external and internal border of right mandible rather straight, a slight concavity posterior to the distal half of the external edge; tip pointed and curved about at right angles to the long axis; left mandible, external margin beginning at a distance one-fourth the mandibular length from proximal end, straight; tip as in right mandible; inner edge not straight but sloping to tip with a slightly ventral flexure of blade near the distal end.

Pronotum, anterior margin biconvex, in some weakly so, notch sometimes pronounced; antero-lateral corners not broadly rounded, lateral margins do not recede rapidly toward the slightly biconvex posterior margin from the antero-lateral corners; notch in the middle of posterior margin either slight or pronounced, usually the former.

Cerci, base broad, second segments longer and pointed; styles shape of apical segments of cerci, thinner and a little shorter.

Measurements of a soldier, *Reticulitermes arenincola*, sp. n.

Length, total	4.660–4.940 mm.
Head and mandibles, length	2.280–2.560
Head to clypeal suture, length	1.559
Head width, maximum posterior	.94 –1.09
Fontanelle, distance from clypeal suture	.422
Labrum, length	.333
Clypeus, posterior width	.399
" anterior width	.177
Antenna, length (16 segments)	1.463
First segment, length	.155

First segment, maximum anterior width	.097
Second segment, length	.088
" " width	.060
Pronotum, width (not removed and flattened)	.731– .870
" length	.459– .574
Gula, length	1.119
" max. width	.402– .460
" min. width	.152– .180
Mandibles, left, length	.888
" right, length	.933
" right, max. width	.162
Cerci, length	.133

Type locality.—Pine, Indiana, several miles west of Gary, Indiana.

Range.—From Buffington eastward along the dunes to Michigan City, Indiana; thence northward along the dunes of Western Michigan to Grand Haven.

Described from several winged imagos and soldiers from a large colony collected at Pine, Indiana. The range in some measurements has been computed from specimens collected in the Indiana and Michigan dunes. Material preserved in 80% alcohol.

Type material deposited with the A. E. Emerson Collection at the University of Chicago.

Field Characteristics of Reticulitermes Species, *R. tibialis* Banks, *R. arenincola* sp. n., *R. flavipes* Kollar, Using Soldier Caste.

The identification of *R. tibialis* Banks, *R. flavipes* Kollar, and *R. arenincola* sp. n. by means of the soldier caste greatly facilitated the work in as much as it was possible to identify each colony in the field at sight without having recourse to Light's (3) new method of differentiating species by the soldier caste in terms of indices or mathematical expressions of relative proportions between parts or sizes of parts. Recourse to this new method, one that presents a laboratory problem, would be necessary were the identification of *R. arenincola* sp. n. and such species as *R. virginicus* Banks and *R. hageni* Banks in question. Reliable field characters of each species (soldier caste) occurring in the Chicago vicinity[1] are to be found in the table below. They permit identification of the colony in the absence of winged first reproductive forms. The color of head and the relatively wide minimum width of the gula of *R. tibialis* had been mentioned by Banks and Snyder (4).

[1]Chicago vicinity: The dune regions in Indiana and Michigan.

TABLE I.

	R. tibialis	*R. flavipes*	*R. arenincola*
1. Color of head	Dull brownish	Pale yellow	Pale yellow
2. Minimum width of gula	Wider than that of the other two species—from .228 to .289 mm.	Narrower than preceding—from .18 to .28 mm.	Narrower than that of tibialis from .15 to .18 mm., approaching in some cases .228 mm.
3. Head and mandibles (length)	Variable, but of no diagnostic value	Large, from 2.65 to 3.20 mm.	Small, from 2.285 to 2.56 mm.

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MINUTES OF THE 431st REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 431st regular meeting of the Entomological Society of Washington wa held at 8 P. M. Thursday, October 1, in Room 43 of the new building of the National Museum. In the absence of Dr. A. C. Baker, President, Mr. F. C. Bishopp, first Vice-President, presided. There were present 49 members and 41 visitors. The minutes of the previous meeting were read and approved. The following individuals were admitted to membership by vote of the Society: Argyle B. Proper, Gypsy Moth Laboratory, 1156 Main St., Melrose Highlands, Mass.; Stansbury Hayden, care of Maryland Academy of Sciences, Baltimore, Md.; R. W. Wagner, University of Maryland, College Park, Md.; Dr. Alan Stone, Foster H. Benjamin, Miss Kathleen McClure, Miss Irene L. Bartlett, Miss Catherine Ford, Dr. H. H. Richardson, S. W. Simmons, U. C. Lofton and Dr. Wm. Robinson, U. S. Bureau of Entomology. The Recording-Secretary, Mr. Rohwer, requested more prompt payment of dues on part of all delinquent members as the funds were low for payment of current printing bills.

The first topic on the regular program was entitled "The Maggot Treatment of Osteomyelitis" and papers were given by F. C. Bishopp, G. F. White, and Wm. Robinson. Mr. Bishopp in his discussion pointed out that the use of larvae of blow flies, particularly *Lucilia sericata* and *Phormia regina*, in the treatment of the grave bone disease known as osteomyelitis as a regular hospital procedure is new and revolutionary. This method was introduced recently by the late Dr. Wm. S. Baer of Johns Hopkins University, Baltimore, Md. The results have been very encouraging and the method is now being followed in more than a score of hospitals. Dr. Baer's work was based on his observations of the apparent beneficial effects of larvae which gained entrance to wounds on the battle fields during the world war. Similar observations were made by military surgeons as far back as the Napoleonic wars, but it remained for Dr. Baer to make application of the idea. In the early stages of the work in 1929 the Bureau of Entomology lent such aid as it could with reference to methods of rearing and handling blow flies and during the summer of 1930 Dr. D. F. Miller was employed, and Dr. G. F. White was assigned to the problem of developing rearing technique suitable for hospitals, and methods of producing sterile larvae. In 1931 Dr. Wm. Robinson was appointed and assigned to the investigation. It is the desire of the Bureau to clear up some of the many entomological questions involved, especially as to the relative effectiveness of different species of blow flies, how the beneficial results are produced by the larvae, and to perfect a method by which an abundant supply of sterile larvae can be made available at all times.

Dr. G. F. White in course of his remarks pointed out that the chief danger attending the use of maggots in surgical wounds lies in the possibility that disease-producing germs might be introduced into the wounds with the maggots. The surgeon therefore must be furnished with maggots free from harmful micro-organisms. The method of obtaining these consists in rearing larvae from sterilized eggs and testing the sterility of the larvae before they are used. Added precaution to insure sterility is taken in the rearing, in the food, and in the care of the adult flies. To make sure of an ample supply of surgical maggots for any hour of the day throughout the year refrigeration is provided for prepupae and pupae and a favorable temperature and humidity for the adult flies. Larvae that are ready for the surgeon are subjected to lowered temperatures to limit their growth until they are needed.

Dr. Robinson, discussing other phases of the problem, pointed out that the maggots shorten the time of recovery from osteomyelitis and also bring about cures in many cases which otherwise have not yielded to the best surgical treatment. Among the essentials for recovery are the complete removal of dead and dying tissue and the disinfection of the wound. These have been difficult to accomplish by ordinary surgical means; and a brief description was given of some of the difficulties encountered by surgeons in treatment. The maggots in their feeding eat and remove effectively the dead tissue and they can penetrate into otherwise inaccessible places in the wound. Also in some way they cause a decrease in the number of the infecting bacteria. The methods of applying the maggots to the wounds and of removing them were mentioned.

During the first few days of the maggot treatment, some of the patients complain that the maggots cause sharp, intermittent pains; but this decreases shortly and the patients usually become quite tolerant of the maggots in the wound. (Author's abstracts.)

The subject was illustrated by a reel of moving pictures. Comments were made by Aldrich, Ewing, Rohwer, McIndoo, and Gahan.

The second paper on the regular program was entitled "Entomological Work at the University of Maryland," by Dr. E. N. Cory. The speaker stated that down to 1919 the work of entomology was combined with that of zoology and known as the Department of Entomology and Zoology. At that time, in order to conform with the requirements of rating agencies, the Department was split and the zoological work was placed in a newly formed School of Arts and Sciences. Even before that time subject matter was the basis of all efforts and there was one head responsible for the educational, research, extension and regulatory activities. Budgets for these, of course, were in the main derived from several sources. The University of Maryland has a unique position among colleges teaching entomology, in that it lies within a few minutes' run of the U. S. Department of Agriculture, the Bureau of Entomology, the Smithsonian Institution, and the U. S. Public Health Service. No other school has such superior advantages. The registration in entomological courses has steadily increased and from 1925 the increase has been remarkable. At the close of last year the registration for 1930–1931 totaled 220. This included about 15 graduate students. The speaker also discussed briefly the matter of space, equipment and funds, including library facilities, the cooperative work with the Enoch Pratt Library of Baltimore and a natural history club. He also described briefly the work with the Conservation Commission of Maryland in the establishment of a laboratory at Solomons Island. In addition to discussion of resident work there was given a resume of extension activities, cooperation with county agents, State beekeepers' organization, and extension teaching work; through exhibits, county and state meetings, various commodity organizations, radio talks, and the like. A list of the projects under investigation were given to indicate scope of activities. Work on individual farms and at the field laboratory at Hancock was stressed. A brief program also was devoted to regulatory work with special emphasis on education of the public as to rights, privileges and responsibilities. Finally it was stressed that the idea that animates the entire Department of Entomology is one of service to the State and Nation, particularly to taxpayers and young people. (Secretary's abstract reviewed by speaker.)

Remarks were made on invitation by C. R. Kellogg, a visitor from China, who reviewed very briefly the entomological work in that country from ancient times down to present status. Another visitor, Mr. H. A. Jaynes, of Trujillo, Peru, also on invitation briefly addressed the Society concerning recent work in South America.

Meeting adjourned at 10.15 P. M.

J. S. WADE,
Recording Secretary.

Actual date of publication December 28, 1931.

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VOL. 34 JANUARY, 1932 No. 1

LAELIUS ANTHRENIVORUS TRANI, AN INTERESTING BETHYLID PARASITE OF ANTHRENUS VERBASCI L. IN FRANCE.

By A. M. VANCE, *Assistant Entomologist*, and H. L. PARKER, *Entomologist U. S. Bureau of Entomology*.[1]

Laelius anthrenivorus Trani is a bethylid that is ectoparasitic in the larval stage on certain of the Dermestidae which infest museum collections. In 1909 this particular species was described as new by Trani (*2*)[2] who found it attacking *Anthrenus musaeorum* in the Zoological Museum at Naples, Italy. His paper is very interesting and several of his observations correspond with those of the present writers.

According to Cockerell (*1*), the genus *Laelius* is well known to be parasitic on dermestid larvae. He has described *L. utilis* as a new species parasitic upon dermestids infesting dry insects in a museum collection in Virginia and has cited four members of the genus from the United States, three from France, and two from Italy.

For several years the writers occasionally had observed a small Hymenopteron on the window panes of the laboratory at Hyères, Var, France, and had often wondered whence it came. In January, 1930, the discovery of eight small, white parasite cocoons among dry insect specimens which were infested with larvae of *Anthrenus verbasci* L. at once called to mind the earlier observations. Subsequent comparison of specimens taken from the two collections showed them to be identical specifically.

So far as known, this is the first record of *L. anthrenivorus* in France and the only noted instance of its occurrence anywhere as a parasite of *A. verbasci*. These facts, together with the biological interest of the host-parasite relationship here encountered, have prompted the writers to publish their personal observations.

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[1]Thanks are due to Drs. L. Berland and P. Lesne, of the National Museum of Natural History at Paris, for their determinations of the parasite and host respectively, and the placing of literature at the disposal of the writers. Appreciation is also expressed to Mr. W. R. Walton for his assistance in the publication of the manuscript.

[2]Reference is made by number to Literature Cited, p. 7.

Adult.—The following is a translation from the Italian description of the adult female of *L. anthrenivorus* given by Trani to the type specimen in the Zoological Museum of the University of Naples:

"Length from 3 to 4 mm. Color black, thorax unpolished, abdomen shiny; legs entirely reddish yellow, antennae brown, darker toward the apex, with the first two joints reddish yellow. Antennae twice as long as the head and composed of 13 joints; the pedicel is claviform, slightly curved, and is twice as long as the first joint; first joint slightly longer and wider than the others, which are cylindrical. Head almost spherical, bearing a few sparse hairs anteriorly; mandibles yellowish, truncate, dentate; palpi palish. Thorax elongate, mesonotum very short without sulci. Scutellum prominent, with a transverse sulcus in the middle; metathorax longer than wide, rugose, with five longitudinal median carinae and with margins carinate. Wings transparent, slightly smoky near their extremities, nervature yellowish; stigmal and marginal nerves slightly developed, bearing long black hairs. Abdomen longer than thorax, ovate, terminating posteriorly in a point with long stiff hairs more numerous at its apex."

The male is stated to be similar to the female, differing only in its smaller size.

Technique.—The cocoons found in the middle of January, 1930, were placed in a glass vial and on June 30 five adults emerged. One of the females was at once isolated in a small glass globe cage containing some dry insect material upon which Anthrenus larvae of different stages were feeding. Two other females were confined in large glass vials, supplied with live host larvae, and observed regularly. Oviposition by the parasite was readily obtained and the resulting progeny were reared to the adult stage in small glass vials.

Egg.—The newly deposited egg (fig. A) of *L. anthrenivorus* is 0.448 mm. in length and 0.168 mm. in width at its middle. It is grayish white in color, elongate-ovoid in form and slightly curved, with the cephalic a little wider than the caudal extremity. The chorion, which has a glistening appearance, is rather thin, and microscopical examination shows its surface to be finely sculptured.

Larva.—The larva has five instars as determined by the presence of that many pairs of mandibles (fig. B). All of the mandibles are very small, weakly chitinized, and light brown in color. Their size increases with each successive molt and between the first and last instar mandible there is a variation from 0.023 to 0.056 mm. in length. Those of the first and second instars (1, 2) bear only one small tooth each, in addition to the longer distal point; that of the third instar (3) possesses two short teeth on its edge, and that of the fourth (4) has four such teeth. The mandible of the fifth instar larva (5) is considerably larger than any of the others, is somewhat squared in appearance, and possesses seven teeth.

In its last instar (8 days old) the larva (fig. D) measures 2.448 mm. in length and 0.672 mm. in greatest width. The contour of the body during all instars is about the same, being more or less cylindrical, slightly arched dorso-ventrally, and more distended in the posterior half, which narrows to a rather pointed anal extremity. The usual fourteen segments are present, as observed in last-stage larvae.

The surface of the body is shiny and appears destitute of spines. It appears to be covered, however, with very minute blunt protuberances. The color of the newly-hatched larva is translucent white but the subsequent accumulation of food within the peritrophic membrane of the mid intestine soon gives it a yellow hue which becomes darker toward the end of the feeding period. About twenty large cream-colored urate cells are distinctly visible through the hypodermis.

The head (fig. E) of the last stage larva may be described as follows: Postocciput distinct, narrow, metopic suture absent, temporal fossae or grooves absent, frons not distinctly defined, clypeus and labrum fused, pleurostoma (*pl*) visible but epistoma (*ep*) not very prominent, hypostoma (*hy*) more so, antennal foramina (*af*) but slightly differentiated, round; labrum (*lm*) distinct with four papillae, maxillae (*mx*) composed of fused mala, stipes, and cardo with faint indications of a suture (malar suture, *mas*) between the mala and stipes, the whole maxillary region, however, set off from the ventral neck membrane (labio-base) by a rather distinct pigmented and thickened border (along the maxillary suture) extending from the preoral clivus (the sloping surface which prolongs the floor of the mouth to the edge of the labium, sometimes erroneously called hypopharynx); maxilla with one palpus (*mpa*) and one seta (*mse*); labial annulus (*lba*), or thickened and pigmented border of labium, forming a complete and distinct ring, transversely oval in outline; labium (*lb*) with distinct salivary duct orifice (*sdo*), one pair of palpi (*lpa*), and no setae; labial plate absent; ventral neck membrane without spines; mandibles (*md*) with seven terminal teeth; transverse tentorial bridge and anterior tentorial rami present, all tentorial fossae (or pits) indistinct.

A tracheal system, with one pair of spiracles (diameter, 0.0319 mm.) opening in the second thoracic segment, is apparent in all stages. The two lateral longitudinal tracheal trunks extend most of the length of the larva and are connected both anteriorly and posteriorly by strong commissures.

The silk glands (fig. C, *sg*) of this larva are somewhat peculiar in arrangement. Each of the two lateral glands, leaving the common duct in the head region, divides into two branches in the thoracic segments. The upper of these branches proceeds posteriorly to the last larval segment while the lower one continues less than half that distance.

In an examination of several specimens of the last-instar larvae the writers were unable to distinguish any Malpighian tubes.

Cocoon—The cocoon measures 3.3 mm. in length and 1.485 mm. in width. It is white in color, oval in form, with the caudal ends sometimes slightly pointed, and is woven rather tightly except for a few looser threads on the exterior.

Habits of adult.—This parasite appears to be negatively phototropic, for, when afforded the opportunity, it preferred to remain hidden among the dry insect material in which the anthrenid larvae were feeding. There the female sought out the host, which she prepared for the reception of her eggs. Later examination showed that she had deposited her eggs on host larvae within old cocoons of Eulimneria and Macrocentrus and in dry puparia of Masicera which formed a part of the Anthrenus-infested material. While a number of paralyzed host larvae were found outside of the dry material, none of them bore eggs of the parasite. This would indicate that the female chose the hidden host larvae for the purpose of egg deposition.

The female was never observed to feed upon the host fluids from any incision made with her ovipositor or mandibles, and the only semblance to feeding on the host was in the biting off of the hairs of the Anthrenus larva. Sometimes a number of the removed hairs were found bunched together as if adhering by reason of a secretion from the mouth of the parasite. It is possible that the adult feeds upon such material or even upon the body juices of the host.

When given neither food nor water, the parasites lived for several weeks. One female which had before her only dry insect specimens, infested with Anthrenus larvae, remained alive for 39 days. In the case of two others small lumps of dry sugar and occasional drops of water were provided part of the time. Apparent feeding on the sugar was observed. Under the latter conditions the length of life of the two insects was 23 and 29 days respectively. All individuals under observation were kept in a warm laboratory room.

It was learned that two parasite eggs deposited on a single Anthrenus larva at approximately the same time may both hatch and that the larvae therefrom may develop to maturity and spin cocoons from which normal adults may emerge. In certain instances one of the two cocoons was smaller than the other but this difference in size was no hindrance to the emergence of the adult.

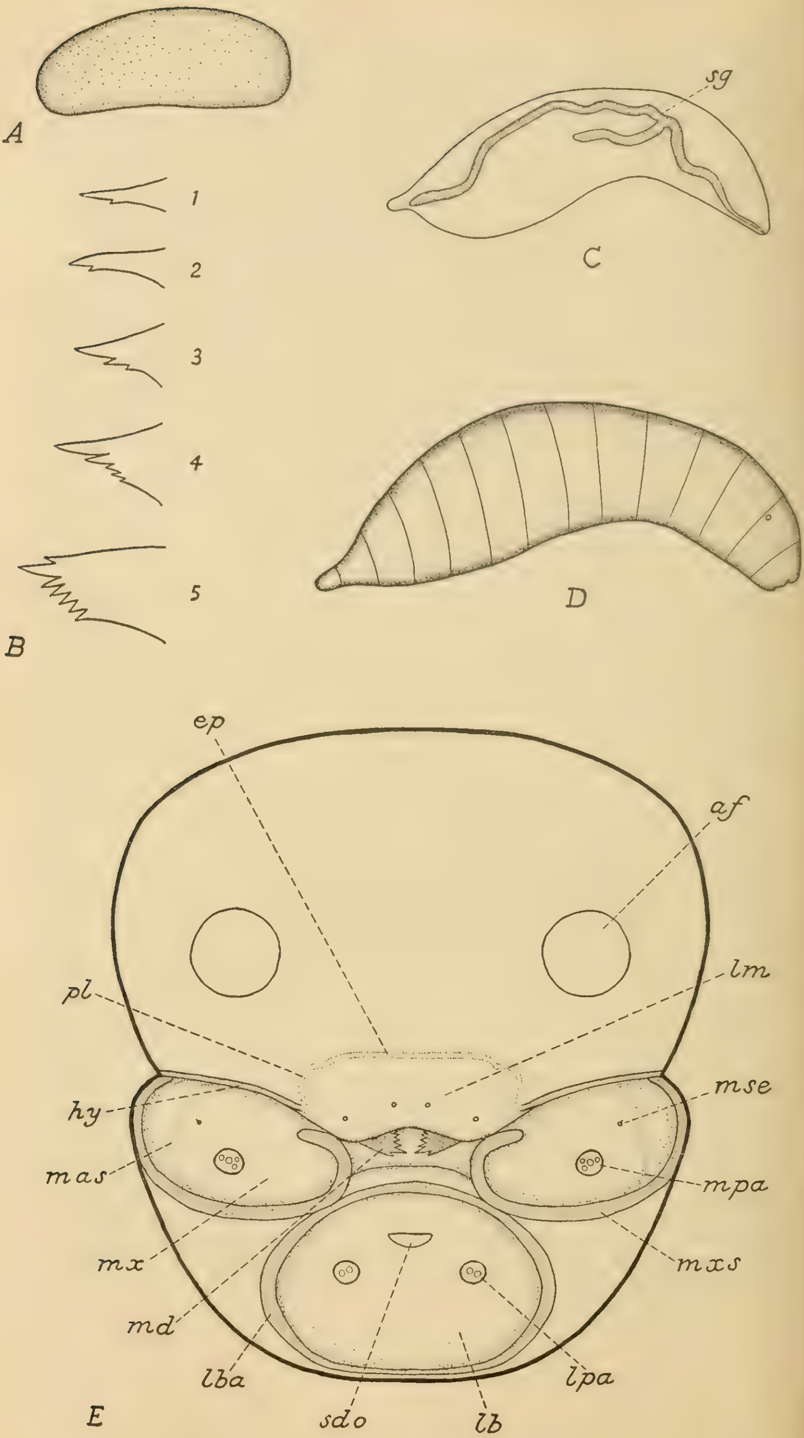
Oviposition.—The actions of the female in preparation for deposition of eggs are unusual. By a thrust of her ovipositor she first paralyzes the Anthrenus larva. She then seizes the motionless victim, often by the head, and pulls it about for some time as if obeying an instinct to drag the prey to her lair. As the entire body of the host is covered with long hairs, the next act of the parasite is to bite off closely a large number of these on the ventral portion of several of the anterior abdominal segments until there has been produced a shiny bare spot. During this process the female will sometimes stop to brush her ovipositor over the area being cleared and then turn about to bite off more hairs. In the operation she has occasionally been observed to seize one of the larva's legs with her strong mandibles and cling tightly to it for several seconds.

In a typical observation, made at 4 o'clock on a warm afternoon, oviposition took place as follows: The female stood quietly for about fifteen seconds with her extended ovipositor resting on a bared spot on the adbomen of a paralyzed Anthrenus larva before the rather large egg issued slowly and came to rest across the cleared segments of the host. The ovipositor was then drawn lightly along the longitudinal axis of the egg and into its sheath, as the female moved away. The egg was not attached in any way but seemed to adhere as if slightly moist. It could be shaken loose easily, however. As a rule the egg is placed more or less nearly parallel with the longitudinal axis of the host larva and usually it lies across two or more of the first four abdominal segments, each of which is a little shorter than the length of the egg itself. The location of 19 eggs, all deposited ventrally, was as follows: across the first and second abdominal segments, 6; across the second and third abdominal segments, 7; and across the third and fourth abdominal segments, 6. Three eggs is the maximum number found on a single host larva.

During a life of 29 days one female deposited 26 eggs and another which lived 39 days deposited 23 eggs. The number of eggs per day, actually counted during part of the period of oviposition, ranged from 1 to 3. It seemed, in several recorded instances, that the females preferred to oviposit in the late afternoon.

Anthrenus larvae paralyzed by a female parasite never recover and it often happens that numbers of them are stung without receiving any eggs afterwards. On one occasion ten larvae of Anthrenus were found paralyzed after only a few hours with the parasite. Sometimes the parasite chewed off the abdominal hairs on a considerable number of the host larvae but deposited her eggs on one or two of them only. No doubt such actions are instinctive preparations for future ovipositions.

Larval growth.—The egg hatches within 24 to 48 hours after its deposition on an Anthrenus larva, and the tiny parasitic larva at once begins feeding through an incision made in the host. Feeding continues steadily and the growing parasite pushes farther and farther into the cavity enlarged in the body of the host until, in the last stages, less than half of its own body is exposed to view. The egg chorion and subsequently molted larval skins are shoved back toward the posterior extremity of the larva. At the end of feeding the parasitic larva has entirely exhausted the contents of its host of which only the skin remains.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In a room where the summer temperature varied around 75° F., the length of larval life for ten individuals averaged 9 days, with a maximum of 10 and a minimum of 7 days.

Construction of cocoon and pupation.—When fully fed, the larva withdraws from the cavity which it has made in the Anthrenus and almost at once begins to spin a cocoon. It is able to construct a cocoon while resting on a smooth surface, where it attaches itself lightly by a few threads. The cocoon is practically completed at the end of 24 hours, and within the next two or three days the meconium is ejected.

The pale yellow pupa may barely be seen through the cocoon and in one instance it had not visibly darkened when observed 12 days after the start of pupation. The exact length of the pupal period was not determined but it is known to be rather long. In the case of the cocoons first discovered in January, the parasites remained therein for at least five months, and in the hot month of July the pupal period was at least a month in duration.

LITERATURE CITED.

(1) Cockerell, T. D. A. 1920. A parasite of dermestid beetles in entomological collections. Canad. Entom., lii., no. 2, p. 34.

(2) Trani, E. 1909. Di un nuovo proctotrupide parassita delle larve degli *Anthrenus musaeorum.* Annuario del Mus. Zoolog. d. Univ. Napoli, n. s., 3, no. 4, pp. 1–6, 1 pl.

Laelius anthrenivorus Trani.

Figure A. Egg, immediately after deposition.
Figure B. Mandibles of first to fifth stage larvae (1–5).
Figure C. Silk gland (*sg*) of last stage larva.
Figure D. Last stage larva, lateral view.
Figure E. Head of last stage larva, front view.

af, antennal fossa; *ep*, epistoma; *hy*, hypostoma; *lb*, labium; *lba*, labial annulus; *lm*, labrum; *lpa*, labial palpus; *mas*, malar suture; *md*, mandible; *mpa*, maxillary palpus; *mse*, maxillary seta; *mx*, maxilla; *mxs*, maxillary suture; *pl*, pleurostoma; *sdo*, silk duct orifice.

AN IMPORTANT NEW ENCYRTID PARASITE OF THE MEALYBUG, PSEUDOCOCCUS VIRGATUS (CKLL.).

By Herbert L. Dozier.

The species of parasite described herewith is of decided economic value, being probably the greatest single factor in checking the mealybug, *Pseudococcus virgatus* (Ckll.) in Haiti. This mealybug is widely distributed throughout the West

Indies and the southern United States and is recorded from a varied list of host-plants. At times it becomes of economic importance in Haiti, completely covering papaya fruits. Certain heavily infested papaya fruits were placed in rearing jars and showed over eighty percent of the mealybugs destroyed by this efficient parasite. No other primary or secondary species of parasites were reared at the time from this material.

Anagyrus coccidivorus, new species.

In the shape of the antennae this species is very closely related to *Anagyrus subalbicornis* Girault and *subalbipes* Ishii, but is readily distinguished by the difference in markings.

Female.—Length, including ovipositor, 1.764 mm.; expanse, 2.71 mm.; greatest width of forewing, 0.416 mm. General color yellowish-orange, the posterior part of the scutellum, the metonotum and propodeum infuscated on dorsum, the abdomen distinctly brown; the anterior margins of the pronotum and the prescutum outlined with fuscous; antennae pale yellowish except the infuscated basal halves of the pedicel and first funicle joint, and the scape which is deeply marked at the middle of the dorsal margin, at the tip, and along the ventral margin with black. Wings hyaline, the venation pale brown. Legs pale yellowish except the slightly darkened hind femora; the last three tarsal joints of the front legs, the terminal tarsal joint of the middle pair, and the last two tarsal joints of the hind legs, fuscous.

Fig. 1.—Antenna of female *Anagyrus coccidivorus*, new species, greatly enlarged.

Eyes covered with short, rather numerous, erect setae. Antennae hairy, very long, the scape very much dilated below or foliaceous, almost twice as long as wide; the pedicel and funicle joints longer and slender, distinctly longer than wide, subequal in length, the last funicle being the shortest; the club joints slightly wider. The darker portions of the head and body appear under high magnification in balsam mounts to be minutely but distinctly reticulated. Forewings uniformly ciliated beyond the oblique hairless streak; the submarginal vein with about twenty-two bristle-like setae. Abdomen longer than the thorax, the ovipositor not extruded.

Male.—Length 0.932 mm. Very different in general appearance and coloration from the female. The head and body are dark brown, the underside of the thorax lighter. All dark portions minutely reticulated under high magnification. Scape pale yellowish, a fuscous band covering nearly all of the distal portion except the tip; pedicel and first funicle joint brown; the remaining joints whitish except the apical third of the terminal joint, which is lightly smoky. Wings hyaline, venation brown, the ciliation less distinct than in the female. Legs pale, the outer margins of the femora and tibiae more or less distinctly infuscated, those of the hind legs more distinctly so; the four last tarsal joints of the front and hind legs smoky, the middle legs with only the terminal tarsal joint smoky.

Very much smaller than the female. Eyes setose. Antennae long and slender, very different from those of the female; scape elongate, slightly expanded; pedicel somewhat robust, distinctly wider than the funicle joints; first funicle joint three times as long as the pedicel and a third longer than the second funicle; the other joints subequal in length and width, the terminal joint rather pointed at the apex, slightly wider and two and one half times as long as the preceding; the flagellum is slender, cylindrical, and is supplied with long hairs, more or less distinctly verticillate or arranged in whorls.

Described from eight females and nine males, mounted in balsam on nine slides; reared by the writer from a mealybug, *Pseudococcus virgatus* (Ckll.), on papaya fruit at Damien, Haiti, August 11, 1930.

Holotype female on slide (U. S. National Museum No. 43818) and allotype male together with paratype male on second slide are deposited in the U. S. National Museum.

MINUTES OF THE 432D REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, NOVEMBER 5, 1931.

The 432d regular meeting of the Entomological Society of Washington was held at 8 P. M., Thursday, November 5, in Room 43 of the new building of the National Museum. In the absence of Dr. A. C. Baker, President, Mr. F. C. Bishopp, Vice-President, presided. There were present 40 members and 45 visitors. The minutes of the previous meeting were read and approved.

The following individuals were admitted to membership by vote of the Society: Mr. E. A. McGregor, Box 576, Lindsay, California; Mr. Wm. Howard Ball, 1861 Ingleside Terrace, N. W., Washington, D. C. There was no preliminary business.

The first paper on the program was entitled "Grasshopper Outbreak of 1931," by Dr. W. H. Larrimer of the Bureau of Entomology. This comprised a brief discussion of the grasshopper outbreak in the United States during the past season. Several slides were shown, illustrating the extent and completeness of damage caused by grasshoppers in South Dakota, the species involved being *Melanoplus differentialis* Thom. and *Melanoplus bivittatus* Say. Control in south-central South Dakota and north-central Nebraska was abandoned because of lack of adequate preparation and consequent inability to secure poisoned-bran bait in quantities sufficient to be effective. Poisoned-bran bait was available for the first time from commercial sources, the bait being prepared complete with only water needing to be added. Over the rest of the country control was secured where necessary by the use of poisoned-bran bait in the usual manner, financed either by individuals, counties, or by State funds. (Author's abstract.)

Dr. Marlatt, at the suggestion of Dr. Larrimer, supplemented the latter's paper by reminiscences of boyhood observations on the great outbreaks of grasshoppers, *Calopterus spretus* Thos., in the Middle West in the '70s. These included remarks on the methods of migration, character and extent of injury, identity of this with nearly related species, and possible causes for subsequent disappearance of the Rocky Mountain locust. Comments were also made on Larrimer's paper by McIndoo and Gahan.

The second communication on the regular program was entitled "The Insect Nervous System," and was presented by R. E. Snodgrass of the Bureau of Entomology. This paper was discussed by McIndoo.

Remarks were made on invitation by Prof. C. R. Crosby of Cornell University, Ithaca, N. Y., who gave a brief resume of entomological conditions in New York State during the past season.

Dr. H. L. Dozier, who has just returned from Haiti, on invitation also briefly addressed the society concerning entomological conditions in that country.

Dr. E. F. Phillips of Cornell University, Ithaca, N. Y., and Dr. C. H. Hadley, of the Bureau of Entomology Japanese Beetle Laboratory at Moorestown, N. J., on invitation also greeted the society.

The meeting adjourned at 10 P. M.

J. S. WADE,
Recording Secretary.

MINUTES OF THE 433D REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, DECEMBER 3, 1931.

The 433d regular meeting of the Entomological Society of Washington was held at 8 P. M., Thursday, December 3, 1931, in Room 43 of the new building of the National Museum. In the absence of Dr. A. C. Baker, President, Mr. F. C. Bishopp, First Vice-President, presided. There were present 51 members and 24 visitors. The minutes of the previous meeting were read and approved.

The following individuals were admitted to membership by vote of the society: F. D. Butcher, A. C. Davis, R. W. Harned, M. P. Jones, C. N. Smith, and Wm. N. Sullivan, all of the U. S. Bureau of Entomology. There was no preliminary business.

The following officers were elected by the society for the year 1932: President, F. C. Bishopp; First Vice-President, Charles T. Greene; Second Vice-President, J. S. Wade; Recording Secretary, F. M. Wadley; Corresponding Secretary-Treasurer, S. A. Rohwer; Editor, W. R. Walton; Executive Committee, the above officers and A. N. Caudell, T. E. Snyder, and W. H. Larrimer; representing the society as Vice-President of the Washington Academy of Sciences, Harold Morrison.

In intervals of above election of officers, remarks were made on invitation or notes presented by several members.

Mr. Rohwer reviewed the methods which the Society had used in electing officers during the last twenty odd years as follows:

During the years beginning with 1909 and extending until 1912 or 1913, viva voce nominations were made from the floor of candidates for officers. At these times the proponent for a candidate often made a speech indicating the character or characteristics of the candidate which made him particularly well fitted for office. Following this no formal ballots were taken and the voting was usually carried on without very much formality. About 1913 one of the older members of the Society who recently attended an election held by the Biological Society suggested that the Society follow the custom which was used in that Society as well as certain others in Washington, namely, the nominating ballot. This suggestion was approved and this method of election has been customary since that time. On many occasions, however, the Society has deviated from this plan. All such cases have referred to one office at a time when the rules have been suspended and nomination made from the floor, the Secretary being instructed to cast the ballot of the Society in favor of the candidate. The constitution of the Society does not specify any method of procedure other than to state that officers shall be elected by ballot. The Society has no by-laws and custom is the only thing that dictates the method of electing officers. It is, of course, understood that all cases where election is by ballot that almost any method can be used from the simple form of instructing the Secretary or some other designated official to cast the ballot in favor of a particular candidate.

Dr. M. D. Leonard discussed very briefly some of his work during the past two seasons in Porto Rico and expressed appreciation of help from the Bureau of Entomology and the National Museum personnel in identification of new material. Dr. T. S. Palmer gave reminiscences of methods of election of officers during the past two or three decades by various scientific societies in Washington and the A. O. U. Dr. H. E. Ewing presented a brief note on the abundance of the Chinese mantis, *Tenodera sinensis* Saussure, during the past year. He observed several individuals in nature at Takoma Park, Md., and noted that each rested upon the upper surface of a green leaf, thus being inconspicuous at a few yards distance. Comments were made on this note by Abbott, Dozier, Rohwer, Busck, Gahan, and Bridwell. Mr. W. S. Abbott discussed briefly recent work on insecticides, notably efficiency of pyrethrin I against certain leaf hoppers. He also mentioned the difficulties occasionally encountered in translating the common names for insects that are used on insecticide labels. Mr. J. C. Bridwell reported finding one of the smallest species of blister beetles, supposed to be *Gnathium Francilloni* Newman, in Essex County, Virginia, about 100 miles south of Washington, on flowers of the grass leaved golden aster (*Chrysopsis graminifolia* Nuttall) early in September, 1931. The northernmost record for *Gnathium Francilloni* is Georgia. If the material represents that species it is but another instance of more northward distribution of Carolinian forms than our present records indicate. The absence in collections of series associated with biological data prevents any fruitful restudy of the group. The species may prove to be parasites of small Halictine or Pangurgine bees, the triungulinid, or first larva, being carried to the nest by the bee from flowers visited where eggs of the parent beetle have been deposited. Dr. H. L. Dozier discussed briefly the Bostrichid beetle, *Sinoxylon conigerum* Gerst, which tunnels around nodes of cotton in Haiti, which he called the cotton joint borer. Mr. F. C. Bishopp discussed briefly recent Bureau work on cattle grubs, especially with reference to the determination of the number of grubs on the right and left sides of cattle. Records on 21,698 *Hypoderma lineatum* larvae showed 11,707, or nearly 54 per cent on the left side. He also reported briefly on recent mosquito investigations in Alaska in collaboration with U. S. Smelting, Refining and Mining Co. Dr. G. S. Tullock was employed for this work and made very substantial progress in determining the species involved, their breeding places, and possible methods of control. Mr. A. S. Hoyt, Dr. E. A. Chapin, Mr. E. C. Loftin, and Prof. R. W. Harned, on invitation also greeted the society.

The first communication on the regular program was entitled "The Trypetidae of Florida with Special Reference to Large Scale Identification of Larvae," by Mr. F. H. Benjamin. He discussed in some detail the problems presented by the identification of specimens in connection with the Mediterranean fruit fly projects, together with a brief review of the species of native fruit flies encountered during the work. He also showed a machine for extracting insects from fruits. (Author's abstract.) A considerable number of slides were shown. This paper was discussed by Leonard.

The second communication presented was entitled "Parasite Collecting in South America," by Mr. H. A. Jaynes of the Bureau of Entomology. He reported on general entomological conditions in Argentine and Peru, giving personal incidents from his travels. He also gave a brief resume of economic conditions in these countries. (Author's abstract.) Due to the lateness of the hour there was no discussion of this paper.

Meeting adjourned at 10.20 P. M.

J. S. WADE,
Recording-Secretary.

COMMON PESTS: How to Control Some of the Pests that Affect Man's Health, Happiness and Welfare, By RENNIE W. DOANE, 388 pages, 215 figures; *Chas. C. Thomas, Springfield, Ill.*

A nicely bound, well and abundantly illustrated, compact volume, embracing a very extensive field. Beginning with the scorpions, spiders and centipedes it includes insect pests and many others that affect not only crops but man's welfare in general. The parasitic worms, injurious slugs and snails as well as the harmful mammals and birds all come in for a brief mention.

Avowedly not intended for the professional naturalist, but rather for the enlightenment of the "farmer, the stockman, the gardener, the householder," etc., one is constrained to regret the frequently incomplete and not seldom obsolete information given on the control of some of the important insect pests. Apparently, the more recent literature on many of the species included was not consulted. The book is also marred in a minor way by numerous typographic errors in the entomological scientific names. —W. R. WALTON.

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OFFICERS FOR THE YEAR 1932.

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VOL. 34 FEBRUARY, 1932 No. 2

EARLY RECORDS AND PRESENT KNOWN DISTRIBUTION IN THE UNITED STATES OF THREE RECENTLY INTRODUCED MITES.

By H. E. EWING, *United States Bureau of Entomology.*

First records of an introduced pest in this country are of particular interest to those who are concerned with the control of the same. They also are of interest to those who study the dispersal of animals, or their geographical distribution.

Frequently much carelessness has existed in the past in regard to fixing the exact date and place of such introductions. Also carelessness has frequently been evident in giving credit to the individual who first reported the occurrence of such a species in our country. Such records should give the name of the person (scientifically trained or not) who first actually saw or collected specimens of such a species. It should give the name of the specialist who authentically identified it, and finally it should give the name of the author who first published the fact that the exotic species has been found here. Seldom, in the case of an introduced pest, has one person been responsible (*a*) for first finding the species in the field, (*b*) for making a determination of it, and (*c*) for first publishing the record of its occurrence in our country.

Essig, 1931, in his "History of Entomology," has quite properly accorded a conspicuous place to the enumeration of the discoveries of introduced insect pests in this country. Such a date as April 6, 1929, when larvae of the Mediterranean fruit fly were first found in the United States, is truly one of prime importance in economic entomology.

In the following paragraphs are given data in regard to early records and present known distribution of three recently introduced mites. One of these, the tropical rat mite, *Liponyssus bacoti* (Hirst), has already assumed the rôle of a pest of major importance. Recently Shelmire and Dove, 1931,[1] have implicated it in the transmission of endemic typhus fever.

[1]In addition to their 1931 paper Shelmire and Dove have in press another paper entitled, "The Rat Mite as a Vector of Endemic Typhus."

THE BOX-TREE SPIDER MITE.

Eutetranychus latus (Canestrini & Fanzago).

The writer has failed to locate any published record of the occurrence of this mite in the United States; however, it is listed in an unpublished manuscript catalogue of the Nearctic Acarina, by Banks, in the Bureau of Entomology Library, the locality reference being to Virginia.

This unpublished reference by Banks probably pertains to a slide in the collection of the Bureau of Entomology with the following data: "Belvoir, Va. (?), on box wood leaves, Fairfax. Mrs. Harrison, 29 Nov. 1915." The material from Mrs. Harrison may have come originally from a nursery at Belvoir.

This year Mr. J. S. Houser of the Ohio Experiment Station sent in for identification mites taken from *Buxus sempervirens*, Spring Grove Cemetery, Cincinnati, Ohio, on May 9, 1931. These were identified by the present writer as *Eutetranychus latus* (Canestrini & Fanzago).

The box-tree spider mite at times does serious injury to its host. It is a species that should be carefully watched in this country.

THE STABLE RAT MITE.

Eulaelaps stabularis (C. L. Koch).

The first specimens to be taken in the United States were identified two years ago. They were in two lots and were a part of a large consignment of rat parasites sent in by Dr. C. L. Williams, Surgeon, U. S. Public Health Service, with letter of May 28, 1929. Of this material there is in the Bureau of Entomology Collection a female specimen (lot No. 375) taken from a rat, Baltimore, Maryland, and another (lot No. 378) taken from a rat at the same place.

In the same year three vials of mites, Nos. 493, 505, and 521, came in from Baltimore rats through Dr. Carroll Fox, Surgeon, U. S. Public Health Service, with letter of date June 19, 1929.

These records are the only ones from the Unites States known to the present writer. This mite, although found about human habitations in Europe, is not known to attack man, at least not habitually to do so.

THE TROPICAL RAT MITE.

Liponyssus bacoti (Hirst).

The earliest date for the occurrence of this mite in the United States as found in the published records is December 30, 1919 (Ewing, 1923). The specimens were taken on mice, New York City, on this date (collector not known). However, a restudy of the material mentioned by the writer in 1923 shows that one of the undated records given then must antedate December 30, 1919. The record given as "on mouse, St. Louis, Missouri, from Dr. Loeb," is for a specimen that was identified to genus by Banks before he left the Bureau. Banks resigned at the end of October, 1916, hence the specimen must have been collected before this date. This specimen was originally poorly mounted. In 1921 I remounted it, thus enabling a specific determination to be made.

The first case of a serious attack on man to be investigated in this country was probably at Longwood, Mississippi, and occurred early in 1921, although other cases in Texas were investigated the same year by Mr. Bishopp of our Bureau and have been reported (Bishopp, 1923). Through Dr. D. L. Van Dine, then of our Bureau, the attention of Dr. L. O. Howard was called to the Longwood, Mississippi, occurrence. Dr. Howard wrote to Dr. Van Dine under the date of May 28, 1921, in part as follows: "I will hand your letter to Dr. Ewing and see if he can do something further with the mite. As I told you the case is worth placing on record even if you can learn nothing further about the scientific name of the mite or its true host."

Dr. Van Dine, together with Dr. S. A. Beach, worked on the control of this mite at Longwood, Mississippi. He reported to Dr. Howard on their success. A copy of this report was received by the writer September 8, 1921. In view of its importance, a part of it is here quoted. The report itself has to my knowledge never been published.

"An interesting occurrence of the tropical rat mite attacking man came to the attention of the writer during May of this year. On May 9, 1921, Dr. S. A. Beach, Health Officer of the Illinois Central Railroad, brought to the Mound Laboratory specimens of a mite which had been collected from the walls of the railway station at Longwood, Mississippi. The railway agent at that point and his family occupied the upper story of the station building as living quarters and the mites were so troublesome that it had been necessary for them to move out of the building and into box cars which the railroad company arranged for them as temporary living quarters. The mite in question has been determined by Doctor H. E. Ewing of the National Museum as *Liponyssus bacoti* (Hirst).

"The trouble with the mites had been called to the attention of Doctor Beach some five weeks previous to the above date. He made a personal investigation of the case and found that the infestation was of rather indefinite standing, though only recently had the mites become particularly annoying."

The remainder of this report has to do with methods of control that were used. It might be added that by getting rid of the rats the mites were finally eliminated.

The first published report of the occurrence of the tropical rat mite in this country was by the writer (1923). In this paper nine records of its occurrence in this country are given. This paper bears the date of 1922, but was long delayed in publication. It actually was issued January 27, 1923.

In October, 1923, Bishopp published his circular devoted exclusively to this mite. In it he gave a summary of what was known at that time about its occurrence in Texas, described its attacks on man, and outlined control measures to be taken against it. He mentioned the occurrence of this mite in a department store in Dallas, Texas, in 1920. This record appears to be the third oldest.

Records based upon specimens in the Bureau of Entomology and United States National Museum collections are here given:

California: San Diego, 1929; San Francisco (date?).

Florida: Eustis, June 18, 1930; Jacksonville, April 12, 1929; Orlando, October 23, 1924 and (month?), 1928.

Georgia: Savannah, May 11, 1922, and June, 1927, and date unknown but recent.

Louisiana: Jeanette, February 2, 1929; New Orleans, June, 1927.

Maryland: Baltimore, 1922, and June 2, 1924, and July 3, 1928, and many lots (no month given), 1929.

Massachusetts: Boston, October, 1927.

Mississippi: Hattiesburg, May 16, 1930; Jackson, December 14, 1929; Longwood, April 12, 1921; Panther Burn, May 7, 1930.

Missouri: St. Louis (some time before November 1, 1916).

North Carolina: Concord, April 6, 1928; Fort Bragg (no date given); New Hanover, 1929.

Ohio: Cincinnati, 1929.

Tennessee: Nashville, 1928.

Texas: College Station, 1928; Dallas, May 25, 1921, and in 1922, and 3 lots with no date; Ft. Worth, April, 1921, and 1 lot with no date; Houston, no date; Laredo, no date.

Virginia: Newport News, 1930; Norfolk, May, 1927, and June 1, 1927; Richmond, June 10, 1927.

Washington: Seattle (no date).

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Shelmire, B., and Dove, W. E. 1931. The Tropical Rat Mite, *Liponyssus bacoti* Hirst, 1914, the Cause of a Skin Eruption of Man, and a Possible Vector of Endemic Typhus Fever. Jour. Amer. Med. Assoc., vol. XCVI, pp. 579–584.

DESCRIPTION OF A NEW COSMOPTERYGID LEAF MINER (LEPIDOPTERA) ON HELIANTHUS.

By AUGUST BUSCK, *U. S. Bureau of Entomology.*

TELADOMA, new genus.

Type: **T. helianthi** Busck.

Labial palpi long, porrected; second joint slightly curved, somewhat thickened with smooth scales; terminal joint shorter than second, thickened with scales at base, acute. Maxillary palpi rudimentary. Tongue spiraled. Head and face smooth, face retreating. Antennae little more than half the wing length, simple, slightly serrate in male, basal joint with strong pecten. Thorax smooth. Forewing smooth, elongate ovate, apex pointed; 10 veins, 2 and 3 obsolete; 4 and 5 approximate from end of cell; 6 separate; 7 and 8 stalked to costa; 11 from middle of cell; 9, 10, and 11 equidistant; 1*b* furcate at base; 1*c* present on basal half, outer half obsolete. Hind wing with costa slightly and evenly bent, apex pointed; 8 veins, all separate; 2, 3, and 4 nearly parallel; 5 bent toward 4 at base, but well separated; 6 and 7 parallel, enclosing apex (Plate 2, Fig. 5). Middle tibiae thickened with rough scales above; posterior tibiae with long rough hair tufts above and below.

Male genitalia (Plate 2, Fig. 1) asymmetrical; uncus absent; gnathos with its two uneven branches united at top into a spear-like point and enclosing the alimentary canal at their base; tegumen with lateral wings, the left much larger than the right; harpes ventrally placed; anellus triangular, with strong free arm supporting the aedoeagus, which is small, sharply pointed at apex, and with penis exit lateral, below the apex. Eighth abdominal segment (Plate 2, Fig. 4) with strong, slightly asymmetrical chitinizations dorsally and ventrally.

Female genitalia (Plate 2, Figs. 2 and 3) with the two lobes of the ovipositor folded inward to form a short tube; ostium protruding outside the abdomen as an asymmetrical tube; ductus long; bursa oval, thin-skinned, without stigma.

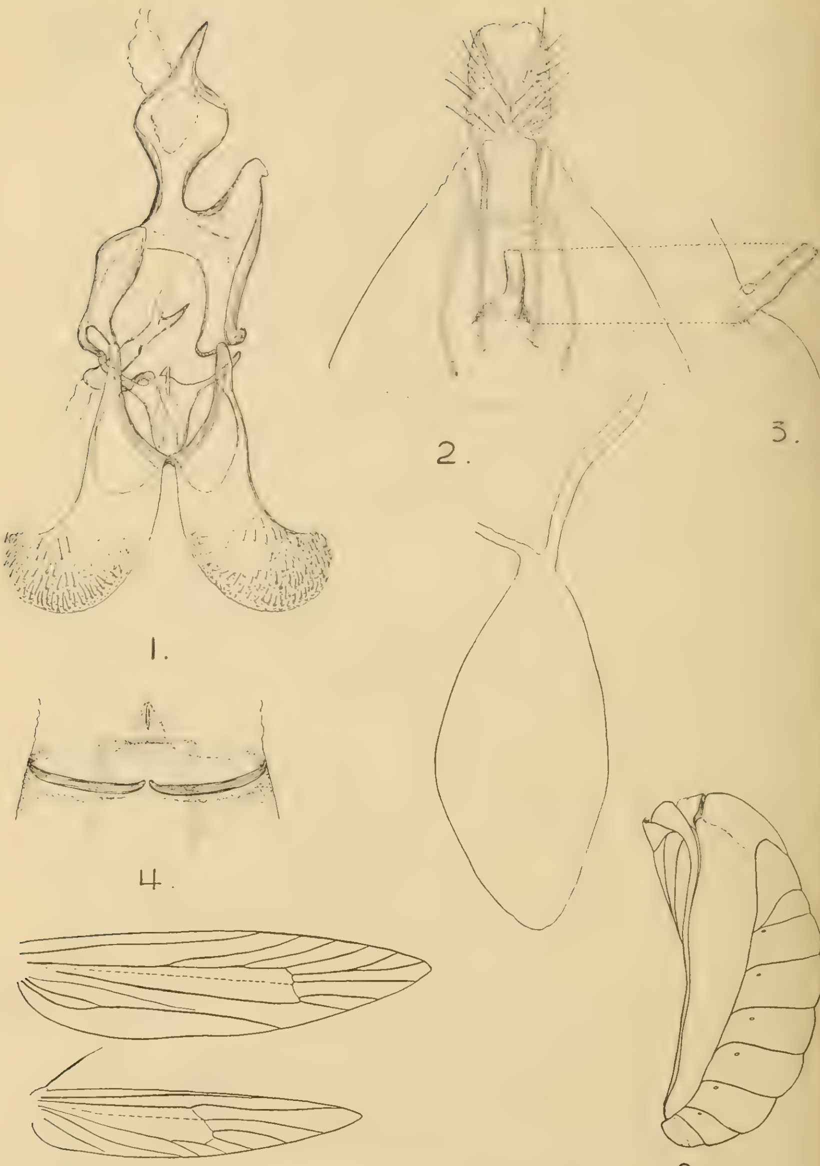
Pupa (Plate 2, Fig. 6) obtect, wingcovers reaching to middle of last abdominal segment and firmly soldered; smooth.

The genus belongs to the family *Cosmopterygidae* as distinguished from the *Momphidae* (Lavernidae). The two families have been confused and united under the former name by European and American authors, the writer included, but they have no close relationship and must be retained as separate families. This will be the subject of a forthcoming paper. The *Momphidae* have symmetrical male genitalia (Plate 3, Fig. 2) and the ostium of the female not protruding beyond the body wall.

Some genera, hitherto placed in the family *Oecophoridae*, are found to belong to the *Cosmopterygidae* (*Triclonella* Busck (Plate 3, Fig. 3) and others).

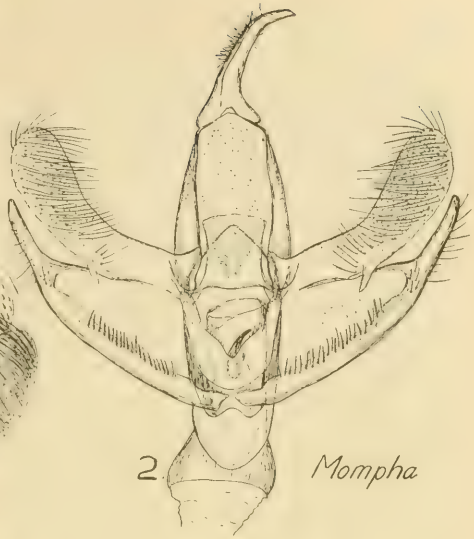
Teladoma helianthi, new species.

Labial palpi dark brown with each scale strongly tipped with white. Head and thorax dark brown with white-tipped scales. Fore wing dark brown dusted with yellowish white, each scale white-tipped, producing a salt and pepper effect;

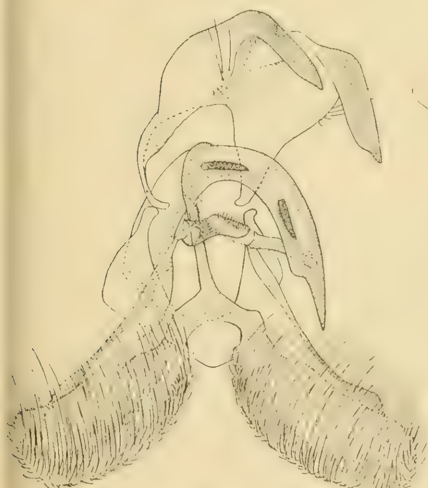


Teladoma helianthi

1. *Cosmopteryx*



2. *Mompha*



3. *Triclonella pergandeella* 4.

in some specimens the white constitutes the major color and the wing appears yellowish white with brown mottling; the obscure, ill-defined, blackish brown first and second discal spots are most noticeable in the light colored specimens and are nearly or quite obsolete in the darker specimens; cilia dark fuscous. Hind wing dark fuscous with lighter fuscous cilia. Abdomen and legs dark brown with each scale white-tipped.

Alar expanse.—9–12 mm.

Habitat.—East St. Louis, Illinois.

Type.—U. S. National Museum No. 43657.

Foodplants.—*Helianthus* and *Xanthium.*

This interesting species was reared in large series from leaf mines in the above plants by Mr. A. F. Satterthwait of the U. S. Bureau of Entomology, who will eventually publish on the biology and economic aspects of the species.

EXPLANATION OF PLATES.

Plate 2.

Teladoma helianthi Busck.

Fig. 1. Male genitalia.
Fig. 2. Female genitalia.
Fig. 3. Protruding ostium of female.
Fig. 4. Eighth abdominal segment of male.
Fig. 5. Wing venation.
Fig. 6. Pupa.

Plate 3.

Fig 1. *Cosmopteryx zieglerella* Hübner. Genotype. Male genitalia.
Fig. 2. *Mompha conturbatella* Hübner. Genotype. Male genitalia.
Fig. 3. *Triclonella pergandeella* Busck. Genotype. Male genitalia.
Fig. 4. *Triclonella pergandeella* Busck. Eighth abdominal segment of male.

(The drawings were made by Mrs. Eleanor A. Carlin under the author's supervision from slides prepared by him.)

A NEW SPECIES INFESTING ANNONA (LEPIDOPTERA: OLETHREUTIDAE).

By CARL HEINRICH,
Bureau of Entomology, United States Department of Agriculture.

Talponia batesi, new species.
(Plate 4, Figs. 1, 2.)

A moderately sized species with basal half of fore wing olivaceous ocherous; outer half paler and marked with leaden metallic streaks and mottlings; costa strongly and abruptly arched just beyond middle; termen concave just below apex; near termen from tornus to apex an irregular row of black dots.

Antenna short, scarcely one-third length of costa; finely pubescent beneath, coarse scaled above. Palpus extending one and one-half times the length of the head beyond it; inner side whitish ocherous; outer side ocherous lined with leaden scales; upper surface leaden metallic; triangular; second joint upcurved; third sharply porrect and longer than second. Head and thorax concolorous with basal half of fore wing. Fore wing with basal half of wing olivaceous ocherous (under magnification showing all the scales as brownish tipped with dull golden ocherous), the outer margin of olivaceous area terminating abruptly (except on costa) and almost vertical to dorsum; outer half of wing with ground color pale ocherous faintly tinged with pinkish and heavily spotted and streaked with leaden metallic scales; costa with five or six metallic streaks on outer two-thirds, the first three long and extending into the pale outer area, those toward apex diminishing in length and beginning on costa as pale ocherous spots; between the first and second streaks a thin, rather long black line; a similar black line between second and third costal streaks; in pale outer area several similar but shorter and more irregular streaks of black scaling; ground color of outer half of costa as at base of wing; a faint indication of the same olivaceous color near termen; apical dot black; below this a series of five or six black dots in a line vertical to costa; at tornus two more similar dots set one above the other; cilia pale, shining, metallic, with a dark metallic basal line. Under side of fore wing pale brown, semilustrous, and with ocherous costal spots and black dots along termen repeated. Hind wing brown; cilia paler with dark semilustrous basal band.

Male and female genitalia figured from type and paratype.

Alar expanse.—11–12.5 mm.

Type and paratypes.—U. S. N. M. No. 43806. Paratype also in Museum of Comparative Zoology, Cambridge, Mass.

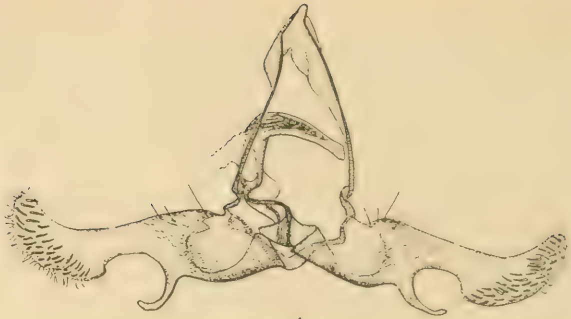
Type locality.—Antigua, Guatemala.

Food plant.—*Annona cherimola.*

Described from male type and one male and four female paratypes all from the type locality and reared 10 Sept., 1930, from larvae feeding in the fruit of *Annona.*

Named in honor of Mr. Marston Bates, Entomologist of the United Fruit Company, who discovered and reared the insect.

The larva is sordid white; about 10 mm. long when full grown; skin covered throughout with evenly spaced, sharp, rather dark scobinations. Head pale yellow with posterior margin of epicranium, adfrontal ridges, epistoma, and margins of hypostoma and mandibles brown and with a small dark spot at incision of lateral hind margin; ocelli white; ocellar pigment discontinuous, black, showing somewhat separated from the ocellar lenses. Thoracic shield light yellow with a broad brown posterior margin. Dorsal sclerotization of ninth abdominal segment forming a brown shield including setae II, I, and III; setae IV, V, and VI of 9th abdominal segment on a single sclerotization. Anal shield brown. Crochets 26 to 30; uniordinal and arranged in a complete circle. Spiracles small, brown, circular. Anal fork absent.



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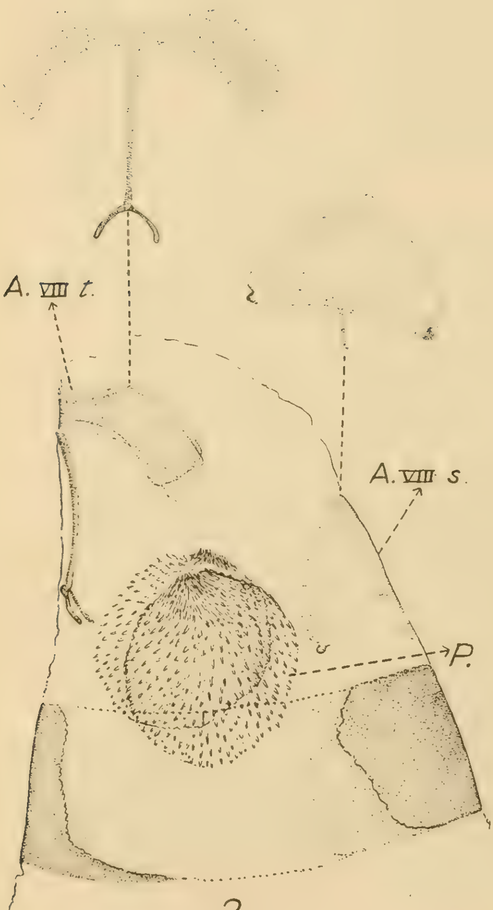

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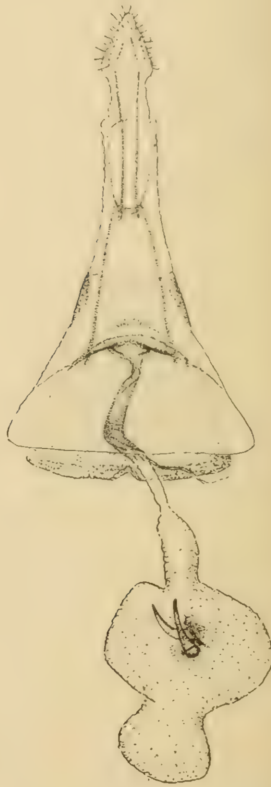

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EXPLANATION OF PLATE.

Talponia batesi Heinrich.

Fig. 1. Male genitalia of type.

Fig. 2. Seventh and eighth abdominal segments of male type showing: P, lateral pocket of sensory scales on 8th abdominal segment; A VIII s, modified sternite of 8th abdominal segment; A VIII t, modified tergite of 8th abdominal segment.

Fig. 3. Female genitalia of paratype.

(Drawings made under the author's supervision by Mrs. Eleanor A. Carlin of the Bureau of Entomology.)

A NEW GENUS AND TWO NEW SPECIES OF MUSCOID FLIES FROM GUATEMALA.

By J. M. ALDRICH, *Associate Curator*, *U. S. National Museum*.

Among some Diptera recently received for identification from Dr. Jos. Bequaert, were the following two new species. Doctor Bequaert wishes to publish on their larval habits and I therefore offer the descriptions in order that they may be properly referred to by him.

Family MUSCIDAE (Anthomyiidae).

CHORTINUS, new genus.

Hind calypter longer than front one; sixth vein not reaching wing margin; scutellum bare below; third vein setulose about halfway to crossvein; first vein setulose on apical half; third and fourth veins parallel near apex, both slightly bent forward and rather far apart; no acrostichals except prescutellar pair; prealar present; pteropleura conspicuously hairy; hypopleura, prosternum and propleura bare; thoracic spiracles large; hind coxae bare behind; hind tibia with minute and almost imperceptible dorsal bristle below middle (calcar).

Type species, *bequaerti*, new species.

Chortinus bequaerti, new species.

General color reddish brown; antennae, palpi and legs except tarsi yellow.

Length, 7.5 to 8.5 mm.

Male.—Eyes with distinctly enlarged facets on the upper half or more, changing gradually to a smaller size below and around the outer edge. Front very narrow, the eyes separated only by the width of the anterior ocellus; frontal stripe entirely absent along the middle; frontal bristles diminishing to small hairs in the narrowest part. Parafacials and posterior orbits with grayish white pollen, that of the cheek rather distinctly yellowish. The cheek hardly one-fourth the eye height. Third antennal joint a little more than twice the second; arista with rather short plumosity which diminishes toward the tip; beard entirely black. Thorax with rather dense whitish pollen on which four longitudinal stripes are quite distinct, the two inner rather narrow and reaching only halfway from the suture to the scutellum, the outer interrupted at the suture. Pleurae a little reddish yellow with thinner gray pollen. Chaetotaxy: dorsocentral 2, 4; humeral 2; posthumeral 1; presutural; 1 notopleural 2; supra-alar 2 (the prealar fully half as long as the one behind); intraalar 2; postalar 2; scutellum with three pairs, sternopleural 1, 2, the lower hind one small. Along the middle part of the mesonotum and on the scutellum the hairs are erect and long, rather dense. Abdomen of the same reddish brown color, with an interrupted median dark line; its surface above and below covered with gray or grayish brown pollen which is densely sprinkled with brown dots at the bases of the hairs. Third segment with a marginal row of somewhat depressed bristles; fourth with some scattered discals and a marginal row somewhat erect.

Wings hyaline, the anterior crossvein strongly infuscated, hind crossvein less so and rather strikingly bicurved. The stem vein has on the hind side a few delicate hairs. Calypters white with very distinct brown rim and brown fringe. Halteres yellow.

Legs yellow except the tarsi, which are black; front tibia without the outer bristle; middle tibia without bristle on outer front side, with two on outer hind side; hind tibia with one rather small on outer hind side and one or two quite small on outer front side. Hind femur with dense row of bristles on its whole length above, somewhat double at the base; on the lower front edge another row longer and more hair-like, those toward the base much stouter; on the lower hind edge a few long hair-like bristles. Claws and pulvilli of all the tarsi moderately enlarged, the latter rather conspicuously whitish and rather pointed.

Female.—Front dark brown, nearly as wide as one eye, the parafrontal about one-fourth as wide as the middle portion. Tibiae more brownish than in the male.

Described from four males and 19 females, all collected at Santa Emilia, Pochuta, Guatemala, in February and March, 1931, by Dr. Jos. Bequaert, after whom the species is named; and one female in the National Museum collection, collected by C. M. Rouillard at La Providencia, Obispo, Guatemala. Two paratype males and five paratype females, of Dr. Bequaert's series, are retained in the U. S. National Museum, the others are returned to him.

Paratype.—Male and female, Cat. No. 43881, U. S. N. M.

This new genus is allied to *Phaonia*, differing in the presence of setules on first and third veins, in the hairiness of the pteropleura, and other characters. The species suggests in the former character *Aricia pruinosa* Macquart, described from Galveston, Tex., in Dipt. Exot. Suppl., I, 1846, p. 329 (sep. p. 20). Stein reports on the supposed type in Bigot's collection in Zeitsch. Hym. u. Dipt., VII, 1907, p. 285, that the first vein is setulose on the apical half, and the third at base, as in the present species. He reports the presence of two pairs of presutural acrostichals and other differences. I have never seen a specimen agreeing with his notes on *pruinosa.*

Family CALLIPHORIDAE.

Mesembrinella formosa, new species.

Mesonotum brown; pleurae, coxae and femora yellow; abdomen yellowish at base, the apical part blue.

Length, 8.2 to 9.4 mm.

Male.—Eyes almost contiguous, the front at narrowest only half as wide as the anterior ocellus. Parafacial and posterior orbit with silvery white pollen which is almost imperceptible on the cheek, the yellow ground color showing through. Antennae yellow, the third joint blackish on the front side from the arista to the tip; palpi yellow. Mesonotum dark brown with almost silvery pollen, leaving a median black stripe and one on each side, all of which reach almost to the scutellum. Scutellum entirely dark brown. Chaetotaxy: acrostichal 1, 1; dorsocentral 2, 3; humeral 3; posthumeral 2; presutural 1; notopleural 2; supraalar 4, the second and fourth very small; intraalar 2; postalar 2; sternopleural 1, 1; scutellum with only one pair of laterals, one apical and one discal. Pleurae yellow, thinly pollinose, the spiracles large and conspicuous. Calypters translucent, the anterior one bordered with black. Halteres yellow.

Abdomen yellow at base, the last three segments shining blue and rather tessellated with white pollen; third and fourth segments with apical row of bristles, no discals.

Tibiae rather brown, middle and hind ones a little more so; all the tarsi blackish. Claws and pulvilli moderately elongated, the latter brownish.

Wing with a uniform brownish infuscation; costal segment between the second and third veins nearly three times that between the third and fourth.

Female.—Front less than one-fourth the head width, the frontal stripe black on the upper half or more, lower part reddish; parafrontal a little over one-fourth the middle stripe. Parafacial rather wide, at narrowest wider than the third antennal joint (in the male not so wide as third antennal joint).

Described from one male and six females. The male and one female were collected at Santa Emilia, Pochuta, Guatemala, in February and March, 1931; one female collected at Pacayal, Pochuta, Guatemala, in the same period; four females at Moca, Guatemala, in March and April, 1931. All were collected by Dr. Jos. Bequaert. Three paratype females are retained by the U. S. National Museum, the others returned to Dr. Bequaert.

Paratype.—Female, Cat. No. 43882 U. S. N. M.

In my key to the genus published in the Proceedings of the U. S. National Museum, vol. 66, art. 18, 1925, p. 11, this species runs to *flavicrura,* from which it differs in having only one pair of presutural acrostichals, the front and parafacial considerably wider in the female, the antennae partly blackish, the epistoma not prominent, the pleurae and tibiae much more yellow.

MINUTES OF THE 434TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, JANUARY 7, 1932.

The 434th regular meeting of the Entomological Society of Washington was held at 8 P. M., Thursday, January 7, 1932, in Room 43 of the new building of the National Museum. Mr. F. C. Bishopp, president, presided. There were present 46 members and 33 visitors. The minutes of the previous meeting were read and approved.

The following individuals were admitted to membership by unanimous vote: A. S. Hoyt of the Plant Quarantine and Control Administration, H. A. Jaynes of the Bureau of Entomology, and D. H. Brannon of the University of Maryland.

Mr. F. C. Bishopp spoke of the wish of the officers of the Washington Academy of Science to extend the usefulness of their Journal.

Mr. S. A. Rohwer explained this more fully. He reviewed briefly the publication of the Journal of the Washington Academy of Science, pointing out that in the earlier days it was confined largely to articles dealing with the exact sciences such as physics, chemistry, and mathematics. About 10 years ago the idea of expanding the Journal and making it more useful was given consideration by a committee which devoted considerable thought to the question. Following the work of the committee a number of changes were made in the plan of publication. These included the broadening of the subject matter included in the journal so as to include taxonomic papers as well as others dealing with biological subjects. A change was also made in the form of the publication, distribution, and frequency of issuance. The idea of the committee at that time was to make the Journal a means of prompt publication of preliminary results as well as a magazine which would include articles of timely interest on general subjects. Following this the Journal also included a large number of notes reporting interesting doings of members of the Academy or other Washington societies. The thought that Doctor Cobb and the governing board of the Washington Academy now has in mind is to increase the usefulness of the Journal, and if possible enlarge its distribution. Some thought has been given to the idea of having the Journal contain more popular illustrated articles with the idea of making it more interesting to the general public. The governing body is anxious to receive comments from all of the affiliated societies in order that they may consider such suggestions in any modification which they make. They had, therefore, requested each society to appoint a committee to receive suggestions and pass them on to the Academy. In place of a committee, Mr. Rohwer suggested that the Society designate a member to receive and transmit such suggestions as the members might have, and recommended that Doctor Morrison, who is the Society's representative on the governing board of the Academy as well as an associate editor, be selected for such a position. Under this plan Doctor Morrison would act as liaison officer between the Society and the Academy in matters pertaining to the publication of the Journal.

A motion was passed that Doctor Morrison be selected for this work.

The first communication on the regular program was by C. P. Clausen, and was entitled "Larval Respiration in the Parasitic Hymenoptera." This was a discussion of the different modifications in form and habit which have developed, for respiratory purposes, among the larvae of the parasitic Hymenoptera. The adaptation in *Encyrtus infidus* Rossi, in which connection is made with the trachael system of the host, was discussed in some detail. The parallel development of the various modifications in widely separated families and orders was pointed out, and their lack of phylogenetic value emphasized. (Author's abstract.)

The second communication was by J. M. Aldrich, and was entitled "Collecting Diptera in the Gaspe Peninsula of Eastern Canada." The Gaspe Peninsula contains the extreme northeastern end of the Appalachian mountain system, which ends at Cape Gaspe. The speaker was interested to compare the Diptera of this region with those occurring much farther south in the same system. He was also interested in ascertaining whether the characteristic maritime or seashore flies of Labrador would be found, or any of them, on the south side of the broad estuary of the St. Lawrence. In July of 1931, he took an auto trip with his wife to Cape Gaspe, collecting at various points with especial reference to the seashore and the highest altitudes available along the highway. No unusual northern forms were encountered, the flies being such as are found farther south. The seashore forms most common and characteristic were the same species which he had collected on the shore of Chesapeake Bay. Lantern slides were shown of the region, which offers much of interest to the tourist, both on account of the beauty of the scenery and the novelty of traveling in a French country, where almost no English is spoken. (Author's abstract.)

This paper was discussed by Bishopp, Cushman, and Blake.

Under the heading of "Notes and Exhibition of Specimens," Mr. C. L. Fluke of the University of Wisconsin exhibited an unusual gynandromorphous fly, of the family Syrphidae, genus Platychirus.

R. D. Wagner stated that in rearing Drosophila for experimental purposes, the work is often interfered with by growths of molds. He found in his work that this trouble could be prevented entirely by the use of formaldehyde in the breeding media.

A satisfactory medium may be prepared as follows:

1 lb. fresh bananas
¼ lb. plain agar
1000 cc. water
1 cc. formaldehyde.

If it is not desirable to incorporate the formaldehyde in the medium, a surface wash of 1 cc. formaldeyde to 1000 cc. of water may be used.

F. C. Bishopp stated that in 1925 he learned from Dr. D. M. DeLong and Prof. J. S. Hine of the breeding of *Drosophila repleta* in the vats containing formaldehyde solution for preserving cadavers used for dissection in Ohio State University. That same year Drosophila was rather annoying in the Veterinary Department where they were attracted to the formaldehyde injected animals under dissection. This would indicate that Drosophila is attracted by formaldehyde, and that apparently the larvae can breed in strong solutions of that substance.

Mr. H. S. McConnell of Maryland University showed specimens of a scale insect (Pulvinaria), found on wild azalea around College Park, and stated that it has been found only on bases of plants that are covered with leaf mould.

Mr. Bishopp reported briefly on the recent New Orleans meetings. The attendance was fair considering economic conditions, and more than 50 members of the Bureau of Entomology were there. The exhibit of the Bureau, in which the work of nearly all the divisions was represented, attracted much favorable attention.

Mr. R. A. Cushman spoke of the introduction of parasites of the pine tip moth (*Rhyacionia frustrana*) from Virginia into the Nebraska National Forest, a large artificial plantation of pine in the sandhill country of Nebraska. The pine in this area, especially the yellow pine, was being so severely injured by the tip moth that discontinuance of planting of that species appeared advisable. The Virginia parasites were liberated in June and July, 1925. Only one of the species liberated (*Campoplex frustranae* Cushman) has been recovered, but this has been so effective that the planting of yellow pine has continued. The parasite has spread throughout virtually the whole plantation, and in the neighborhood of the original point of liberation has parasitized as high as 80 per cent of the tip moth larvae.

Mr. L. G. Baumhofer of Halsy, spoke further of this case. In four years following the introduction of *C. frustranae*, in 1925, parasitism of Rhyacionia rose from 10 to 83 per cent in the plantation where originally liberated; the next year, with host population very low, the parasitism was 78 per cent. The parasite has since dropped off because of scarcity of host material, and parasitism is now under 15 per cent, with the result that the host is again building up Injury to terminal shoots of yellow pine was reduced from over 90% to 15%. The introduced Campoplex spread naturally from the point of liberation to the limits of the planted area, nearly five miles distance, within four years.

These talks were discussed by Graf.

Mr. R. C. Shannon spoke of a trip in Brazil, to study mosquitoes, that traversed 6,000 miles along the Coast and up the Amazon. He told of travel conditions, native life, and mosquito and health problems. Insect-borne diseases constitute a major problem in many areas.

Meeting adjourned at 10 P. M.

F. M. WADLEY,
Recording Secretary.

Actual date of publication, February 29, 1932.

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PROCEEDINGS OF THE
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DESCRIPTIONS OF NEW TRICHOGRAMMATID (HYMENOPTERA) EGG PARASITES FROM THE WEST INDIES.

By HERBERT L. DOZIER.

To date very little has been published concerning the representatives of the family Trichogrammidae in the West Indies. The present paper describes six new species of these interesting minute egg-parasites and gives a number of valuable distribution and rearing records, accumulated by the writer while Entomologist for the Service Technique de l'Agriculture at Port-au-Prince, Haiti.

Trichogramma minutum (Riley).

Hatte Lathan, Haiti, Nov. 28, 1930, numbers of the golden yellow strain of this species were reared from eggs of the Cotton Leaf Worm, *Alabama argillaceae;* a yellow strain having the vertex and abdomen darker was reared from red bean foliage at Damien, Haiti, March 4, 1931, and from sweet potato foliage at Port-au-Prince, Haiti, Dec. 28, 1929; an almost brown strain was reared in very abundant numbers from eggs of the Larger Canna Leaf-roller, *Calpodes ethlius* Cramer, on canna at Damien, Haiti, June 1, 1931, and was very effective in stopping the outbreak of this pest. This dark strain either represents an undescribed strain of *T. minutum* (Riley) or a distinct species.

Megaphragma mymaripenne Timberlake.

1924 Timberlake, P. H., Descr. of New Chalcid-Flies from Hawaii and Mexico, Proc. Haw. Ent. Soc., V, no. 3, pp. 412–415, fig. 7.

1931 Pemberton, C. E. An Egg Parasite of Thrips in Hawaii, Proc. Haw. Ent. Soc, Vii, no 3, pp. 481–482.

Port-au-Prince, Haiti, May 11, 1931, the writer reared numerous females of this species from croton foliage infested with a very minute species of pale thrips, *Microthrips* sp. close to *piercei* Morgan.

The species was originally described from specimens collected by C. E. Pemberton on leaves of an undetermined forest tree in association with an undetermined thrips in 1920 in Hawaii. At the time it was suspected of being a parasite of the eggs of this thrips. He again noted this parasite on leaves of croton, *Codiaenum variegatum*, in Honolulu in association with small colonies of *Heliothrips haemorrhoidalis* Bouché. He located the eggs of the thrips in minute swellings on the leaves and dissected out numbers of *Megaphragma* pupae. In addition he reared out seventeen adults noting that the parasite cuts a neat, imperfectly circular exit hole at the point of emergence, measuring from .08 to .09 mm. in diameter. He suggests that this minute wasp is an important factor in the control of *Heliothrips haemorrhoidalis* in Hawaii. This thrips is a well-known pest of various ornamentals, especially croton, in greenhouses in Europe and the United States and appears to be a native of tropical America. The writer has observed this thrips working outdoors on magnolia foliage at New Orleans, La.

The Haitian material measures from 0.172–0.20 mm. in length, distinctly shorter than the measurements given in the original description, but this smaller size is at once explained by the smaller size of the eggs of the *Microthrips* in comparison with those of *H. haemorrhoidalis*. The small size of this species at once ranks it among the smallest of all known insects.

It seems very likely that this parasite can be successfully used against the notorious bean thrips, *Heliothrips fasciatus* Perg., particularly in the southern portion of its range, and seems well worth investigation.

Abbella ducassei, new species.

Closest allied to *Abbella prima* (Perkins) recorded from Mexico and Porto Rico, differing from the description of that species in lacking "a yellow median line on the mesonotum, united with the yellow hind margin" and "the scutellum, postscutellum and propodeum (except on the sides) yellow." The type of *A. auriscutellum* Gir. (1916, Ent. News, vol. 27, p. 4—from Arizona), later synonymized with *A. prima* by Girault (1918, No. Amer Hym. Trichogrammatidae, p. 4, Sydney), has been examined by the writer in the U. S. National Museum and is very distinct from the present new species.

Female.—Length 0.459–0.617 mm.; expanse 0.918–1.076 mm.; greatest width of forewing 0.158–0.186 mm. General color rather dark brown in balsam mounted specimens by transmitted light, the abdomen crossed near base and on distal third with yellowish, marked with more golden yellow by direct light; antennae pale except the pedicel and joints 1 and 3 of the club which are brown; forewings bifasciate, with the venation brown; a very prominent grayish clouding extends from below the distal half of the marginal vein to the end of the stigmal vein and is continued entirely across the wing; the second fascia is a faint interrupted clouding beneath the submarginal vein; legs brown, lightening up on the distal third of the tibiae, the two proximal joints of the tarsi, pale.

Antenna rather long and slender, 9-jointed, consisting of scape, pedicel, two ring-joints, two funicle joints and a 3-jointed club. Scape long and slender, about two and a half times as long as the pedicel; pedicel distinctly wider than the scape and the two funicle joints and slightly longer than the last combined; two minute ring-joints, the proximal one about twice as wide as the second; the first funicle joint slightly longer than the second, subequal in width but slightly narrowed at base; the club distinctly wider than the funicle, at its greatest width about twice as wide, the second and third joints narrowing gradually to tip. Forewings only moderately long and broad, two and a third times longer than the greatest width; discal ciliation of the forewing distinctly more sparse than in *Abbella acuminata* (Ashm.), *americana* Gir. and *nympha* Gir, arranged in about 18–20 much confused lines of various lengths, counting across the widest portion of the wing; the cilia across the clouded area showing up quite definitely, especially a line of six to seven slightly longer ones running obliquely inwards from the end of the stigmal vein. Abdomen conic-ovate, about as long as the head and thorax combined, the ovipositor only slightly extruded.

Described from the type female reared from red bean foliage, infested with *Empoasca fabalis* De L. at Damien, Haiti, Jan. 20, 1930, and a paratype female (U. S. National Museum No. 43889) reared by the writer from sweet potato foliage infested with *Empoasca* n. sp. and *Protalebra similis* Baker at Port-au-Prince, Haiti, Dec. 28, 1929.

The writer takes pleasure in naming this species after Mr. Emmanuel Ducasse, Assistant Entomologist of the Service Technique, who rendered him valuable assistance in the collection and rearing of material.

Chaetostricha phaseoli, new species.

Differs greatly in shape of wing from *C. flavipes* (Gir.) from Georgia. It differs from *C. punctata* (Howard), described in 1896 from a single female collected on the island of Grenada, under the name of *Paracentrobia*, by its coloration. *C. punctata* is described as measuring 1.0 mm. in length and orange yellow in color with a black dot on the outer margin of each abdominal segment, with the legs and antennae pallid, the femora somewhat dusky in the middle.

Male.—Length, 0.545 mm.; expanse 1.12 mm.; greatest width of forewing 0.133 mm. General color orange yellow, the vertex, side of thorax and the distal half of the abdomen, fuscous; antennae and venation slightly smoky; legs dusky.

Rather elongate in form, the head about equal in width to the thorax. Eyes large and prominent, hairless. Antennae 7-jointed, composed of scape, ring-joint, pedicel, one funicle, and a 3-jointed club. Scape long and slender, twice as long as the wider bulbous pedicel; the ring-joint very minute and easily overlooked; the single funicle joint is slightly shorter than the pedicel and a third narrower; club composed of three distinct joints, rather long and tapering somewhat to a rather blunt tip; second and third joints subequal in length, a third longer than the first; the setae rather sparse and inconspicuous. Forewings typical for the genus, in form agreeing most closely with the European *Chaetostricha werneri* Kryger. The outer and lower half of the forewing is covered with numbers of cilia arranged in very indefinite confused lines. There is a border of long marginal cilia running around the distal half of the forewing, longest at the apex, is over two-thirds as long as the greatest width of the wing. A very light shading beneath the stigma only confuses its proper outline. Abdomen distinctly shorter than the thorax, of nearly equal width at the base, narrowing for its distal half to a rather acute tip.

Described from a single male, reared by the writer from red bean foliage, infested with *Empoasca fabalis* DeL., *Franklinothrips vespiformis*, etc., at Damien, Haiti, Jan. 22, 1930.

Ittys platycotis, new species.

Distinguished at once from the North American *Ittys ceresarem* (Ashm.), a parasite also of the eggs of a membracid, by its distinctly smaller size, thicker venation and darker coloration.

Male.—Length 0.66 mm.; expanse 1.448 mm.; greatest width of forewing 0.272 mm. General color dark brown, the head, basal third and sides of the prescutum, the scutellum, portions of the scapulae and axillae, the postscutum and propodeum, orange-yellow; the antenna light brown, except the pale scape; eyes red; legs with the femora more or less brown, the remainder yellowish; venation grayish. The forewing lacks the distinct substigmal fuscous spot present in *Ittys ceresarum* but the basal half of the wing appears very faintly clouded.

Antenna only 8-jointed, consisting of scape, pedicel, one very distinct ring-joint, two funicle joints, and a 3-jointed club. The scape is very long and broad in comparison with the remainder of the antenna, widest at the middle, two and a half times longer than its width; pedicel less than half as long as the scape, subconical, widest at its apex; ring-joint very distinct; the two funicle joints are closely joined, nearly subequal in width and length; club at base subequal in width to the funicle joints, gradually tapering to a rather pointed tip; the third joint about equalling in length that of the first and second combined, furnished with a single visible long corneous sensorium that extends completely to the tip; funicle and club joints provided with numerous bristle-like hairs. Forewings long, fairly broad but regularly rounded at the apex, with a marginal fringe of moderately long hairs. Discal ciliation is arranged in about 19–20 lines; some of these lines are confused and short but most of them are regular. Submarginal vein distinctly shorter than the marginal, with two long setae, widest at its proximal end where it equals the greatest width of the marginal vein, then narrows slightly towards the marginal; marginal vein thick, about twice as long as the stigmal, provided with three conspicuous large setae and nine smaller ones; stigmal vein rather thick, provided on outer margin near its base with a distinct uncus composed of four minute pustules. Hind wings normal for the genus, provided with three distinct lines of cilia.

Described from two males, reared by the writer from eggs of the tree hopper, *Platycotis* (*Lophopelta*) *tuberculatus* Fairm. in avocado twigs in the mountains at Kenskoff, Haiti, Nov. 5-6, 1930. The egg masses of the host were abundant at the time but for the most part hatched, and yielded only the two specimens.

One male paratype, mounted in balsam on slide, is deposited in the U. S. National Museum, No. 43890.

UFENS Girault.

1911 Girault, Trans. Amer. Ent. Soc., vol. 37, p. 32.

As pointed out by Mr. P. H. Timberlake (Proc. Haw. Ent. Soc., VI, no. 3, p. 525, 1927) there are two ring-joints present in the genus Ufens, making the antennae 9-jointed, the second ring-joint often being very obscure and closely joined to the base of the funicle. In the female the two wide funicle joints are usually very large, having a peculiar twisted appearance, and there are a number of very conspicuous long corneous sensoria that project more or less beyond the distal ends of the joints. The antennae are dissimilar in the male sex, being provided with whorls of long hairs, the club not being well differentiated from the funicle; the sensoria are less numerous and prominent; the terminal joint of the club is provided with an apical bud-like appendage. The forewings are short and broad, oblately rounded at the apex, shaped somewhat like a broad flat paddle; venation rather straight and not forming a regular arch or bow. The ovipositor only slightly exserted.

Ufens beneficus, new species.

Closest allied in both structure and habits to *Ufens elimaeae* Timb., a species reared from the eggs of the orthopteron, *Elimaea punctifera*, in Hawaii, but differing in its larger size and stouter antennae.

Female—Length 0.50-0.573 mm.; expanse 1.089 mm.; greatest width of forewing 0.272 mm. General color very dark brown, the vertex a shade lighter, the oblique lateral margins of the prescutum posteriorly, the scutellum, hind margins of the axillae, marked with yellowish-orange: the propodeum very pale, scape pale, the funicle and club dark brown, eyes red; legs grayish-brown, the femora slightly pale at their distal ends, the tibiae with the distal third pale, all tarsi pale; venation grayish.

Short and rather stout. The head about as wide as the thorax, the vertex broad. Antennae 9-jointed, the scape short and distinctly widened, about one-third as wide as long; pedicel very short, almost as wide as long, under high magnification lineately reticulated; two ring-joints present but very minute and easily overlooked; the first and second funicle joints very closely fused, separated by fine suture, appearing at first glance to be one, very wide and prominent, about twice as wide as the pedicel, provided with numerous conspicuous corneous sensoria arranged obliquely outwards; the club 3-jointed, inserted towards ventral edge of the apex of the funicle, the second club-joint appearing to be longer than the first, separated by a distinct suture; the corneous sensoria are very conspicuous, those of the first club-joint arranged obliquely outwards in the opposite direction from those of the second, projecting slightly beyond the tip of the joint; club 1 subequal in width to that of the funicle; club 2 distinctly narrower and directed inwardly; terminal joint decidedly narrow, being at base only about one-half as wide as the second club-joint, pointed. In addition to the prominent sensoria the antenna is provided rather sparsely with a number of bristle-like setae. Forewings large and broad, rounded at the apices. Typical for the genus. Marginal fringes very short and dense, the discal setae arranged in 17 lines, three of which are more prominent than the others, namely, lines 1 and 7 which start at the stigmal vein; line 16 which continues inwardly a short distance from the posterior margin to a point opposite the proximal end of the marginal vein; about four times as long as wide, widening towards its apex; stigmal vein about one-third as long as the marginal, constricted at base for a very short distance and then widens out into a somewhat rectangular form, appearing very short and broad; the subrectangular part is provided on distal margin, just before the middle with an uncus, formed of four distinct pustules. arranged in a line, decreasing in size toward the apex; a slight gap between the first two pustules and the remaining two.

Male.—Length 0.720 mm. The single male specimen associated with the above females appears almost like a different species, being distinctly larger, of a totally different coloration and having the antennae dissimilar. General color yellowish, the head more orange, the prescutum, scutellum, axillae and propodeum and tip of abdomen suffused with brown; legs pale yellowish with exception of two-thirds of the posterior tibiae. Antennae very pale brownish, the club more yellowish, and there is an indication of reddish pigment at base of the first funicle joint; the scape compressed, over twice as long as wide; the pedicel subtriangular, only about half as long as the scape; provided with bristle-like setae, but the corneous sensoria are less numerous than in the female and less distinctly defined. Forewings quite similar to those of the female, the marginal and stigmal veins appearing somewhat thicker and the latter is less rectangular, the inner apical point being more drawn out.

Described from a series of 59 females, mounted in balsam on nine slides, and a single male, all reared by the writer from eggs of an orthopterous insect, presumably a small katydid, on the Haitian oak, *Catalpa longissima*, at Damien, Haiti, Feb. 27, 1931. Two slides containing eleven paratype females deposited in the U. S. National Museum No. 43891.

A large number of the host egg masses were collected Feb. 25, 1931, on two young Haitian oak trees. These for the most part were glued on the upper surface of the leaf, always at its base along the main vein, but some placed on stems just at the joint. The masses contained from seven to eleven rather elongated eggs (measuring 1.50 mm. in length), each in a layer of flat dried skin-like parchment. These are placed overlapping each other, somewhat scale-like, and the mass appearing as only a slightly elevated glistening chitin colored object that easily escapes observation. The entire mass measured about 3.50 x 4 mm. The eggs within the glued mass were of a dirty grayish color with an olive cast. On February 27, large numbers of the parasites issued, one to each egg, leaving small round exit holes. Four specimens of an undetermined entodonine wasp parasite were reared at the same time from the egg masses but their status is unknown.

Ufens ormenidis, new species.

Easily separated from the known North American and West Indian species of the genus by its small size, coloration, antennal and venational characters.

Female.—Length 0.487 mm.; expanse 0.903 mm.; greatest width of forewing 0.229 mm. General color orange-yellow, marked with fuscous beneath, on the sides of the thorax, and the posterior border of each abdominal segment is marked with a fuscous band; the antennae pale brown, the scape distinctly paler; eyes red; legs with the proximal two-thirds of the femora and tibiae more or less fuscous, the remainder pale to a soiled yellowish.

Rather short and robust in appearance, the head about equal in width to the thorax. Scape rather short and compressed, a third longer than the pedicel; two very minute ring-joints present; the two funicle joints closely joined, separated only by a fine suture, the first joint being distinctly the shorter and only about half as long as the second; the two combined funicle joints are about equal to the pedicel in length and are slightly wider; the club 3-jointed. Each joint diminishing successively in width, the first being distinctly wider than the funicles, the terminal joint at base about half the width of the second club-joint; all the funicle and club joints are provided with the conspicuous corneous sensoria so characteristic of the genus; in this case these are not developed to the extent of those in *Ufens osborni*, reaching only very slightly beyond the distal margins of the joints. The forewings are typical for the genus, being large and rather broad, rounded at the apices; the discal cilia arranged in about 19–20 lines, less regular than in *Ufens beneficus* Dozier and more regular than in *Ufens niger* (Ashm.) and *Ufens osborni* Dozier. Hind wings with three regular lines of setae. The darker portions of the body and legs appear elongately recticulated, under high magnification.

Male.—Length 0.574–0.659 mm. Similar to the female in color but distinguished at once by the dissimilar antennae and the presence of bulbous internal genital organs that show through the wall of the abdomen in balsam mounted specimens; under direct light these appear distinctly orange. The male antennae do not show as much difference between those of the female in this species as is the case with *Ufens beneficus* and *osborni*. Composed of nine joints, the scape nearly twice as long as the pedicel; first and second funicle joints closely joined together but separated by a distinct suture, the first joint being very short, only about one-fifth as long as the second, the two combined being longer and wider than the pedicel; the second joint with revolving or twisted sensoria; the club 3-jointed, the first joint narrowest at its base, then widening to its juncture with the second where the club presents its greatest width, from that point tapering to the terminal apex; the sutures dividing the club-joints are very irregular; club joints provided with numerous bristle-like hairs and a few corneous sensoria.

Described from twelve females and three males, mounted in balsam on seven slides, reared by the writer from cottony covered eggs of the common fulgorid, *Ormenis* sp., on red-flowered ornamental shrub on the Ecole Centrale grounds at Damien, Haiti, Feb. 19–24, 1931; four females and one male, reared from eggs of undetermined *Ormenis* on large-leaved *Bunchosia* on hillside at Tapion, Haiti, Feb. 20, 1930; one female reared from *Stigmatophyllum lingulatum* vine material at Damien, Haiti, May 11, 1930; one male from *Malphigia glabra*, infested with *Ormenis* sp. at Port-au-Prince, Haiti, Aug. 3, 1931; one female from white cottony covered fulgorid egg mass on Stigmatophyllum at Cazeau, Haiti, Jan. 6, 1930.

Three slides containing two paratype males and three paratype females are deposited in the U. S. National Museum No. 43892.

Ufens osborni, new species.

Distinctly larger than all described members of the genus. A superficial study would seem to warrant the erection of a new genus to contain this species but a detailed examination shows that the species falls into *Ufens*, the most distinctive features being the greater development of the corneous sensoria of the antennae and the greatly shortened marginal vein.

Female.—Length 0.760 mm.; expanse 1.30 mm.; greatest width of forewing 0.329 mm. General color yellowish-orange, the head distinctly darker, the pronotum infuscated on the dorsum; the dorsum of the abdomen marked on its basal half with fuscous, appearing almost like two transverse bands in balsam mounted specimens; another transverse band of fuscous present nearer the tip; eyes red; antennae pale brown; legs pale yellowish.

Antennae 9-jointed, consisting of long scape, pedicel, two minute but distinct ring-joints, two funicle joints, and a 3-jointed club. Scape rather long and only slightly compressed; pedicel subtriangular, slightly over a third as long as the scape; the two funicle joints subequal in length and width, exceeding slightly in combined length that of the first club joint; club composed of three joints, the second distinctly longer than the first and slightly narrower; last club joint distinctly long and narrow with a terminal narrow extension; the funicle and club joints are provided with conspicuously developed long corneous sensoria that project considerably beyond the distal ends of the joints and flaring outwards visibly from the sides; in addition there are numerous strong bristle-like setae present. Forewings typical in shape for *Ufens* being rather large and broad, rounded at the apices; marginal fringe very short and dense; the discal setae arranged in 24 or more lines, so irregular that it is impossible to say accurately how many lines or rows there are; two lines appear slightly more prominent than the others, namely, the third which runs on a line with the uncus and another extending from the distal end of the stigmal vein; the submarginal vein is somewhat triangular in shape, with a pair of very strong setae; the marginal vein remarkably short and broad, almost as wide as long; stigmal vein also very short, distinctly shorter than the marginal to which it is joined by a short constriction, subquadrate in shape with an uncus present at upper distal end, composed of four minute but distinct pustules. Rather robust in general form, the abdomen being subequal in length to the thorax. The front and middle femora long and narrow, the hind femora distinctly more robust and thicker. The ovipositor barely extruded beyond the tip of the abdomen.

Male.—Length 0.78 mm. Similar to the female in coloration but differing in antennal structure greatly. Antennae 9-jointed, there being no great differentiation between the funicle and club joints, each having one to two whorls of prominent long verticillate hairs; the funicle and club joints decrease slightly and successively in width and length.

Described from a series of specimens, reared by Herbert T. Osborn at Central Aguirre, Porto Rico, in 1930 from eggs of the Sugar Cane Root Weevil, *Diaprepes abbreviatus*, and kindly given the writer for study and determination by Dr. J. G. Myers, and a slide containing four females and three males in the U. S. National Museum, also reared by H. T. Osborn at Central Aguirre in October, 1928. The female holotype and male allotype on the above mentioned slide, mounted in balsam, is in the U. S. National Museum Type No. 43893.

The writer takes pleasure in naming this valuable parasite after its discoverer, Dr. H. T. Osborn, former Entomologist for the Aguirre Sugar Company.

A NEW THRIPS FROM PLUMMER'S ISLAND, MARYLAND.

By J. Douglas Hood, *University of Rochester*.

Nearly nineteen years have elapsed since the first specimen of the thrips here described was collected in early spring beneath loose bark on a living sycamore tree on Plummer's Island, Maryland; and in the eighteen years which have passed since the last accessions were made, I have constantly hoped to discover something of its habits during the summer season, and to learn upon what plant or plants it feeds—for, of course, it is either phyllophilous or anthophilous and not bark-inhabiting. But as it is clearly new to the North American list and quite unlike any of the numerous European species, I have finally ventured to describe it. The types are in my collection.

Thrips pectinatus sp. nov.

(*Pl. 5, Figs. 1-4.*)

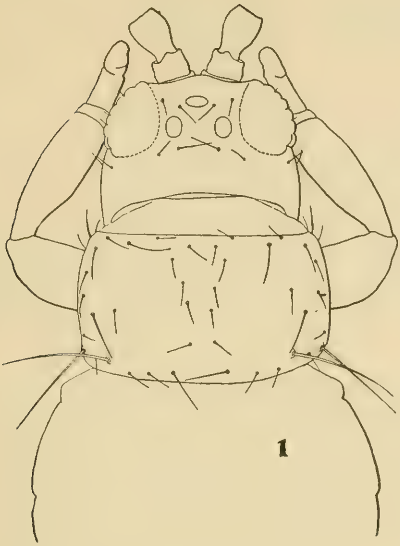
Female (macropterous).—Length about 1.07 mm. Color straw-yellow; pterothorax and seminal receptacle darker and slightly orange; abdomen with about a dozen blotches of pale yellow subhypodermal pigmentation, these black by transmitted light and hardly half as large as eye; ocellar pigmentation bright red; antennae with segments 1 and 3 pale yellow, 2 distinctly darker, concolorous with sides of pterothorax, 4 pale yellow, lightly clouded apically, 5 clear yellow in basal half, clouded with gray-brown in apical half, 6 gray-brown, paler in basal fourth, 7 gray-brown; wings lightly yellowish; legs clear pale yellow; all body bristles pale, yellowish, excepting those at tip of abdomen, which are pale brownish.

Head nearly 1.5 times as wide as long (measuring from sides of frontal costa to posterior dorsal margin), nearly 0.9 the length of pronotum, broadest midway between eyes and base; cheeks moderately arched; vertex flattened, transverse, and nearly vertical, scarcely forming an overhanging angulation above antennae; interocellar bristles shorter than postocellars, somewhat longer and stronger than postoculars, all transparent and barely visible. Eyes nearly 0.6 as long as head and nearly 0.7 as wide as their interval, not prominent nor protruding, pilose as usual. Ocelli normal, situated slightly in advance of middle of eyes. Antennæ (Pl. 5, fig. 2) slender, about 2.57 times as long as head, of normal structure; segment 3 about 2.7 times as long as wide, equal in length to 6; 7 slender, nearly three times as long as greatest width.

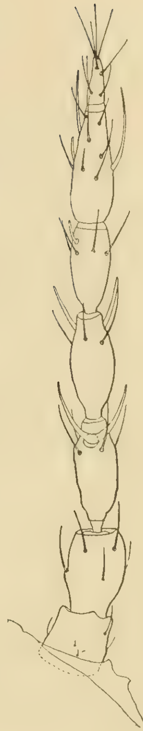
Prothorax about 1.5 times as wide as long, usually slightly narrowed in front, slightly longer than and 1.2 times as wide as head; bristles at posterior angle, yellow, long, subequal, or with the outer pair somewhat shorter (70–72 μ) than the inner (72–76 μ); all other pronotal bristles long, slender, pale, and nearly invisible, three pairs on posterior margin, the innermost pair half the length of the inner pair at posterior angles. Pterothorax more than 1.3 times as wide as prothorax. Fore wings (Pl. 5, fig. 4) about 0.68 mm. long, costa with about 22 bristles, anterior vein with about 7 (4+3) near base and 3 equidistant ones (rarely 2) in distal half, posterior vein usually with 10.

Abdomen of normal form; tergite 8 (Pl. 5, fig. 3) with a complete comb of slender teeth on posterior margin; abdominal bristles yellow, with a slight brownish cast, inner pair on posterior margin of tergite 9 about 80 μ long, outer pair 92–100 μ, lateral pair 88 μ, inner pair on tergite 10 about 88 μ and outer pair 76 μ; ovipositor 200 μ; sternites with the usual three pairs of long bristles on extreme posterior margin, but without accessory bristles.

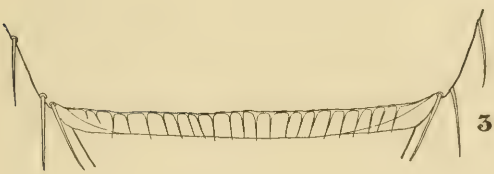
Measurements of holotype (♀): Length 1.07 mm.; head, median dorsal length 0.102 mm., greatest width (behind eyes) 0.153 mm., least width (at base) 0.146 mm., width across eyes 0.150 mm.; eyes, length 0.060 mm., width 0.044 mm., interval 0.064 mm.; prothorax, length 0.120 mm., width .188 mm.;



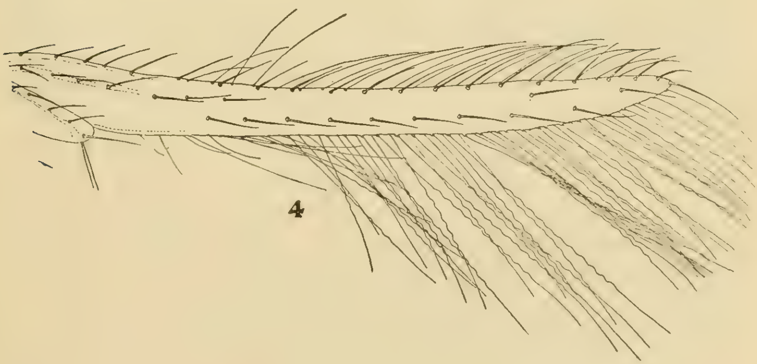
1



2



3



4

inner bristles at posterior angles of prothorax, length 76 μ; outer bristles, length 72 μ; pterothorax, width 0.252 mm.; fore wings, length 0.675 mm.; abdomen, greatest width 0.260 mm.

Antennal segments:	1	2	3	4	5	6	7
Length (μ)	27	40	49	42	36	49	19
Width (μ)	27	25	18	18	18	17	7

Total length of antenna 0.262 mm.

Male.—Unknown.

Described from ten females taken by the writer on Plummer's Island, Maryland, under the loose bark of a living sycamore tree. One of them was reared from a pupa taken March 30, 1913; the other nine were taken April 12, 1914, from the same individual tree.

From all North American species of the genus, with the exception of *winnemanae*, *heraclei*, and *flavus*, this species may readily be separated by the pale body color, pale antennae, complete comb on abdominal tergite 8, and the presence of three bristles only on the distal half of the anterior vein of the fore wings. From these three it may at once be known by the pale, slender bristles on the body and wings, the presence of 9 or 10 instead of 12–15 bristles on the posterior vein of the fore wings, the much shorter head (which is 1.4–1.5 times as wide as its median dorsal length, as against 1.3 for *winnemanae* and not more than 1.2 for *flavus* and *heraclei*), and the stouter fifth antennal segment, which is only twice as long as wide. For some years I have considered it a new species allied to the European *albopilosus*, and it has been identified as that species by one of the leading European students of the group; but *albopilosus* has the comb of abdominal tergite 8 broadly interrupted medially. In Priesner's key *pectinatus* runs to *praetermissus;* but that has a decidedly longer head[1] and much shorter and darker body bristles.

EXPLANATION OF PLATE

(*J. D. H., camera lucida.*)

Thrips pectinatus, sp. nov.

Fig. 1. Head and prothorax, ♀, paratype; bristles omitted from all appendages.
Fig. 2. Left antenna, ♀, paratype; microtrichia omitted.
Fig. 3. Posterior portion of tergite 8, ♀, paratype, showing comb.
Fig. 4. Right fore wing, ♀, paratype; microtrichia omitted.

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[1]In making this comparison it should be borne in mind that Priesner considers the length of the head to be the distance from its posterior dorsal margin to the front margin of the eyes, instead of to its most anterior prolongation between the antennal bases. Measuring the head of *pectinatus* in this way, one gets 1.8 as the ratio between greatest width and length, instead of 1.5 as given in the above description.

ON THE IDENTIFICATION OF ANOPHELES MOSQUITO LARVAE IN FLORIDA.

By G. H. BRADLEY,

Bureau of Entomology, United States Department of Agriculture.

The writer was located in northeastern Louisiana for several years and while there he used the "Key to the larvae of the three common anopheline mosquitoes of the southern United States," worked out by Russell[1] for identifying the larvae of *Anopheles quadrimaculatus* Say, *A. crucians* Wied., and *A. punctipennis* Say. Frequent rearings of adults from identified larvae during that period gave no reason to doubt the value of the larval characters used in that key. The key is as follows:

1. Abdominal segments 4 and 5 having two dorsal tufted hairs directly anterior to the palmate hair, one in front of the other........*A. crucians*
   Abdominal segments 4 and 5 having but one dorsal hair directly anterior to the palmate hair........2.
2. Anterior internal clypeal hairs close together at base........*A. punctipennis*
   Anterior internal clypeal hairs well separated at base....*A. quadrimaculatus*

Since coming to Florida, however, the writer has found that in this area the characters used in this key can not be relied upon entirely to distinguish the larvae of these mosquitoes.

For instance, a collection of anopheline larvae from Chara pools along the St. John's River, just east of Orlando, was recently made and the larvae were identified by the foregoing key. There appeared to be larvae of all three species present, with those of *A. punctipennis* predominating. These larvae were separated for rearing, with the result that only *A. crucians* adults emerged from each lot. Examination of mounts of male genitalia showed them to be typical *crucians*.

The water in the pools from which these larvae were taken was slightly brackish, having a salts content of 3.9 grams per liter of water.[2] Since making the collection the writer has taken apparently similar larvae from coastal marshes at Buras, La., and from Coden, Ala., but he has been unable to rear any adults from them.[3]

The situation seems to be as follows: There are two varieties of *A. crucians* larvae present in this territory. One variety is

[1]Russell, P. F. 1925. Identification of the larvae of the three common anopheline mosquitoes of the southern United States. Amer. Jour. Hyg. 5: 149–174.

[2]The writer is indebted to Dr. A. E. Hughes, of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, for making this determination.

[3]Since this paper was prepared Dr. E. H. Hinman has informed the writer that he has reared *A. crucians* from larvae of this variety collected at Buras.

easily identified by the presence of two pairs of hairs (antepalmate and dorsal submarginal hairs of Russell), each with from 4 to 7 branches anterior to the palmate hairs on abdominal segments 4 and 5. The other has only one pair of either single or two-branched hairs (antepalmate hairs of Russell) anterior to the palmate hairs on these segments. For purposes of this discussion these varieties will be called the inland and the coastal variety, respectively. Both varieties usually have the bases of the anterior internal clypeal hairs close together. Russell[1] found these anterior internal clypeal hairs well separated in only 3.4 per cent of larvae of the inland variety, and the writer has found this wide separation occurring in 12.5 per cent of larvae of the coastal variety. It was this wide separation occurring with a single pair of antepalmate hairs on abdominal segments 4 and 5 which led the writer to identify some of these larvae as *quadrimaculatus*. It is apparent, therefore, that in this area other characters must be considered in making specific determinations of Anopheles from larvae.

The following key for separating these larvae has been prepared for use in this area. It is based in part on the characters used and discussed by Russell[1] and in part on those by Dyar.[1]

1. Abdominal segments 4 and 5 with 2 dorsal hair tufts directly anterior to the palmate hair, one in front of the other....*crucians* (inland variety)
   Abdominal segments 4 and 5 with but 1 hair tuft directly anterior to palmate hair........2.
2. Abdomen with well developed palmate hairs on segments 2 to 7, inclusive. Bases of anterior internal clypeal hairs well separated...... *quadrimaculatus*
   Abdomen with well developed palmate hairs on segments 3 to 7, inclusive. Bases of anterior internal clypeal hairs usually close together........3.
3. Palmate hairs on abdominal segment 7 smaller than on 6; posterior clypeal hairs longer, usually single. Antennal branched hair long........ *crucians* (coastal variety)
   Palmate hairs on abdominal segment 7 of approximately the same size as on 6. Posterior clypeal hairs shorter, usually double. Antennal branched hair small........*punctipennis*

An excellent discussion of the variations which will be encountered in the use of the characters given in the above key will be found in the paper by Russell,[1] and in this connection attention should also be called to the valuable work of Root[2] on the pilotaxy of Anopheles larvae.

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[1]Dyar, H. G. 1928. The mosquitoes of the Americas. Carnegie Inst. Washington Pub. 387. 616 pp.

[2]Root, F. M. 1924. The larval pilotaxy of *Anopheles quadrimaculatus* and *Anopheles punctipennis*. Amer. Jour. Hyg. 4 : 710–724.

A series of reared adults, together with their larval skins, of the coastal type of *A. crucians* discussed herein has been deposited in the National Museum.

A LIST OF INSECTS COLLECTED IN MOSS AND LICHENS ON OAK TREES NEAR CORVALLIS, OREGON.

By A. O. Larson and Frank G. Hinman.

While collecting pea weevils from their winter hibernating quarters near Corvallis, Oregon, during January and February, 1931, the writers obtained many other insects spending the winter in moss and lichens attached to the trunks and branches of trees. The lichen *Usnea plicata*, in which most of the insects were found, was attached mainly to oak trees and is very abundant in western Oregon, where it apparently furnishes winter protection for great numbers of insects.

Some of the insects collected appear to be new to science. In the case of one species even the genus was unknown. Others have been reported as hibernating in quite different surroundings. The winter habits of others of these insects have not been recorded. For these reasons it is desirable that this list of insects be published. They were kindly determined by the specialists of the Bureau of Entomology as listed below.

COLEOPTERA

Epitrix subcrinita Lec.
Phyllotreta pusilla Horn.
Chalcoides helxines Auct.
Galerucella nymphaeae L.
Orsodachne atra vittata Say.
Anthicus nitidulus Lec.
Anthicus floralis L.
Listrus sp.
Dasytid (Genus unknown).
Bruchus pisorum L.
Bruchus pauperculus Lec.
(Determined by H. S. Barber.)

Typhaea fumata L.
Melanophthalma americana Mann.
Melanophthalma gibbosa Hbst.
Lathridius armatulus Fall.
Throscus sericeus var. debilis Horn.
Ludius carbo (Lec.).
(Determined by W. S. Fisher.)

Pseudohylesinus sp.—sericeus or near.
(Determined by M. W. Blackman.)

Lebia guttula Lec.
Anthonomus squamosus Lec.
Sciopithes obscurus Horn.
Apion cribricolle Lec.
Apion sp.
Smicronyx cinereus Mots.
Smicronyx sp.
Hypera compta Say.
Sitona hispidula Fab.
(Determined by L. L. Buchanan.)

Psyllobora taedata Lec.
Adalia bipunctata L.
Coccinella juliana Muls.
Cycloneda munda Say.
Cleis picta Rand.
Hippodamia ambigua Lec. and Hippodamia convergens Guer. Showing transitional forms.

Hippodamia complex Csy.
Hippodamia parenthesis Say.
Scymnus phelpsi Crotch.
Scymnus americanus Muls.
Scymnus sp. (25 pp.)
Tachyporus sp.
Cryptarcha liturata Lec.
Meligethes mutatus Har.
Helops pernitens Lec.
Helops laetus Lec.
Aphodius pardalis Lec.
(Determined by E. A. Chapin.)

HEMIPTERA

Neottiglossa cavifrons Stål.
Heterogaster behrensii Uhl.
Peritrechus tristis VanD.
Peritrechus Sp. (probably new)
Ischnorhynchus franciscanus Stål.
Crophius bohemani Stål.
Nysius californicus Stål.
Piesma cinerea Say.
Corythucha salicata Gibson.
Monanthia labeculata Uhl.
Lygus pratensis L.
Lygus rubicundus Fall.
Deraeocoris brevis Uhl.
Corizus scutatus Say.
Corizus n. sp. (?).
Corizus punctatus Sign.
Neides muticus Say.
Anthocoris sp. ? (Poor condition).
Nabis alternatus Parsh.
(Determined by H. G. Barber.)

DIPTERA

Mycetophila sp. (broken).
Sciara sp.
Chironomus sp.
Empis sp. (poor condition) near poplitea Lw.
(Determined by C. T. Greene.)
Oscinella n. sp.
Ephydrid—unrecognizable.
(Determined by J. M. Aldrich.)

HYMENOPTERA

Polyscelis spp. (Apparently two different species of the same genus and both probably new.)
(Determined by A. B. Gahan.)
Andricus sp.
(Determined by L. H. Weld.)

Hormius sp.
Hemiteles sp.
(Determined by R. A. Cushman.)

NEUROPTERA

Raphidia sp. larvae
(Determined by A. G. Böving.)
Hemerobius pacificus Bks.
(Determined by A. N. Caudell.)

CLASSIFICATION OF INSECTS.

A Key to the known Families of Insects and Other Terrestrial Arthropods. By Charles T. Brues and A. L. Melander. *Bulletin Museum of Comparative Zoology, Cambridge, Mass., vol. 73. 672 pages, 1125 figures. Price, bound in cloth, $6.50.*

This work is an expansion of a small volume by the same authors in 1915, entitled "Key to the Families of North American Insects." In its present form it covers the orders and families, and in many cases subfamilies, for the entire world.

Many years ago, in high school together under the late O. S. Westcott, these two authors began to collect insects and get them determined; before entering college they had accumulated named material in surprising quantity. Taking their college work under Professor Wm. M. Wheeler, they were encouraged to follow their natural bent in taxonomy. All this was many years ago, but the present volume is the logical result of the beginning under Westcott and Wheeler. Both of the authors are highly versatile, and while they are known as specialists in certain groups they have always had a voracious interest in all insects. Continuous teaching of entomology for many years by both has contributed to the retention of a broad interest in taxonomy. Now at the height of their activity they have given to the entomological world a summary of classification covering the whole field, certainly a notable contribution.

The system adopted, as would be expected, is derived from current literature with few changes; but as the various writers in this field differ considerably among themselves there has been much opportunity for selection. A conspectus at the beginning gives a condensed outline, from which the following list enumerates merely the subclasses and orders, with the number of families accepted in each order:

CLASS INSECTA.

Subclass APTERYGOTA.

Protura, 2 families.
Thysanura, 2 families.
Entotrophi, 3 families.
Collembola, 5 families.

Subclass PTERYGOTA.

GRYLLOBLATTODEA, 1 family.

Orthoptera,
Suborder Tettigoniodea, 8 families.
Suborder Acridodea, 4 families.
Phasmatodea, 5 families.
Dermaptera,
Suborder Forficulina, 29 families.
Suborder Arixenina, 1 family.
Diploglossata, 1 family.
Thysanoptera,
Suborder Terebrantia, 9 families.
Suborder Tubulifera, 9 families.
Blattariae, 24 families.
Mantodea, 1 family.
Embiodea, 2 families.
Isoptera, 5 families.
Corrodentia,
Suborder Parapsocida, 7 families.
Suborder Eupsocida, 6 families.
Zoraptera, 1 family.
Mallophaga,
Suborder Amblycera, 6 families.
Suborder Ischnocera, 4 families.
Anoplura, 6 families.
Homoptera,
Suborder Auchenorrhyncha, 40 families.
Suborder Sternorrhyncha, 17 families.

Suborder Coleorrhyncha, 2 families.
Hempitera,
Suborder Gymnocerata, 44 families.
Suborder Cryptocerata, 7 families.
Odonata,
Suborder Zygoptera, 12 families.
Suborder Anisozygoptera, 1 family.
Suborder Anicoptera, 6 families.
Plecoptera, 7 families.
Plectoptera, 14 families.
Megaloptera, 2 families.
Rhaphidiodea, 1 family.
Neuroptera, 20 families.
Mecoptera,
Suborder Protomecoptera, 2 families.
Suborder Eumecoptera, 3 families.
Trichoptera,
Suborder Aequipalpia, 10 families.
Suborder Inaequipalpia, 3 families.
Lepidoptera,
Suborder Jugatae, 7 families.
Suborder Frenatae, 120 families.
Suborder Rhopalocera, 16 families.
Diptera,
Suborder Nematocera, 29 families.
Suborder Brachycera, 96 families.
Siphonaptera,
Suborder Fractocipita, 3 families.
Suborder Integricipita, 6 families.
Coleoptera,
Suborder Adephaga, 13 families.
Suborder Polyphaga, 163 families.
Strepsiptera, 11 families.
Hymenoptera,
Suborder Chalastrogastra, 13 families.
Suborder Clistogastra, 94 families.
Total 34 orders and 903 families.

Immature stages are provided with keys, as far as the present state of knowledge permits, and many illustrations of them are given. This is an important feature of the work.

Pronunciation of names is indicated, and there will be many surprises for the average entomologist in the accented syllable of names in common use.

Still another important feature of the book, and one hardly to be expected, is a series of keys to "other terrestrial arthropods," including families of spiders, mites, myriopods, etc.

Important references to standard monographs and papers are given at the end of each order.

A glossary of special terms occupies 12 pages, and the pronunciation is indicated.

The index is very complete, extending to 53 pages, and common names separately indexed occupy three additional pages.

In design and execution, this may properly be called a monumental work. It should have a large circulation in all parts of the world. "North of Mexico," or even "North America," is a limitation which should not confine the entomologist of the future.

—J. M. Aldrich.

MINUTES OF THE 435TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, FEBRUARY 4, 1932.

The 435th regular meeting of the Entomological Society of Washington was held at 8 P. M., Thursday, February 4, 1932, in Room 43, of the new building of the National Museum. Mr. J. S. Wade, second vice-president, presided. There were present 46 members and 23 visitors. The minutes of the previous meeting were read and approved.

H. S. McConnell of the University of Maryland was admitted to membership by unanimous vote.

Under the heading "Reports of Officers," Mr. Rohwer read the following announcement which was received from Dr. C. W. Stiles:

"Formal notice has been received from Paris from Dr. L. Joubin, President of the Permanent Committee of the International Zoological Congress, that the twelfth congress will meet in Lisbon in the summer of 1935 under the

Presidency of Professor Arthur R. Gorge. I have been requested to bring this fact to the attention of American zoologists."

The first communication on the regular program was by E. A. Back, and was entitled "The pea-weevil problem in the northwest."

The pea weevil (*Bruchus pisorum*) although a cosmopolitan pest established in the United States from colonial days and for many years present in garden peas in the Northwest, has become a pest of major importance in the Palouse region of Idaho and Washington, and in the Willamette Valley in Oregon. The growing of Canadian field peas for food and seed in the Palouse area, and the rapid expansion of the Austrian winter pea seed industry in Oregon, to compete with seed introductions from Europe, has resulted in a tremendous increase in infestation by the pea weevil. In the Palouse area where the losses are not so excessive, due perhaps to climatic and floral conditions, the infestation of seeds delivered at the warehouse during 1926–1929 varied from 5% to 20% per year, representing in a cash loss to the growers of $583,035.00, to say nothing of the losses sustained in the field during harvest due to shattering and found to vary from 7% to 50% of the crop. In the Willamette Valley, favorable hibernating and climatic conditions result in a rapid building up of infestations when the same field is cropped continuously to peas. Fields cropped 1, 2, and 3 years showed infestations ranging from 1–10%, 22–27% and 77–98%, respectively. It is admitted that the pea weevil is to-day the only real obstacle to the firm establishment of the seed pea industry with resulting increase in land values. Bankers in the Palouse area state that the value of land will increase from $75 to $125 per acre with the firm establishment of the field pea in that area, meaning as it does an additional cash crop to be grown during what would otherwise be a fallow year between wheat crops.

Reference was made to the work of the Bureau of Entomology under way at Corvallis and Moscow, and facts given regarding the tremendous number of weevil adults that hibernate in vegetation surrounding pea fields, and to excessive shattering, of interest not only because of actual loss of crop but as an aid to field hibernation. Among the control measures developed by A. O. Larson, in field charge of the pea weevil investigations, is the burning of the pea vines after harvest. This has killed over 90% of the weevils in shattered peas and although necessitating a revolutionary change in cultural methods, is considered at present an excellent adjunct to prompt fumigation of the stored seeds. Lantern slides illustrated the paper.

Dr. Back stated in answer to a question that the common lupine of the Oregon Coast has not been found infested, and Mr. Bridwell added that no trustworthy records of attack on lupines by Bruchidae are known. A question on parasitism was referred to Mr. Bridwell, who stated that *Uscana semifumipennis* is a world-wide and efficient egg parasite of Bruchidae, which might be artificially increased, and that other parasites are known. (Author's abstract.)

This paper was discussed by Hyslop, Fracker, McIndoo, Middleton, Cory, Rohwer, Wade, Dozier, and Bridwell.

The second communication was by E. R. Sasscer, and was entitled "Ways in which plant pests may be introduced into the Continental United States."

After making a brief reference to the Act of 1905—An Act to Prohibit the Importation or Interstate Transportation of Insect Pests and the use of the

United States Mails for that purpose, and to the Plant Quarantine Act of 1912, reference was made to the enforcement of quarantines and regulatory orders issued thereunder.

While mention was made of insects and plant diseases which are intercepted in commercial shipments imported under permit, special emphasis was given to the unusual ways in which insects may be introduced, i. e., in passengers' baggage, ships' stores, crews' quarters, parcel post, etc. It was pointed out that for the most part, prohibited material found infested with insects was brought in through ignorance, but that there were a number of records of attempts to smuggle. Attention was also given to the risk which has developed in connection with the increased use of airplanes and dirigibles. Examples of insect pests were cited, which have arrived by these methods of transportation. The talk was illustrated with lantern slides. (Author's abstract.)

This paper was discussed by Back, Clausen, A. C. Davis, and Bridwell.

Under the heading "Notes and exhibition of specimens," Dr. Böving showed a letter from France announcing the death of Doctor Charles Janet; he spoke of his acquaintance with Janet, and of the life and work of this entomologist. Dr. Böving also exhibited a copy of the new book by Böving and Craighead entitled "An illustrated synopsis of the principal larval forms of the order Coleoptera."

Mr. Middleton spoke of the introduction of *Diprion polytomum* Hartig, a European pest, into the Gaspe region of Canada. It was found for the first time in 1930 injuring spruce over an area of 75 square miles.

This note was discussed by Rohwer.

Mr. Bridwell called attention to the interesting and important paper by Vance and Parker in the January Proceedings on the habits of *Laelius anthrenivorus* Trani., which is a substantial addition to our knowledge of the Bethylidae. This recalled the classical observations on the habits of *L. trogodermatis* Ashmead made by our good friend August Busck, briefly reported by him in our Proceedings 4 : 234–235, 1897, and more fully by Dr. L. O. Howard, 1901, Insect Book 35–36, which seems to have been overlooked by the authors and most other writers on the habits of the Bethylidae. The oversight of this important contribution is easily understood, for such large books as Dr. Howard's are rarely well abstracted and indexed in general bibliographical works. The Zoological Record for 1901 contains no reference to this original contribution, and the index of our Proceedings, Vol. 4, does not include *Laelius*. Many other notes of similar value are buried in our 33 published volumes and it is to be hoped that our publication funds may permit the compilation and publication of a full General Index of our Proceedings with the end of Volume 50, if not before. In addition to the two species of *Laelius* mentioned, *L. utilis* Cockerell affects dermestid museum pests. Other species of *Laelius* are reported by Kieffer on the authority of Perris to affect *Exocentrus* (Cerambycidae), *Synoxylon sexdentatus* (Bostrychidae), and *Anobium villosum* (Anobiidae).

Meeting adjourned at 10.05 P. M.

F. M. WADLEY,
Recording Secretary.

Actual date of publication, April 1, 1932.

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PROCEEDINGS OF THE

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THE EARLY STAGES OF SOME TRYPHONINE HYMENOPTERA PARASITIC ON SAWFLY LARVAE.

By CURTIS P. CLAUSEN,
Senior Entomologist, Bureau of Entomology, United States Department of Agriculture.

A considerable number of the tryphonine Hymenoptera are parasitic upon the larvae of sawflies, and numerous records are available of their rearing from the cocoons of this group. Aside from the host records, however, very little has been published regarding their life histories or habits.

This paper deals with five species of the subfamily which have been found as external parasites of sawfly larvae in Chosen (Korea). These species,[1] with their hosts, are as follows:

Anisoctenion alacer Grav.	Allantus
Exenterus coreensis Uchida	Lophyrus
Polyrhysia clauseni Uchida	Periclista
Tryphon incestus Holmg.	Dolerus
Tryphon semirufus Uchida	Periclista

Particular attention has been paid to the egg and first larval forms of these species, as they present unusual deviations from the normal type occurring in the Ichneumonidae.

THE EGG.

The eggs of the five species discussed in this paper may be divided into two distinct groups on the basis of their structure, which is correlated with the manner of their attachment to the body of the host to prevent loss at the time of molting. In the first group the egg is largely imbedded in the body of the host, with only its dorsal surface exposed externally. The most simple egg of this type is that of *Exenterus coreensis* (Pl. 6, Fig. C.), which is oval in form and without any accessory structures whatever. A second species of this group is *Anisoctenion alacer*, which reveals an egg markedly different from

[1]Determinations and descriptions of new species are by Prof. T. Uchida, of the Hokkaido Imperial University, Sapporo, Japan.

any heretofore recorded in the family. This egg (Pl. 6, Figs. E, F), bears upon its ventral side a large shield-shaped structure which opens, umbrella-like, when laid. The margins of this shield are coarsely dentate and the anterior end is somewhat extended and broadened. The marginal areas are black, while the central portion is clear, with the exception of the median longitudinal area, which is slightly darkened. In the ovarian egg (Pl. 6, Fig. D) this shield is quite transparent, and the marginal portions envelop the egg more closely than when laid. The dorsal surface of the laid egg (Pl. 6, Fig. G), which is exposed after deposition, is very nearly flat, and at each end there is a distinct flattened process, which lies parallel with the longitudinal axis of the egg. These processes may possibly fulfill some function at the time of oviposition. That portion of the dorsum of the egg which is external to the host after deposition bears irregular reticulate markings.

The egg of Anisoctenion is sunk into the skin of the host larva in exactly the same way as is that of Exenterus, and the added security afforded by the shield seems quite unnecessary. The egg proper can be readily removed from the body of the host, and in this case the shield remains in the wound and seals it. This darkened shield is distinctly visibly externally and serves to distinguish clearly those host larvae which have been attacked by the parasite.

In the second group mentioned above the egg body lies entirely external to the host, rather than being imbedded in the skin, and is securely fixed to the host body by an "anchor," which alone is inserted beneath the derm. The anchor itself is quite distinct from the egg chorion, whereas the stalk to which it is attached is evidently a continuation of the chorion. In the ovarian egg this stalk is much shortened, and is drawn out to its final form at the time of extrusion from the ovisac, which may or may not coincide with the time of oviposition. After deposition the anchor becomes black and, in the older specimens, is surrounded by a mass of material of host origin. This is probably the result of the defensive reactions of the host in an effort to encapsulate the foreign body.

In the laid egg of *Tryphon incestus* the stalk is approximately two-thirds the length of the egg body, and the anchor is relatively small. This egg is always placed in the groove between the head and the first thoracic segment of the host larva. The anchor lies immediately beneath the derm, and the greater portion of the stalk, and the entire egg body as well, is external. The chorion of this egg is yellowish in color and exceedingly tough, and it is only with difficulty that the egg or the stalk can be pierced or broken. The ovarian and laid eggs are shown in Plate 6, Figure A, and the anchor is situated at the posterior end. In Plate 6, Figure B, several eggs in various stages of development are shown in the normal position at the neck of the host larva.

The extreme of this type of egg is shown in *Tryphon semirufus* (Pl. 6, Fig. H) in which both the anchor and the slender stalk to which it is attached are nearly twice the length of the egg body. The ovarian egg reveals the stalk as being only one-fifth the length of the egg body itself. The posterior portion of the anchor is much shortened, broadened and curved dorsally, while the narrower anterior portion extends along the length of the ventral side of the egg, along the median line, and curves around the anterior end.

At the time of extrusion from the ovisac the stalk is drawn out to its final thread-like form, and the anchor expands to the form shown in the figure. The width of the anchor approximately equals its thickness. Unlike the egg of *Tryphon incestus*, in which the anchor only is imbedded in the host body, that of *T. semirufus* is imbedded to the full length of the stalk. Even at this depth the black color of the anchor is distinctly visible through the host derm. An egg identical with that here described is figured by Bischoff[2] for Tryphon in Europe.

In *Polyrhysia clauseni* the egg is intermediate in form between that of *T. semirufus* and that of *T. incestus*. The anchor of the ovarian egg extends only half the length of the egg ventrally, while in the laid egg both the anchor and the stalk are proportionately shorter.

THE PRIMARY LARVA.

In the first larval stage of the Tryphonini here dealt with there is also a marked departure in form from what may be considered as the normal for the family. In view of the conditions under which these larvae develop, these modifications are difficult of explanation. The two extremes are represented by *Tryphon incestus* (Pl. 2, Fig. E) and *Anisoctenion alacer* (Pl. 2, Fig. B). The larva of *T. incestus* is of quite normal ichneumonoid form and habit, with the head relatively large and heavily chitinized and the various body segments bearing numerous short setae. Those of the thoracic segments are evenly distributed over the dorsum and the sides, while on the abdominal segments they occur only dorsally, and in the median transverse area. The antennae are relatively small.

In *Anisoctenion alacer* the most conspicuous modification is that which provides each body segment with a group of long, slender hairs extending outward from the lateral margins. On the thoracic segments these hairs usually number five or six on each margin, and they are situated on the median transverse line. Those on the abdominal segments are similarly situated,

[2]Bischoff, H. Biologie der Hymenopteren. Berlin, 1927. p. 314.

though on the first two segments they are four in number and on the remaining segments only three. These lateral hairs of the first two body segments are about half the body length, while those of the following segments are successively shorter. On the ventral side of the body is one pair of spines on each segment except the last, while dorsally two pairs are present on the corresponding segments. These spines are approximately equal in length to the segment on which they are borne. In addition to the long hairs and the spines mentioned above there are a number of setae upon each of the first nine body segments, all of which are situated on the median transverse line.

Each of the first five abdominal segments bears a pronounced welt or raised area on the median dorsal line, the anterior ones being the larger. The caudal segment is modified into a sucker-like organ similar to that possessed by many other parasitic and predacious larvae of external feeding habit. This sucker, however, is directed dorsad, rather than ventrad.

The head of *A. alacer* is more triangular than that of *T. incestus* and the antennae are exceptionally large. A single pair of setae is present on the latero-posterior margin dorsally, while on the ventral side there are six pairs, equally spaced just within the lateral margin, and two pairs, of somewhat greater length, in the medial posterior area, as shown in Plate 2, Figure C.

The larva of Anisoctenion has developed the suprising habit of moving upon its back in a looping manner rather than in the normal way. The morphological modifications above mentioned all contribute to the accomplishment of this mode of locomotion, and apparently have been developed for this purpose. The lateral tufts of long hairs serve to hold the body in a horizontal position, while the median row of welts on the dorsum of the abdomen, and the dorsally directed caudal sucker, give adequate purchase upon the surface. The larva of *T. incestus*, which does not possess these modifications, achieves movement in the normal manner.

The larva of *Tryphon semirufus* differs markedly from that of *T. incestus* and, instead, is similar in all essential respects to that of Anisoctenion. The lateral groups of hairs are approximately half as long as those in *A. alacer*, while the dorsal segmental welts on the abdomen and the dorsally directed caudal sucker are also present.

In *Exenterus coreensis* (Pl. 7, Fig. D) the larval characters are identical with those of *T. semirufus*. The groups of long lateral hairs on the median transverse line of each segment are set on very distinct raised areas.

It is thus seen that the modifications in larval form do not group themselves in accordance with the egg forms. The larvae of *Anisoctenion alacer* and *Exenterus coreensis*, which develop from imbedded eggs lacking the stalk, are equipped for locomotion in the inverted position, while that of *Tryphon semirufus*, which comes from the extreme form of stalked egg, is almost identical with that of Exenterus. In contrast to this, the larva of *Tryphon incestus* lacks entirely the lateral tufts of long hairs, the dorsal welts on the abdominal segments, and the dorsally directed sucker at the caudal end of the body. It consequently effects locomotion in the normal way.

THE LATER LARVAL STAGES.

Only fragmentary data were secured regarding the second and succeeding larval stages. In *Anisoctenion alacer* and *Exenterus coreensis* the seond larval stage reverts to the normal ichneumonoid form for that stage. The conspicuous hairs and the caudal sucker are lacking, the dorsal segmental welts are reduced in size, and the head is small and only lightly pigmented.

The mature larva of *Anisoctenion alacer* is of thirteen body segments and is quite robust. Nine pairs of spiracles are present, which occur at the posterior margin of the first thoracic segment and near the anterior margins of the first eight abdominal segments. The median dorsal welts of the first five abdominal segments are still in evidence, though of reduced size. Each body segment bears a single row of small spines or setae on the median transverse line, and this row extends completely around the body.

LIFE HISTORIES AND HABITS.

OVIPOSITION.

In that group of the Tryphonini which have stalked eggs such as have been described herein the females are often seen to carry one or more of them already extruded from the ovisac, and with only the anchor held by the ovipositor. This habit was particularly noticeable in *Tryphon incestus*, and females carrying as many as ten eggs have been seen in the field. No apparent difficulty is experienced in actual oviposition under this condition.

The female of *T. incestus* deposits her egg upon the Dolerus larva when the latter is halfgrown or larger. She usually approaches it from the rear, examines it momentarily with the antennae, and then springs upon it with great speed. The ovipositor is thrust through the skin at the juncture of the head and the first thoracic segment, either dorsally or laterally. The anchor of the egg is inserted through the puncture, while the stalk and the egg body remain external. In the field larvae may be found bearing a "collar" of five or six of these eggs encircling the neck.

In *Exenterus coreensis* the egg is always placed transversely on the median dorsal line of the second thoracic segment. That of *Anisoctenion alacer* is usually at the lateral or latero-ventral margin of the thoracic or the first abdominal segments, though a few have occasionally been seen on the caudal segments also.

INCUBATION.

In the five species which have been studied the duration of the incubation period of the egg was found to be dependent upon the stage of growth of the host larva when attached. In *Tryphon incestus* the development of the embryo progresses quite rapidly, and the fully developed and darkened larva can readily be seen through the chorion six to eight days after deposition of the egg. In all of these species actual hatching does not occur until the pupation cell of the host has been formed and the latter is in the prepupal stage. In *T. semirufus* even the development of the embryo does not advance appreciably during the period in which the host completes feeding.

HATCHING.

As previously mentioned, all of these parasites are external in habit, even though the eggs of some species are so deeply imbedded in the derm of the host as to indicate that they will probably hatch internally. In Anisoctenion and Exenterus, in which the dorsum of the egg is flush with the body surface of the host, external hatching is made possible by the U-shape in which the embryo develops. The anterior and posterior ends of the body are sharply bent over the back, and the mouthparts of the larva are consequently in contact with the exposed dorsal side of the egg. The larva thus emerges externally rather than into the body of the host.

From experiments upon the eggs of *Tryphon incestus* it appears that the determining factor influencing the time of hatching is atmospheric humidity. Halfgrown Dolerus larvae bearing numbers of these eggs were placed in Petri dishes with an ample supply of fresh foliage of Equisetum for food. This foliage naturally induced a high humidity in the dishes, and under these conditions the eggs hatched quickly and irrespective of the stage of development of the host. The chorion of the egg of this species is so thick and tough that it is improbable that the larva would be able to break it under normal conditions. The increased moisture of the feeding dish, or of the host pupation cell, apparently softens the chorion after a few days and the shell splits longitudinally, beginning at the anterior end, and extending for approximately half its length.

After emergence from the egg the larva wanders about over the body of the host prepupa and soon settles and begins feeding. It is particularly noteworthy that the larvae of these species abandon the eggshell immediately after hatching. This is in marked contrast to the habits of certain known Paniscini (*Paniscus* spp.) which have an external stalked egg that serves to anchor the larva after hatching, and of certain Polysphinctini (*Polysphincta* spp.) which have an unmodified egg that strongly adheres to the host derm, and which serves the larva in the same way.

Development of the parasite larva is very rapid and the host dies without being able to attain the pupal stage. The five species which have been studied hibernate in the mature larval stage in the host cocoon. *Anisoctenion alacer* has only a single generation each year, and this is probably true of the other species also.

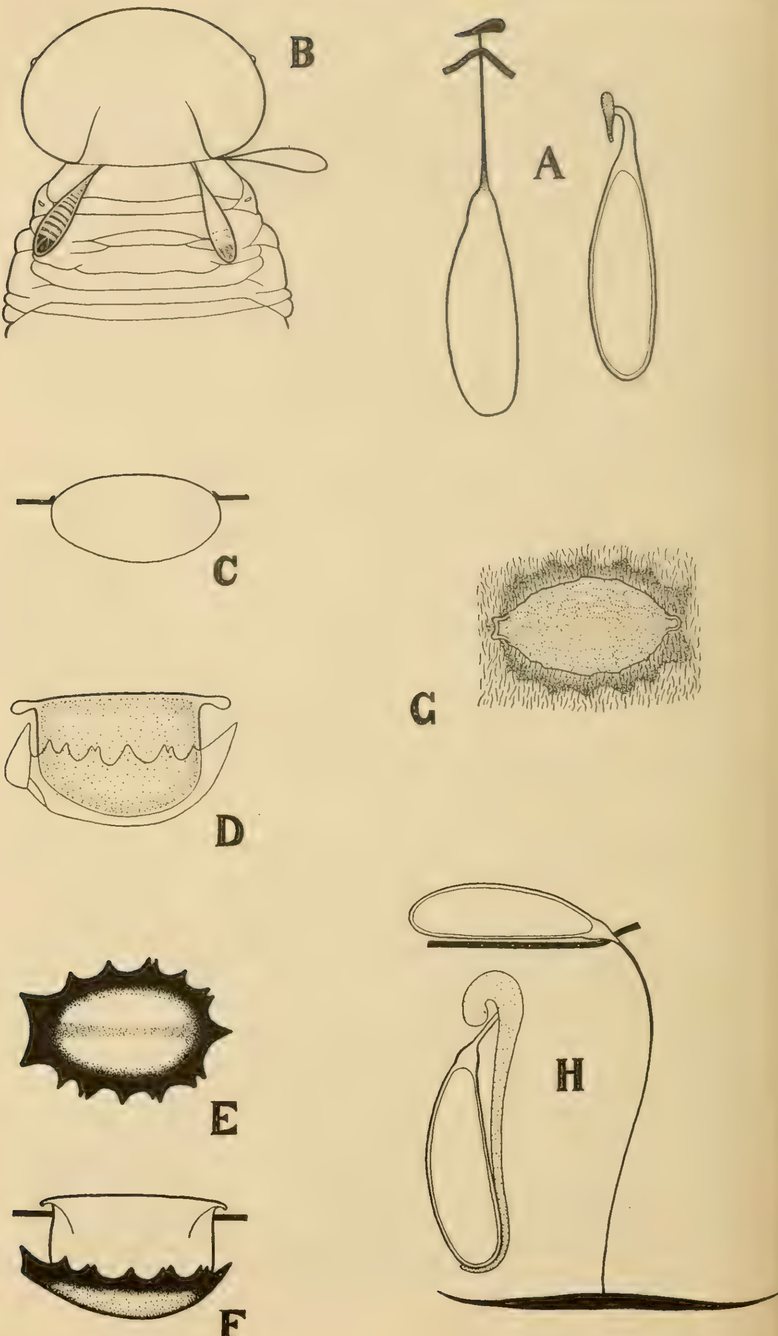
FIELD PARASITIZATION.

The larvae of *Dolerus* sp. feeding upon Equisetum at Suigen, Chosen, in May and early June of 1923, 1924, and 1928 were parasitized to the extent of 60 to 90 per cent by *Tryphon incestus*. In the same locality in May, 1923, *Periclista* sp. on oak showed approximately 10 per cent attack by *T. semirufus*. *Anisoctenion alacer* effected a parasitization of about 35 per cent of the larvae of *Allantus* sp. occurring upon oak in that section in 1928. *Exenterus coreensis* upon *Lophyrus* sp. on pine, and *Polyrhysia clauseni* upon *Periclista* sp. on oak, were relatively rare.

DESCRIPTIONS OF IMMATURE STAGES.

Anisoctenion alacer Crav.

The ovarian egg (Pl. 6, Fig. D) is 1.1 mm. long and 0.7 mm. wide, with the ventral side markedly convex, the dorsum nearly flat, and the poles also flat and at right angles to the dorsal surface. At each end of the dorsal side there is present a flattened chitinized process approximately 0.1 mm. in length. The egg bears ventrally a thick transparent shield, and the dentate margins of this shield lie closely appressed to the sides of the egg. The anterior end is thickened and broadened, with the tips lying just beneath the flattened process of the dorso-cephalic margin of the egg. The laid egg (Pl. 6, Figs. E, F, and G) is identical in form with the ovarian egg, but with the ventral shield expanded and 1.5 mm. in length. The margins bear 5 or 6 heavy teeth on each side, several of which may be notched at the tip. The posterior end bears a median tooth, whereas the anterior margin is slightly incurved and widely separates the first pair of teeth. The marginal area of the shield is black, the median longitudinal line slightly darkened, and the remaining portions are transparent. There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F

is no apparent fixed connection between the chorion of the egg and the shield. That portion of the egg surface which is external to the host bears irregular reticulate markings.

The first-stage larva (Pl. 7, Fig. B) is 1.3 mm. in length and comprises 13 body segments. The head is triangular in outline and bears large conical antennae. A single pair of setae occurs on the dorsum of the head, these being situated near the latero-posterior angles. There are 8 pairs of setae ventrally (Pl. 7, Fig. C), 6 of which are situated equidistant from each other along the lateral margins and the remaining 2 in the medial posterior area. Laterally on each of the body segments there is a group of long hairs, these being situated on the median transverse line. On the thorax each group numbers 5 or 6, while those of the first 2 abdominal segments have only 4 and the following segments only 3. The lateral hairs on the thorax are approximately half the body length, while on the succeeding segments they become progesssively shorter towards the end of the body. In addition to these long lateral hairs there are 2 pairs, slightly longer than the segments themselves, situated dorsally and 1 pair of slightly greater length ventrally. All of these hairs are situated on the median transverse line of the segments, and between them are numerous short setae. The first 5 abdominal segments each bear a prominent welt on the median dorsal line, these decreasing in size caudad. The caudal segment terminates in a distinct, dorsally directed suctorial disc.

The second-stage larva is of normal form, with the head much reduced in size and not so heavily chitinized, the long body hairs and setae lacking, and the dorsal abdominal welts reduced.

The mature larva has 13 body segments, and the head has small conical antennae and a small darkened stripe at each side of the median line. There are 9 pairs of spiracles, which are situated at the posterior margin of the first thoracic and near the anterior margins of the first 8 abdominal segments, respectively. The dorsal abdominal welts of the first 5 abdominal segments persist in modified form. Each body segment except the last bears a ring of short setae on the median transverse line. This ring is complete on the thoracic and on the eighth and ninth abdominal segments, but is broken laterally on the intervening segments.

Exenterus coreensis Uchida.

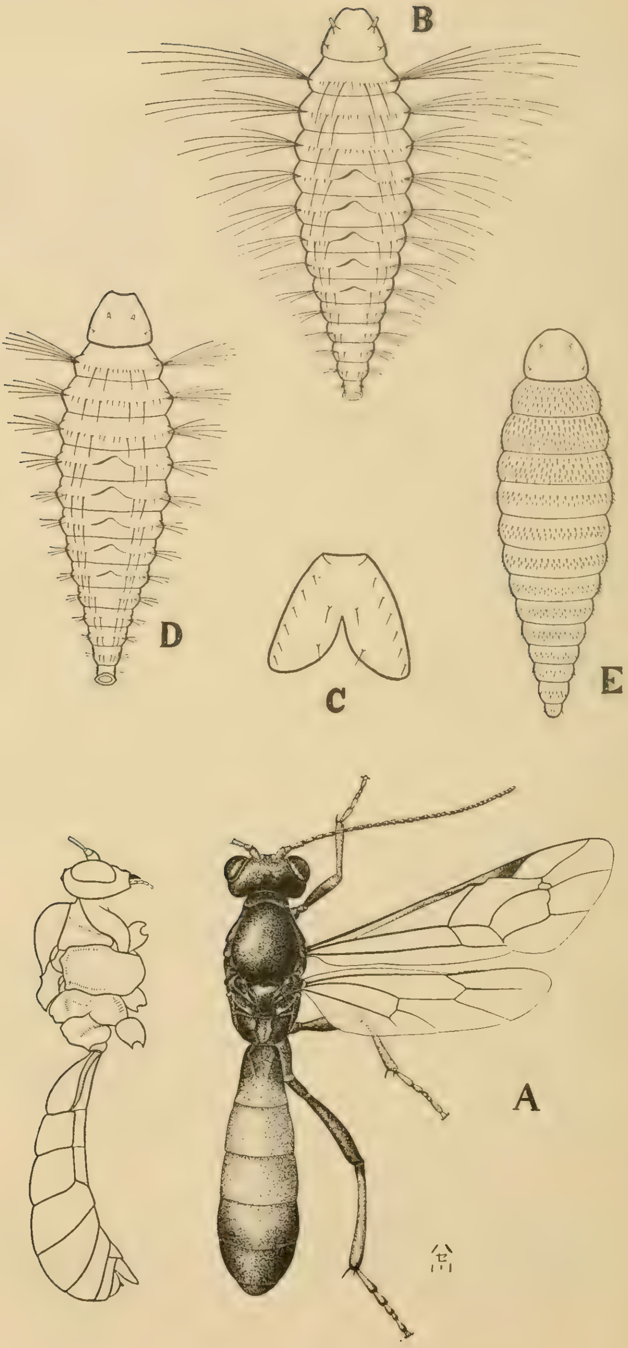
The egg (Pl. 6, Fig. C) is 0.7 mm. long and 0.35 mm. wide, with no accessory structures or surface markings.

The first-stage larva (Pl. 7, Fig. D) is 0.8 mm. in length and very similar in all characters to that of *A. alacer.* The head is somewhat more rounded and the lateral tufts of hairs upon the body segments are set upon distinct transverse ridges. These hairs are only half the length of those of *A. alacer.*

The seond-stage larva is of normal form, and without hairs or setae.

Tryphon semirufus Uchida.

The ovarian egg (Pl. 6, Fig. H) is 0.65 mm. in length, and consists of the main body, which is 0.5 mm. long and 0.2 mm. wide, and a short stalk, 0.1mm. in length, at the anterior end, which connects with the "anchor" process. This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structure is thickened and curved beyond the point of attachment, while the ventral half is produced and extends along the median ventral line of the egg and over the anterior pole. The laid egg (Pl. 6, Fig. H) has the stalk drawn out to a fine thread 1.0 mm. in length, while the anchor is expanded at right angles to the stalk, the former coiled portion having become extended to equal the ventral process in length. (In the figure the anchor is reduced one-half in size in relation to the egg body.) The total length of the anchor is 1.1 mm. The central portion is dense black, while the tips are deep amber.

The first-stage larva is 0.6 mm. in length and identical in all general characters with that of *Exenterus coreensis.*

Tryphon incestus Holmg.

The ovarian egg (Pl. 6, Fig. A) is 0.7 mm. in length, including the anterior stalk, which is 0.1 mm. in length, thickened, and bent nearly at right angles to the axis of the egg. The anchor is 0.15 mm. long and attached at its middle point to the stalk, and lies parallel to the axis of the egg. The laid egg is 0.5 mm. in length, the stalk is drawn out to 0.4 mm., and the anchor is 0.1 mm. long, the latter having retained the form and size of that of the ovarian egg. The chorion of the egg and stalk is yellowish in color and exceedingly tough.

The first-stage larva (Pl. 7, Fig. E) is 0.6 mm. in length, and has the usual 13 body segments. The head is more rounded than in the preceding species, and the antennae are smaller. The groups of long lateral hairs are entirely lacking, and instead, the dorsum and sides of the segments are clothed with numerous short, dark setae. These cover the thoracic segments completely, but on the abdominal segments they are borne only on the median transverse area, leaving the anterior and posterior margins clear. The dorsal abdominal welts and the dorsally directed caudal sucker are lacking.

Polyrhysia clauseni Uchida.

The ovarian egg is 0.6 mm. in length and similar in form to that of *T. semirufus* except that the anchor process is smaller, the ventral half extending only half the length of the egg. The laid egg is also similar, but with the anchor only slightly longer than the egg body.

EXPLANATION OF PLATES.

Plate 6.

Fig. A. The ovarian egg (at right) and laid eggs (at left) of *Tryphon incestus.*

Fig. B. Three eggs of *Tryphon incestus*, in different stages of development, on the neck of a Lophyrus larva.

Fig. C. The egg of *Exenterus coreensis*, imbedded in the derm of the host larva.

Fig. D. The ovarian egg of *Anisoctenion alacer*, lateral view.

Figs. E and F. The laid egg of *Anisoctenion alacer*, ventral and lateral views showing the ventral shield.

Fig. G. The egg of *Anisoctenion alacer*, dorsal view, with the shield visible through the host derm.

Fig. H. The ovarian egg (at left) and laid egg (at right) of *Tryphon semirufus.*

PLATE 7.

Fig. A. Adult female of *Tryphon incestus*, with outline of lateral view.

Fig. B. First-stage larva of *Anisoctenion alacer*, dorsal view.

Fig. C. Head of *Anisoctenion alacer*, ventral view, showing arrangement of setae.

Fig. D. First-stage larva of *Exenterus coreensis*, dorsal view.

Fig. E. First-stage larva of *Tryphon incestus*, dorsal view.

THE UBIQUITOUS MITE, A NEW SPECIES ON CITRUS.

By E. A. McGREGOR,
Bureau of Entomology, U. S. Department of Agriculture.

In the course of observations made over a period of years in citrus orchards in California, the author has seen very frequently a rather minute mite which moves about actively on the foliage. It is only comparatively recently that he has critically studied its anatomy and paid some attention to its habits.

It was learned rather early that this eupodid mite (*Tydeus ubiquitus* sp. nov.) is not phytophagous, but that its food consists of other insects present on the foliage. The question as to whether this mite functions as a predator or as a scavenger has been rather a difficult matter to determine. The occasional finding of the mite under mature reproducing scales at first encouraged the belief that it might be a true predator. Through lack of sufficient evidence to the contrary, however, the conclusion has been reached that the ubiquitous mite confines its feeding chiefly to the dead bodies of insects and to lifeless eggs. Hundreds of live and dead soft-brown and gray citrus scales have been examined critically for the presence of these mites. They are very commonly found associated with dead scales, but I have yet to observe them actually feeding on living insects.

Various species of Tydeus have been credited with being predatory on scale insects and their eggs. Among these are *T. gloveri* Ashm. and *T. coccophagus* Ewing. Ashmead[1] believed that the former feeds upon eggs of the oval scale. Ewing and Webster[2] state that *T. coccophagus* Ewing is of some importance as an enemy of the oyster-shell scale in Iowa. Banks[3] also records that *T. gloveri* Ashm. "feeds on the young and eggs of

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[1]Ashmead, W. H. Injurious and Beneficial Insects Found on the Orange Trees of Florida. Canad. Ent. 11:159–160 (1879).

[2]Ewing, H. E. New Predaceous and Parasitic Acarina. Psyche 18: 37–43, illus. (1911).

[3]Banks. The Acarina or Mites, U. S. Dept. Agr. Rept. 108, 153 pp., illus. 1915). (See p. 21.)

scale insects." Tothill[4] states that the latter species is found under old scales, but believes that it plays little part in the control of this scale. He expresses the opinion that *T. cocophagus* Ewing is identical with Ashmead's old species, *T. gloveri*. Miller,[5] in his work on the Acarina of Ohio, says that "A species of Tydeus is of no little economic importance from its habit of preying upon the oyster-shell scale." He does not identify the species.

There appears to be no previous record of the occurrence of any species of Tydeus on citrus in California. However, in 1879 Ashmead[6] described a species (*T. gloveri*) on citrus in Florida, and stated that it was "found in company with the oval scale insect (*Aspidiotus citricola*) on the eggs of which it probably feeds."

Living healthy scales are almost invariably so tightly appressed to the plant substratum that it is impossible for mites of the size of Tydeus to crawl under them. However, individual scales that have been weakened by one cause or another, or which are harboring masses of eggs or young, are frequently loosened sufficiently from the plant surface to permit the mites to gain entrance to the space beneath them. *Tydeus ubiquitus* has thus been seen under such mature individuals both of the gray and the soft-brown scales, and developmental activity on the part of the mites has been observed in these locations. In fact these mites appear by preference to breed within the cavities formed by scale shells, but also rear their little colonies entirely in the open. Colonies have been observed under and adjacent to dead bodies of cottony-cushion scale, citrus thrips, spiders, etc.

The ubiquitous mite is an active species. One frequently sees it running about on the citrus foliage and at times on the fruit. Of all animals, this mite is probably the one most generally abundant on citrus foliage in California. The stalked eggs are placed in every conceivable location on the tree, but usually most commonly in the immediate vicinity of dead scales. It is rather common to see them actually attached to the shells of dead scales. In the immediate vicinity of scale insects the eggs at times are so thick as to resemble a forest of stalks. As previously noted, the cavity within the dead scale shells is the favorite breeding place, and as many as 20 to 30

[4]Tothill, J. D. Some Notes on the Natural Control of the Oyster-shell Scale (*Lepidosaphes ulmi*, L.). Bul. Ent. Research 9: 183–196, illus. (1919). (See p. 195.)

[5]Miller, A. E. An Introductory Study of the Acarina, or Mites, of Ohio. Ohio Agr. Expt. Sta. Bul. 386, pp. 85–172, illus. (1925.) (See p. 92.)

[6]Ashmead, W. H. Injurious and Beneficial Insects Found on the Orange Trees of Florida. Canad. Ent. 11: 159–160 (1879).

cast mite skins are often seen under a single scale. The cast skins are always on the surface of the plant —not on the scales. As many as six Tydeus mites have been seen under a scale, and mating takes place in these cavities. Just as in the case of red spiders, the males hover around the quiescent deutonymphs which are soon to molt to females. Several males compete for a single female.

The following table indicates the association of the *Tydeus* mite with scale insects:

TABLE I.—*Tydeus mites found associated with scale insects in Tulare County, California.*

	Number of scales examined	Number of scales harboring *Tydeus* mites	Per cent of scales harboring mites	Greatest number of live mites per colony
Dead scales	300	111	37.0	6[2]
Live scales	200[1]	0	00.0	0

[1]Note: The live scales examined were all immature.

[2]As many as 17 overwintering mites have been seen under one scale.

The description of the ubiquitous mite follows:

Tydeus ubiquitus, new species.

Small soft-bodied mites, female about 0.225 mm. long. Color, pale slaty-amber to pearl-lavender, a paler narrow stripe of smoky-pearl-lavender color extending dorsally along median line from cephalothorax to hind end (this stripe evidently a generic character); legs colorless. Body widest across anterior region of abdomen; as viewed dorsally the body margin is distinctly indented behind the shoulders, this being more accentuated in the male than in the female. About 24 bristles, distributed dorsally as follows: one at each postero-lateral corner of the cephalothorax, a very weak pair medially just in front of the suture which sharply separates the cephalothorax from the abdomen, a very strong pair antero-laterad of the latter, a transverse series of four evenly distributed just behind the suture, eight arranged in a double longitudinal series along the posterior half of the abdomen, a weak and a stronger pair near the hind end, and a sublateral pair just before the latter. Legs sparingly supplied with shortish pale hairs. Three weakly defined annular segments at hind portion of abdomen. Palpi simple, four-jointed, second joint longest, penultimate joint shortest, slightly exceeding the mandibles, which are moderately stout and tapering. Legs moderately long but all shorter than body; all but first pair having tapering tarsi with weakly hooked terminal pair of claws and a narrowly elliptical pulvillus; tarsi of forelegs much shorter, not narrowed distally, and entirely void of the claws and pulvillus. Relative lengths of joints of foreleg as follows: coxa, 18; trochanter, 15, femur, 27; patella, 14; tibia, 14; tarsus, 13. Male distinctly smaller than female and with abdomen more narrowed behind. Egg elliptical, pale greenish-amber, borne on a long filamentous stalk.

Type slide.—Cat. No. 1048, U. S. N. M.

The type material is from Lindsay, California, November 28, 1931, from foliage of citrus trees.

Rather universally distributed in citrus orchards throughout California. Occurring also on various other wild and cultivated plants.

The species described herein is possibly closest to *T. gloveri* Ashm., from which it may readily be separated by the characteristics given below.

T. gloveri: Body oval, flattened; color pale yellow with a broad pinkish-flesh-colored stripe medially on dorsal aspect of abdomen extending to posterior tip; hind tip of abdomen obtuse; legs thin, with two claws.

T. ubiquitus: Body strongly subpyriform, not flattened; color pale slaty-amber (large individuals at times pearl-lavender), with a narrow stripe of smoky pearl-lavender dorsally along median line beginning at a point on cephalothorax just before the transverse suture and fading to obscurity somewhat before the hind margin of abdomen; hind tip of abdomen sharply rounded; legs thickish, the first pair devoid of terminal appendages, other three pairs each with a pair of hooked claws and a prominent pulvillus.

T. ubiquitus is distinguished from *T. coccophagus* Ewing by the differences mentioned below.

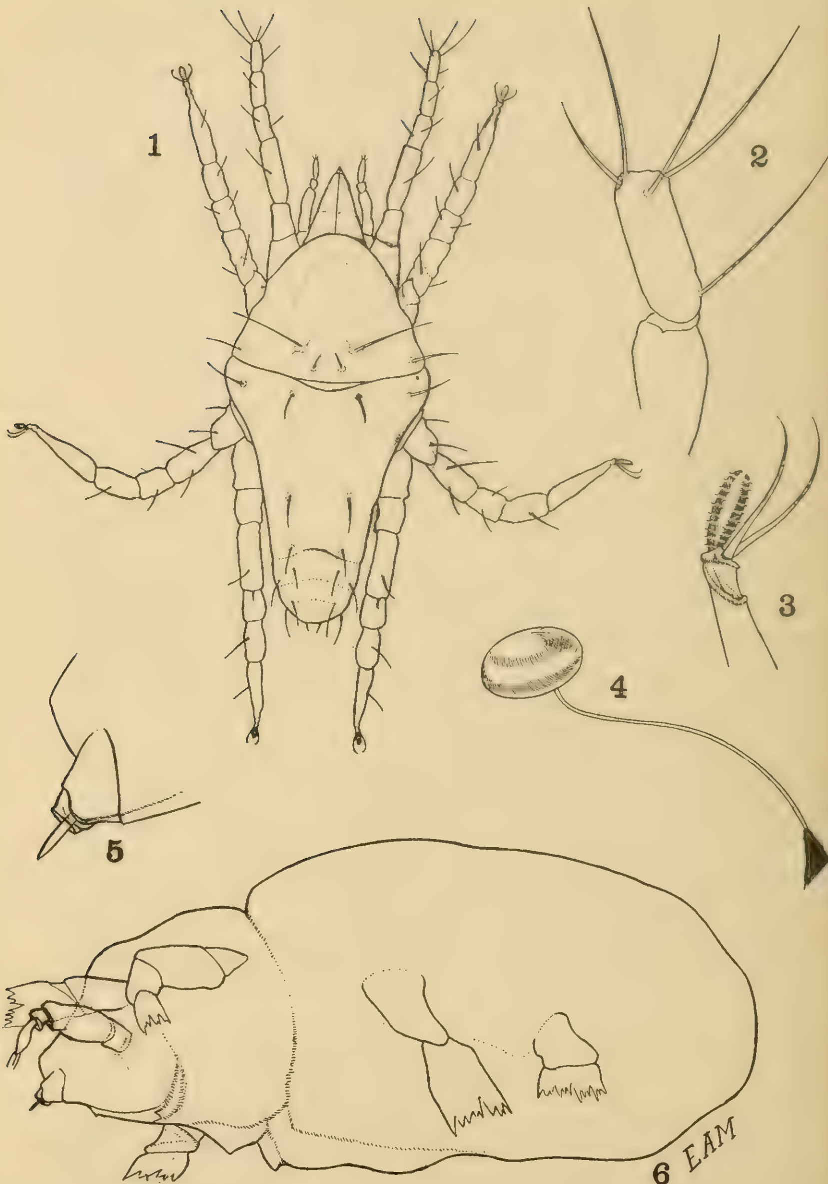
T. coccophagus: Hyaline in color (no mention of the dorsal median abdominal stripe); 4 pairs of dorsal body bristles; first pair of legs slightly longer than others; hind pair of legs barely reaching tip of abdomen; tarsus one-and-one-half times as long as tibia; tibia one-and-one-half times as long as patella; body length, 0.20 mm.

T. ubiquitus: Pale slaty-amber to pearl-lavender in color, with a narrow median stripe of smoky-pearl-lavender; 12 pairs of dorsal body bristles; first pair of legs not longer than others; hind pair of legs reaching much beyond tip of abdomen; tarsus of legs I hardly equaling tibia; tibia merely equaling patella; body length, 0.225 mm.

Explanation of Plate 8.

Tydeus ubiquitus McGregor.

Fig. 1, dorsal view of male; Fig. 2, distal portion of leg I, showing tarsal bristles; Fig. 3, terminal tarsal appendages of other legs; Fig. 4, egg with stalk attached to tip of leaf; Fig. 5, mandible, lateral view; Fig. 6, lateral view of female with legs partly amputated.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TWO PALEARCTIC HEMIPTERA IN THE NEARCTIC FAUNA (HETEROPTERA-PENTATOMIDAE : NABIDAE).

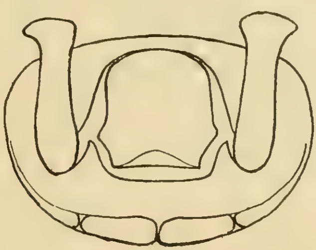
By H. G. Barber, *U. S. Bureau of Entomology.*

Elasmostethus interstinctus Linn.[1]

=dentatus (De Geer) 1773 Mém. 3: 260.

=*Acanthosoma cruciata* Say var. *cooleyi* (Van Duzee) 1904. Trans. Amer. Ent. Soc. xxx: 74.

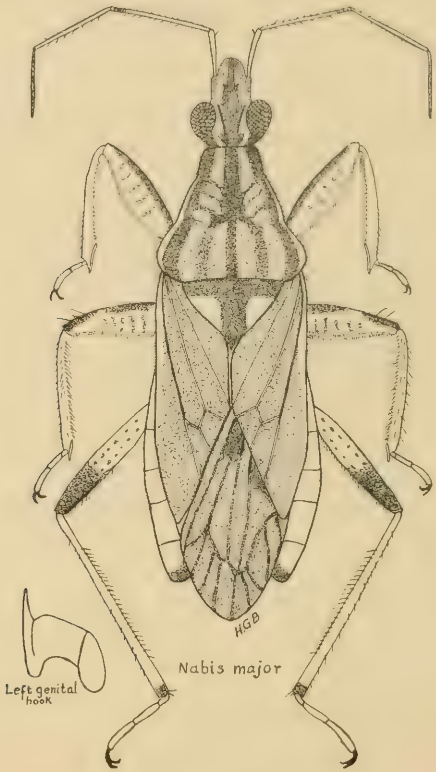
In the palearctic region this species ranges across northern and middle Europe through Siberia into northern China and Japan. Ten specimens in the United States National Museum collection show that it is well established in northwestern Canada and Alaska. These specimens from the Uhler collection are labeled as follows: "R.A." [Russian America] and "Upper Mackensie R." Also very recently Mr. J. R. Malloch of the U. S. Biological Survey has received a number of specimens collected by Mr. Owen Bryant at Black Mt. near Aklavik not far from the delta of the Mackensie River. These answer to Mr. Van Duzee's description of *Acanthosoma cruciata* var. *cooleyi* which was described from Bozeman, Montana, in 1904. That author's specimen of *dentatus* which he mentions as having only the small black tooth on either side of the genital segment of the male, without the close-set brush of stiff bristles, must have been defective. All of the specimens of this species in the Museum collection are provided with these bristles. It is very closely related to *E. cruciatus* from which it differs by the pale greenish color of the pronotum, dorsal parts more closely punctate with fuscous, and with a row of black spots on either side of the venter, midway on segments 2 to 6. See Fig. of genital segment of male-caudad view, much enlarged.



Elasmostethus interstinctus
Genital segment ♂

[1]1758, Syst. Nat. ed. 10: 445.

From the recorded geographical range this species is more restricted in its distribution than the preceding one. Oshanin's Catalogue lists it from middle and southern Europe as well as from Morocco. I have recently received from Mr. A. O. Larson, U. S. Bureau of Entomology, for determination eleven specimens of this species from Corvallis and Dever, Oregon. These were collected in July and August, 1931. They correspond exactly with European specimens in the National Collection. As this is the first example of the subgenus *Nabis* to occur in the United States, it will not fit into Harris's key to the subgenera in his Monograph of the Nabidae of North



Nabis (Nabis) major Costa.

America, 1928. Drawing, dorsal view of male much enlarged and left genital hook.

EDITORIAL.

Entomological Illustrations, Technical and Popular.

Since the beginning of entomology in America, a custom has been observed in the preparation of entomological drawings for illustrative purposes, of presenting the insects in full dorsal view with the wings fully spread and the legs sprawled out in order to show as much of the structure and vestiture as possible. While no student of entomology *per se* will object to this procedure, there is a serious question whether this method of presentation is more than occasionally justifiable in illustrating publications intended for distribution to lay population, such, for instance, as the leaflets and Farmers' Bulletins published by the United States Department of Agriculture and the State Experiment Stations.

What is the chief desideratum and the ultimate object of including illustrations of the insects in publications of this character? The answer, of course, is: First, that the lay reader may recognize the insect pest and thus be enabled to select the proper remedy; second, to add interest to the publication and thus induce the beholder of the illustration to read the context. There is reason to believe that the former of these latter desiderata is effected, but a dark suspicion obtains respecting the practical attainment of the last one. However, to return to the first and more important objective: by presenting the illustration of the insect, usually vastly enlarged in size, with the wings widely spread, the legs sprawled out toward the cardinal points of the compass and the antennae often curled around in positions where they would actually interfere with flight (in order to find space on the page for them), the insect is made to appear as no lay observer would or could ever see it in nature. This fact immediately suggests the following questions: Does not this method, in fact, defeat the principal objective aimed at in the publication of the illustration? Could not this objective be more nearly attained by the substitution of illustrations showing the insect in perspective, of natural size, preferably working on its host plant, and with the latter exhibiting the injurious work of the pest?

That the presentation of the insect in pose, size and detail not seen by the lay observer (who in most cases will never have gazed on an insect with the aid of even a hand lens) does defeat the purpose of the illustration will be obvious and no argument in favor of this thesis seems necessary.

Let us, however, examine both sides of the second question. It must at once be admitted that the presentation of the more minute of the insect pests, in the manner here suggested, is surrounded by great difficulties. Take, for instance, the alfalfa seed chalcid; the insect is so small as often to appear to the unaided vision, scarcely more than a speck of soot or bit of coal cinder. To illustrate it as seen in nature is manifestly impracticable. One could, however, illustrate its work, or the effect of its work on the plant, without great difficulty. The same might be said of the Hessian fly and of many other minute insect pests, and in the final analysis it is these effects of the presence of the insect and not the pest itself, that the farmer sees and in which he is chiefly interested. On the other hand, there are many of the insects, of medium and large sizes, that could and should be treated illustratively in perspective, of about natural size, and at work on their cultivated host plants as the grower himself sees them in the field. This method of treatment, however, predicates the opportunity of the artist to study the insects in their natural environments, an important desideratum which as yet has received far too little consideration from administrative officials.

—W. R. W.

MINUTES OF THE 436TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, MARCH 3, 1932.

The 436th regular meeting of the Entomological Society of Washington was held at 8 P. M., Thursday, March 3, 1932, in Room 43 of the new building of the National Museum. Mr. F. C. Bishopp, president, presided. There were present 34 members and 35 visitors. The minutes of the previous meeting were read and approved. There was no preliminary business.

The first communication on the regular program was by F. L. Campbell, and was entitled "The toxicology of insecticides." The speaker described and illustrated the methods that are being used at Takoma Park station for determination of the toxicity of stomach and contact insecticides. The talk was concluded by a demonstration of the effectiveness of derris root powder against house flies. (Author's abstract.) This paper was discussed by McIndoo and Abbott.

The second communication on the program was by J. L. Robertson of the Public Health Service, and was entitled "Some Methods used in large-scale mosquito control work." The mosquito control problem in the District of Columbia was first discussed. Many offices are concerned in this work The species were listed and their habitats described. The "domestic" group must be controlled on streets and private properties; the "wild" and "semi-wild" species on streams, ponds and marshes. The "domestic" group is the more important. The appearance of salt-marsh mosquitoes in the District in 1931, the first time on record, was noted. Methods used, such as drainage, oiling and other clean-up measures against breeding places, were described. A jar of live minnows of the genus Gambusia, which are often employed against mosquito larvae, was shown. Moving picture films illustrating mosquito life history, and arsenical dusting of marshy areas for control, were then exhibited. This paper was discussed by Bishopp, Abbott and Gahan.

Under the heading "Notes and Exhibition of Specimens," Dr. Aldrich showed a copy of a new book by Brues and Melander, entitled "Classification of insects. A key to the known families of insects and other terrestrial arthropods." It contains keys for identification of families of insects and other terrestrial arthropods of the world. Meeting adjourned at 10.12 P. M.

F. M. WADLEY,
Recording Secretary.

Actual date of publication, May 7, 1932.

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PROCEEDINGS OF THE

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NEW NORTH AMERICAN BEES.

By J. C. Crawford, *U. S. Department of Agriculture.*[1]

Halictus sopinci, new species.

Female.—Length 8.5 mm. Black, shiny, thinly clothed with short whitish hair; head and thorax very finely and delicately lineolate, more distinct and rougher on middle of face, less so on clypeus; a spot on each side of clypeus and vertex not lineolate; face with fine scattered punctures, those of clypeus coarser; facial quadrangle subquadrate; clypeus well produced and almost one-half as long as width between bases of mandibles; third joint of antennae distinctly shorter than fourth; mesonotum sparsely, finely punctured, scutellum smoother and more shiny, the punctures more scattered; propodeum with fine rugae not reaching apex, the apical portion finely reticulately lineolate; truncation of propodeum surrounded by a delicate carina, which is distinct at upper middle so that the base of propodeum is distinctly, sharply truncate; truncation with vertical striae curving outwardly; tegulae dark, with a reddish testaceous center and margin; wings slightly dusky, more so apically; stigma brown, veins lighter; scopa light ochraceous, plumose behind; basal joint of hind tarsi very much narrower than tibia, hind inner spur with a few long teeth; abdomen almost impunctate, finely lineolate, apical margins of segments reddish, segments 2–4 with basal patches of appressed white pubescence.

One specimen from Southern Pines, N. C., Mar. 26, 1923, A. H. Manee, coll.

In my key to Halictus, in Journ. N. Y. Ent. Soc. XV, 183, 1907, this would run to couplet 35 and fits neither alternate completely, as the rugae of propodeum are much too fine for the *pectoralis* group and the truncate propodeum does not fit the *quadrimaculatus* group.

There is no enclosure on propodeum as in *pectoralis.* In general appearance, *sopinci* resembles *truncatus*, rather the species to which it runs in the key, but it differs as widely in structure of propodeum from the *truncatus* group.

Halictus ralenci, new species.

Female.—Length 7.5 mm. Black, shiny, slender; thinly clothed with short griseous pubescence; head and thorax finely reticulately lineolate, but vertex,

[1]The work reported in this paper was done by Mr. Crawford while in the employ of the North Carolina Department of Agriculture. (Ed.)

clypeus and sides of face below almost smooth; post-vertex transversely striate; facial quadrangle subquadrate, not narrowed below; face above antennae closely punctured, below sparsely so, clypeus with only scattered punctures; clypeus hardly one third as long as width between bases of mandibles; third joint of antennae as long as fourth; mesonotum rather sparsely and finely punctate, punctures of scutellum, except two discal spots, as close; propodeum with few quite regular rugae, reaching apex, and medially at apex an indistinct carina of basal enclosure; truncation with a cordate carina, indistinct only medially above; tegulae dark, with a testaceous outer margin; wings slightly dusky; stigma brown, veins lighter; legs brown, scopa thinly plumose, basal joint of hind tarsi slender; hind inner spur with five long teeth, the three intermediate ones flattened, plate-like; abdomen smooth, with scattered minute punctures, apical margins of segments testaceous; basal hair patches of segments small and indistinct.

One specimen Raleigh, N. C., May 29, 1924, C. S. Brimley.

The scopa of this specimen contains a few grains of *Oenothera* pollen grains.

This species runs in the key as does the former but is as readily separated from the species as is *sopinci*.

Halictus brycinci, new species.

Female.—Length 5 mm. Head and thorax olive-green, abdomen dark brown, with a faint greenish reflection, apical margins of segments testaceous; head and thorax thinly clothed with long ochraceous pubescence; facial quadrangle slightly longer than wide, clypeus produced; face strongly reticulately lineolate, with crowded punctures above antennae, below punctures sparse, coarser on clypeus; mesonotum strongly reticulated, with close quite coarse punctures; propodeum with few longitudinal, somewhat irregular, rugae, not quite reaching apex which is coarsely lineolated; lateral rugae extending onto pleurae; truncation with carina not reaching to upper lateral angles; tegulae reddish, darker inwardly; wings yellowish, stigma and veins honey color; mesopleurae reticulated and with rather close punctures; legs brownish-black with white pubescence; abdomen delicately reticulated, first segment with scattered minute punctures, those of second segment closer and more distinct; sides of first and second segments and whole surface of following segments with thin white appressed pubescence.

Type.—Cat. No. 40304, U. S. N. M.

Type locality.—Bryson City, N. C.

Type and one paratype, Apr. 14, on *Fragaria virginiana;* on the same flower, one each on Apr. 15 and 22; one Apr., 14 on *Potentilla canadensis*, all collected in 1923 by the author.

A species somewhat resembling *albipennis*, from which it differs by the more slender form, broader face more deeply colored pubescence and wings, carina of truncation of propodeum not extending above lateral angles, etc.

Halictus abanci, new species.

Female.—Length 7 mm. Form slender, abdomen noticeably pointed at apex, head and thorax very dark green, with scanty ochraceous pubescence; abdomen purplish black with only scattered ochraceous hairs; facial quadrangle slightly longer than wide, clypeus well produced; head and thorax conspicuously reticulately lineolate, apical half of clypeus and a spot on each side of clypeus smooth; face in front of ocelli with crowded punctures, below this and sides of face with sparse punctures becoming scattered on clypeus and supraclypeal area; mesonotum with sparse fine punctures, those at rear varying in size, which is especially so on scutellum; propodeum with weak irregular longitudinal regulae not reaching apex which is conspicuously reticulated; median ruga stronger, straighter and usually reaching almost to apex; mesopleurae finely rugulose and with scattered punctures; sides of propodeum and truncation reticulated, surrounding carina not reaching to upper lateral angles; tegulae dark; wings deeply infuscated stigma and veins brown; legs dark, with ochraceous pubescence; abdomen delicately and reticulately lineolated, first segment one with a few scattered minutely punctures, second segment with a few more punctures basally, apical part impunctate.

Type.—Cat. No. 40305, U. S. N. M.

Type.—From Andrews Bald Mountain (6,000 ft.), Swain Co., N. C., July 26, 1923, J. C. Crawford, coll.

One specimen from mouth of Bear Creek, Swain Co., N. C., July 27, 1923 (Crawford coll.); Highlands, N. C. July 14, 1923 and September 5, 1920, T. B. Mitchell, coll.

Easily recognized among the eastern species by the deeply colored wings, resembles *nigroviridis* Graenicher, which has the wings somewhat lighter, the carina of truncation of propodeum reaching above lateral angles, form more robust and abdomen more bluntly pointed at apex, clypeus less produced, facial quadrangle broader than long, etc.

Halictus brimleyi, new species.

Female.—Length 7.5 mm. Head and thorax dark olive-green, pleurae more bluish, the head and propodeum often somewhat bluish-green; facial quadrangle about square, narrowed below; clypeus hardly produced, sparsely punctured, mostly purplish-black; face below antennae sparsely punctured, opposite antennae reticulately rugose, above antennae the punctures becoming larger and closer; above ocelli wrinkled; mandibles reddish near apex; antennae dark brown, flagel obscurely reddish beneath; head and thorax with long ochraceous pubescence, abundant and very plumose on propodeum, except enclosure; mesoscutum reticulately rugose anteriorly, especially at sides, along median groove often wrinkled, with interspersed punctures; posterior part of mesoscutum with coarse, close punctures; base of scutel with fine close punctures, posteriorly with coarser and sparser punctures, disk with two impunctate spots; metanotum rugose; truncation of propodeum reticulately rugose, surrounded by a strong salient rim; dorsum of propodeum with wavy longitudinal rugae, base with a distinct enclosure bounded by a strong carina, which is more salient medially;

pleurae reticulately rugose, in part striately rugose, especially on anterior part of propodeum; legs dark brown, mid and hind tarsi often reddish; scopa golden-ochraceous; front trochanters flattened in front, hardly narrowed towards base, so that at base exteriorly there is a distinct angular corner; viewed laterally, the front surface of fore trochanters is concave with the depression running to the basal exterior angle; tegulae brownish, exteriorly testaceous; wings brownish, stigma and veins honey color, subcosta darker; abdomen dark brown, segments one and two distinctly though minutely punctured; second segment with basal hair patches of appressed whitish pubescence; segments three and four mostly covered with similar hair, interspersed with abundant long ochraceous hairs; fifth segment without appressed hair but having abundant long golden hair.

Type from Bryson City, N. C., with the following data: Crawford number 5505, on *Ilex opaca*, May 24, 1923, J. C. Crawford, collector.

Other specimens from the type locality taken in 1923 as follows: May 24, on *Senecio balsamitae* (one specimen); July 8 (three specimens) and 9 (one specimen), on flowers of Canna; July 9, on flowers of Gladiolus (six specimens); July 9 on *Nicandra physalodes* (one), July 9 on *Mirabilis jalapa* (one); one small specimen only about 5.5 mm. with the same data as the type specimen (all collected by the author).

Named in honor of Mr. C. S. Brimley who has added so much to our knowledge of the North Carolina insects and who was my companion on the trip on which the type specimen was collected.

Type.—Cat. No. 40306 U. S. N. M.

The following species have the propodeum surrounded by a strong salient carina: *nymphaearum* Robt. and *oceanicus* Ckll., with punctured tegulae; *cressonii* Robt. which is without reticulations on the mesoscutum; *reticulatus* Robt., *hartii* Robt., *rugosus* Cwfd., and *bruneri* Cwfd.

Of these *reticulatus* and *bruneri* have similarly flattened front trochanters; *rugosus* does not (nor does *cressonii*); *hartii*, unknown to me, is described as having the head green and thorax blue and the abdomen without hair patches. *H. reticulatus* has a dark blue head and thorax; *bruneri* is smaller, with light colored legs, base of propodeum without a distinct enclosure and with finer rugae, and with rugae of truncation of propodeum diverging from point of insertion of abdomen.

Halictus hunteri, new species.

Female.—Length 5 mm. Head and thorax green, abdomen red; tegulae testaceous, large, punctured all over, pointed behind; apex of clypeus purplish-black; head and thorax closely, coursely punctured (about as in *pictus*), reticulately lineolated, somewhat shiny; antennae red beneath; punctures of scutellum finer and closer (except two discal spots) than on mesoscutum;

propodeum with irregular rugae not reaching apex, those laterad straighter and extending over onto pleurae; truncation with a delicate surrounding carina interrupted only medially above; wings yellowish, stigma and veins honey color; legs reddish-brown; abdomen finely transversely lineolate, with scattered minute punctures.

Described from six specimens from the collection of the U. S. National Museum as follows: four specimens from Victoria, Texas, collected Febr. 26, 1904, Apr. 7, 1904, J. C. Crawford, collector; Apr. 17, 1904, A. W. Morrill, collector; one from Runge, Tex., Sept. 29, 1904, J. C. Crawford, coll.; one from Edna, Tex., Mar. 24, 1907, J. D. Mitchell, coll.

Type.—Cat. No. 40307 U. S. N. M.

Distinguished from the other species with red abdomen by the large and punctate tegulae; only *nymphalis* and *pictus* (which also occurs at Victoria, Tex.), of the eastern species with the abdomen red have coarsely (for this group) punctured mesonotum.

Dedicated to the late Dr. W. D. Hunter.

Halictus raleighensis, new species.

Female.—Length 5 mm. Very similar to *ashmeadi*, having the same long narrow face and strongly lineolated surface of head and thorax but differ in having punctures of mesoscutum evenly spaced over whole surface, and about a puncture width apart, while in *ashmeadi* they are very close laterally, becoming more sparse centrally so that medially and especially anteriorly the surface is almost impunctate; first and second abdominal segments closely, strongly punctate; in *ashmeadi* impunctate or at most with very minute, scattered, shallow and almost invisible punctures; carinae on sides of posterior face of propodeum not reaching to upper lateral angles, in *ashmeadi* they reach angles and turn inward but do not meet.

Described from one specimen with the following data: Raleigh, N. C., June 5, 1923, on *Baptisia tinctoria*, T. B. Mitchell, collector.

The following key will aid in the separation of the species allied to *ashmeadi* and *floridanus:*

1. Veins and stigma light color........2
   Veins and stigma dark brown........3
2. Wings whitish, third cubital cell subobsolete; mesonotum finely sparsely punctured 4–5 mm. (Florida; N. C.)........*longiceps* Robt.
   Wings dusky; third cubital cell not subobsolete; mesonotum closely and more coarsely punctured, 6–7 mm. (Florida; N. C.)........ *floridanus* Robt.

3. Abdominal segments one and two closely punctured (N. C.) .... *raleighensis* Cwfd.

Abdominal segments one and two not visibly punctured (Florida; N. C.) *ashmeadi* Robt.

Epeolus ainsliei, new species.

Female.—Length 8 mm. Black, compact, with the following parts red: mandibles, except apices, labrum, clypeus anteriorly, scape and basal joints of flagellum beneath, tubercles, tegulae, lateral anterior corners of mesoscutum, pleurae largely, scutellum and axillary teeth, legs, except anterior and mid coxae, fifth abdominal segment apically, sixth, and most of ventral segments; in some paratypes mesoscutum laterally, pronotum, clypeus almost entirely, fore and mid coxa and abdominal sternites entirely, red; face closely and finely punctured, front with coarser and sparser punctures; punctures of mesoscutum close, in size similar to those of front; punctures of pleurae separated by slightly less than a puncture width, becoming sparser below and on sternum; pubescence as follows, white: face well covered, with that on front sparser and slightly yellowish, margins of mesoscutum and two lines on anterior margin, posterior margin of scutellum, metonotum, propodeum, except triangle, mesopleurae, posterior coxae, band on base of abdominal segment one, apices of segments one to four and lateral spots on five; bands on apices of segments one and two narrowed medially; all bands somewhat widened laterally; axillary teeth somewhat longer than dorsal face of scutellum, slightly incurved; hind tibial spurs black; abdomen closely, rather finely punctured.

Type.—Cat. No. 40308 U. S. N. M.
Type locality.—Sioux City, Iowa.
Type and 2 paratypes, July 15, 1922, one each: July 8, July 9, 1921, and July 20, 1920. All collected by Mr. C. N. Ainslie, after whom the species is named.

A species greatly resembling *pusillus* Cresson but differing in the greater amount of red and in the much more sparsely punctured pleurae and sternum.

Of the species with sparsely punctured pleurae and sternum *lectus* and *lectoides* have black legs and sparsely, coarsely punctured mesonotum; *interruptus* has the abdominal bands interrupted and the inner ends dilated, and the axillary spines distinctly shorter than scutellum.

Perdita ainsliei, new species.

Male.—Length 4 mm. Head and thorax green, abdomen apricot color, apical margins of segments lighter, and preapically more brownish; pubescence scanty, long, white; head broader than thorax, well produced behind eyes, facial quadrangle broader than long (22 :17); mandibles, except tips, labrum, clypeus and lateral face marks, which are broadly truncate above just below antennal sockets, ivory white; head and thorax finely granular and with scattered minute punctures; clypeus and lateral face marks smooth and shiny; scape dark, flagellum light reddish slightly darker above; tegulae hyaline, tubercles ivory white; wings subhyaline, veins light testaceous, stigma and subcosta brown; stigma narrow, about four-fifths length of marginal cell; first recurrent received by second cubital cell about one-sixth from base, second recurrent sub-interstitial; femora brown, lighter above, tibiae lighter, tars testaceous; anterior tibiae with a yellowish ivory stripe in front; knees, beses and apices of tibiae lighter; pubescence at apex of abdomen golden.

Female.—Length 5 mm. Similar to male, antennae darker; clypeus and supraclypeal area bronzy-black, clypeus with an irregular whitish mark on disk; lateral face marks more obliquely truncate; head somewhat less produced behind eyes, hardly broader than thorax; facial quadrangle broader than long, inner orbits sub-parallel; tubercles ivory; legs brown, knees ivory; preapical brown of abdominal segments more distinct and forming bands.

Type.—Cat. No. 40309 U. S. N. M.

Type locality.—Sioux City, Iowa.

Type, allotype and 3 male and 3 female paratypes July 4, 1925; 1 female, July 2, 1925; one female, July 22, 1924; one male July 17, 1926; 2 males, July 22, 1926; 4 females and 3 males, July 26, 1924; 2 females, no date.

All collected by Mr. C. N. Ainslie, after whom the species is named.

Perdita gerardiae, new species.

Male.—Length 7 mm. Head and thorax green, rather thinly clothed with long white pubescence; head finely shagreened and with scattered fine punctures; mandibles, labrum, clypeus (except occasionally extreme upper edge) except two discal dots, and lateral face marks truncate above, extending to upper edge of clypeus, creamy-white; inner orbits subparallel; facial quadrangle one-third longer than side; thorax with scuplture similar to that of head; wings dusky, more so apically; nervures brown, with center of stigma testaceous; tegulae dark anteriorly, with a testaceous center and lighter apically; legs dark, tarsi reddish; knees and stripes on front of fore femora apically, and fore and mid tibiae, very light yellowish; abdomen satiny black with a short transverse creamy line on each side of segments 2 and 3; those on segment 3 shorter and sometimes absent; segment 7 reddish testaceous.

Female.—Length 8 mm. Similar to male but labrum dark; mark on clypeus not extending to upper margin, but with a mdeian upper extension; lateral face marks almost triangular, the upper margin very oblique; light markings on legs confined to small spots on fore and mid knees and stripse on fore tibiae; pygideal area reddish.

Type locality.—Southern Pines, N. C.

Type.—Cat. No. 40310 U. S. N. M.

One female and 7 males from flowers of a purple *Gerardia*, Sept. 26, 1923. T. B. Mitchell, coll.

Also Gliden, Chowan Co., N. C.; five females and four males, from *Gerardia fasciculata* Sept. 19, 1923, T. B. Mitchell;

McCullers, N. C., Sept. 14, 1923, on *Gerardia*, one female, T. B. Mitchell.

PSEUDOPANURGUS ROBERTSON.

The characters given by Robertson for his genus *Heterosarus* are the simple scopa of the female and the lateral face marks in the male not reaching to the upper margin of the clypeus. Of the 5 Eastern species known to me in which the female has a simple scopa, the males of only 2 are as generically characterized. *P. illinoiensis* Cress. has the lateral marks somewhat obliquely truncate just at upper margin of clypeus, with the end touching inner orbit, a little higher; in the 2 species described below the marks extend above clypeus.

P. virginicus, *pauper* and the 2 new species herein described from a close group of species which are closely and minutely punctured and silky from fine lineolation. So fine and close are the punctures of the apical margins of the abdominal segments of the new species, that, when resolved under a high power of the binocular microscope they appear as minute thimble-like punctures.

The following key will distinguish the species discussed.

Males

1. With abundant long erect pubescence .... *illinoiensis* Cress.
   Pubescence sparse, short, recumbent 2
2. Face subquadrate, inner orbits subparallel .... *virginicus* Ckll.
   Inner orbits converging below 3
3. Lateral face marks not extending to upper margin of clypeus, truncate above .... *pauper* Cress.
   Lateral face marks extending above clypeus, pointed on inner orbits 4
4. First and second cubital cells subequal (first at times shorter); first recurrent further from base of second cubital than first intercubital is from stigma; first abscissa of radius distinctly shorter than second .... *gerardiae* n. sp.
   First cubital about one-fifth longer than second; first recurrent nearer base of second cubital than first intercubital is to stigma; first and second abscissae of radius subequal .... *stevensi* n. sp.

Females

1. With abundant long erect pubescence on head and thorax .... *illinoiensis* Cress.
   Pubescence short, sparse, recumbent 2
2. Face not narrowed below .... *virginicus* Ckll.
   Inner orbits converging below 3
3. First abdominal segment rather closely minutely punctured; second with scattered punctures and strongly reticulately lineolate; third not punctured, lineolate .... *pauper* Cress.
   Abdominal segments 1–3 closely, minutely punctured 4

4. First and second cubital cells subequal; first recurrent further from base of second cubital than first intercubitus is from stigma............... *gerardiae* n. sp.
   First cubital one-fifth longer than second; first recurrent at most as far from base of second cubital as first intercubitus is from stigma *stevensi* n. sp.

Pseudopanurgus pauper (Cresson).

Calliopsis pauper Cress.
Calliopsis parvus Robt.
Heterosarus parvus Robt.

A homotype of *P. pauper* in the U. S. N. M. has been compared with specimens of *parvus* determined by Robertson and they are identical. In the female the supraclypeal area and base of clypeus are smooth and shiny, hardly lineolate; foveae long usually ending about on the level of a line touching lower margin of antennal sockets; first cubital cell distincly longer than second; first recurrent about as far from base of second cubital as length of first abscissa of radius; face marks of male ivory color, punctures of scutellum fine, well separated; abdomen punctured as in female.

Pseudopanurgus virginicus (Cockerell).

Raleigh, N. C., May 18, 1926, C. S. Brimley; Bryson City, N. C., June 2, 1923, on *Houstonia purpurea*, J. C. Crawford. These records, the first for this State, considerably extend the known range of the species.

Pseudopanurgus gerardiae, new species.

Male.—Length 4.5 mm. Very similar in general appearance to *pauper;* base of mandibles, labrum, clypeus, triangular lateral face marks, attenuated above and ending on inner orbits above upper margin of clypeus, light lemon yellow; process of labrum slightly narrowed apically; sculpture of head and thorax about as in *pauper* but ocellar triangle and caudad and laterad of it more closely punctate; punctures of mesonotum slightly coarser, of scutellum slightly closer; tegulae with a large dark spot inwardly; legs marked as *pauper* but yellow stripe on anterior tibiae narrow and not extending onto posterior face; punctures of abdomen though very fine, distinct and close even on depressed apical margins of segments.

Female.—Length 5 mm. Similar to the male and close to the female of *pauper*, differing as indicated in the key; foveae ending about on a line touching upper margins of antennal sockets; supraclypeal area and base of clypeus dull from lineolation; tegulae dark brownish black inwardly.

Type.—Cat. No. 40311 U. S. N. M.
Type locality.—Bryson City, N. C.
Described from 11 males and 7 females taken by the author Aug. 26, 27 and Sept. 7, 1923, on *Gerardia tenuifolia.*

Pseudopanurgus stevensi, new species.

Male.—Length 5.5 mm. Similar to the two preceding species but distinct as indicated; in face marks slightly more yellowish than in *gerardiae;* lateral face marks appearing less attenuated above, since they extend higher up on eye; clypeus with basal margin distinctly wider than *gerardiae;* process of labrum only slightly narrowed apically; sculpture about as in *gerardiae.*

Female.—Length 6 mm. Similar to the male, distinguished as in the key; supraclypeal area and base of clypeus dull from lineolation; foveae as in *gerardiae* tegulae larger than in *gerardiae* and inwardly reddish-testaceous; abdominal segments less closely punctured, less distinctly lineolate and more shiny than *gerardiae.*

Type.—Cat. No. 40312 U. S. N. M.

Described from 3 pairs from Lucca, N. D., July 16, 1913, on *Lactuca pulchella;* from same locality and date one female on *Ratibida columnaris;* Kenmare, N. D., July 15, 1913, on *Carduus undulatus*, four females; Nicholson, N. D., July 4, 1913, on *Brassica arvensis*, one female; Valley City, N. D., July 26, 1913, on *Carduus undulatus*, two females. All collected by O. A. Stevens.

Panurginus rohweri, new name.

Panurginus bakeri Crawford, Proc. Ent. Soc. Wash., vol. 28, no. 9, Dec., 1926, pp. 209, 213—Not (*Calliopsis*) *Panurginus bakeri* Cockerell, Trans. Amer. Ent. Soc., vol. 32, 1906, p. 299.

NOTES ON HELMIDAE (COLEOPTERA) TAKEN IN THE TENNESSEE GREAT SMOKY MOUNTAINS, WITH DESCRIPTION OF A NEW SPECIES.

By Paul N. Musgrave, *Fairmont, W. Va.*

Intensive collecting in the Little Pigeon River and a few of its tributaries from June 9–14, 1931, produced a large number of specimens of four species, one of which is new.

Stenelmis crenata Say was regularly taken with a hand screen in the main stream wherever sand was found in any noticeable quantities. Its range apparently did not extend into the colder tributaries.

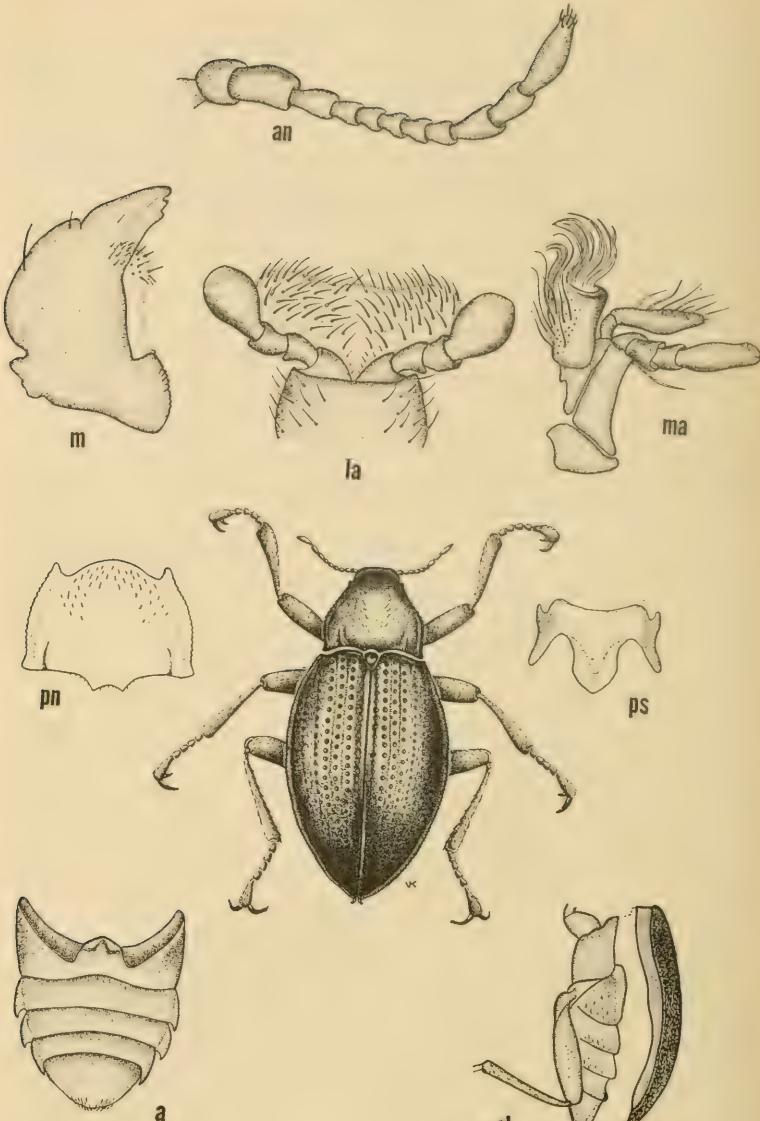
Limnius ovalis Lec. was occasionally found with *S. crenata* Say but it appeared in great abundance in the colder streams flowing through clearings.

Limnius cryophilus n. sp. seemed to like the spring-fed, rapid flowing rills which raced through dark laurel thickets. Disturbing the moss-covered stones in such a stream usually produced from one to ten specimens on the hand screen. This species in some cases was taken in company with *L. ovalis* Lec. but it regularly lives in company with *Heterelmis latiusculus* Lec.

Heterelmis latiusculus Lec. was the most abundant species of the four, being found in all the smaller streams collected. It appeared in small numbers at the highest point collected (3500) where no other Helmid was found after careful search.

Limnius cryophilus, n. sp.

Female (Pl. 9).—*General*—Body elongate-oval, moderately convex, piceous black, ventral side, antennae, legs and palpi, rufous. Length 2 mm. *Head* globose, inserted in the prothorax to the eyes so that the mouth parts are almost hidden, surface granular, uniformly covered with yellowish recumbent pubescence. Eyes not prominent, their surface almost coinciding with the curve of the head. Antennae (an) inserted on front at margin, filiform, 11-jointed, 1 and 2 enlarged, 3 slightly longer than any of the next five which are about equal, 9 and 10 larger than 7 and 8, 11 as long as 9 and 10 together, pointed and hairy at apex. Mentum rounded and slightly concave. Mandibles (m) strongly curved and with two notches on the outer margin, dentate behind the apex on the inner side. Maxillary palpi (ma) 4-jointed, 2 slightly larger than 1 or 3, 4 as long as the first three together. Labial palpi (la) 3-jointed, 1 and 2 equal, 3 larger than first two together, flattened, oval, sub-truncate at tip. *Pronotum* (pn) slightly broader than long, convex; the finely crenulate sides almost parallel in basal third and then gradually convergent, basal margin sinuate, apical margin moderately extended forming a hood over head, strongly sinuate close to the prominent front angles; disc uniformly punctulate, punctures separated by about or more than their own diameter, clothed with sparse gray pubescence; the elevated lines on each side reaching from base one third of length. *Prosternum* (ps) in front of coxa, short, very broad with shallow transverse furrow, the intercoxal process about as long as its width at base but narrowed posteriorly to a blunt point. *Legs* long and strong; front coxa transverse, femora about as long as tibia which have a large area of tomentum on the inner sides; tarsi, including the large claws, shorter than tibia. *Elytra* at base slightly wider than thorax but evenly arcuate to apex, moderately convex, impressed stria of punctures larger than those of thorax, intervals with grayish pubescence arising from two rows of minute punctures. Margin finely crenulate, epipleura broad and flat at base, gradually tapering to just before the apex where they abruptly end. Beginning at postcoxal angle, opposite the second abdominal tergite, there is a deep groove just within the epipleural margin, into which is received the lateral margin of the large first visible sternite. Wings of holotype vestigial, not more than three times as long as scutellum, which is longer than wide. Some female paratypes with normal wings. Abdomen (a) on under side uniformly covered with short, silky, decumbent pubescence, with 5 movable sternites, 4th shortest, 5th rounded without lateral tooth or process. Segment 1 with long slender processes which match the above noted grooves in the elytra, segments 2, 3 and 4 with marginal processes which curve over the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outside of the epipleural margin, that of 2 short, of 3 much longer and the process of 4 longest and with strongest curve.

Male.—Slightly smaller, otherwise externally similar to female.

Type locality.—Greenbrier, Great Smoky Mountains, Tenn.

Types.—Holotype (female), allotype (male) and six paratypes in the U. S. National Museum. Several additional paratypes in the collection of author. All types taken from spring-fed mountain stream of very cold water which flows into the Right Fork of Little Pigeon River about two miles above Greenbrier, Tenn., and near the "Big Barn," at about 2,000 ft. elevation, June 12, 1931. Species was taken from a similar stream at Rocky Bottom (elevation 1,800 feet) near Clemson College, S. C., July 9, 1931. May be separated from other Eastern species of *Limnius* by the solid color of the elytra. Drawings for the plate were made by Miss Velma Knox.

EXPLANATION OF PLATE.

Limnius cryophilus Musgrave.

an antenna
m mandible
la labium
ma maxilla
pn pronotum
ps prosternum
a abdomen, ventral aspect
al lateral aspect to show coadaptation of elytra and margins of sternites

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TWO NEW SPECIES OF PHANOMERIS FOERSTER (HYMENOPTERA, BRACONIDAE) PARASITIC ON LEAF-MINING SAWFLIES.

By C. F. W. MUESEBECK, *Bureau of Entomology.*

The only character by which *Phanomeris* Foerst. appears to be distinguishable from *Exothecus* Wesm. is the presence in the former of a distinctly impressed suture between the second and third abdominal tergites. This difference may not be of generic importance, but the material I have seen appears to be separable into two groups on this character, and pending a revision of the Exothecinae I am inclined to recognize *Phanomeris* as distinct. Up to the present only a single Nearctic species, *mellipes* (Prov.), has been referred to this genus; it was orginally described in *Opius* but has been removed to *Phanomeris* by Gahan.[1] I have not seen this species, which is known only from the unique type, but on the basis of the original description, and notes made by Gahan on an examination of the type, it seems to differ from both species described here in lacking the median longitudinal carina of the first tergite, in

[1]Proc. U. S. Nat. Mus., vol. 49, 1915, p. 92.

having the second tergite aciculate only at base, and in having the face more or less bicarinate medially.

Phanomeris metalli, new species.

Very similar to the genotype, *abnormis* (Wesm.), which is considered a synonym of *dimidiatus* (Nees). The propodeum and metapleura, however, are mostly smooth and shining, while in the genotype they are finely closely rugulose and opaque; furthermore, the second abdominal tergite is more broadly smooth laterally in the present species, only the middle two-thirds being sculptured.

Female.—Length, 3 mm. Head transverse, about as wide as thorax; face broader than long, receding, mostly smooth, but with a finely shagreened opaque area each side between mouth-opening and eye; malar space at least as long as basal width of mandible; frons, vertex, temples, and cheeks polished; ocell-ocular line longer than postocellar line, but less than twice diameter of an ocellus; occipital carina very narrowly erased medially; temples rounded; antennae longer than body, 38-segmented; first flagellar segment scarcely longer than second. Thorax not higher than wide; pronotum dorsally with a large, deep, median fovea; notauli sharply impressed anteriorly, smooth, becoming obsolete posteriorly; mesoscutum, scutellum, sides of pronotum, and mesopleura entirely polished; scutellar furrow narrow, not distinctly foveolate; propodeum narrowing behind, smooth and shining, a median carina on basal half, lateral margins and apex weakly rugulose; stigma long, acuminate; radius arising from distinctly before middle of stigma and attaining extreme apex of wing; nervulus postfurcal by nearly its length; recurrent entering first cubital cell; second abscissa of radius twice as long as first and a little longer than first intercubitus; second cubital cell narrowing a little outwardly; radiella wanting; cubitella distinct, complete; mediella slightly shorter than basal abscissa of basella; postnervellus distinct, inclivous. Abdomen about as long as thorax, subsessile, broadening strongly to third tergite where it is distinctly broader than thorax; first tergite longer than broad at apex, somewhat elevated down middle and sloping gradually to lateral margins, finely longitudinally rugulose except for a small triangular smooth basal area which is margined by carinae that meet behind to form a more or less distinct median carina; second tergite transverse but longer than third, the middle two-thirds completely closely longitudinally rugulose aciculate, shining; third and following tergites polished, the third with a row of elongate punctures at extreme base medially; ovipositor sheaths about as long as first tergite.

Black; palpi yellowish white; mandibles and scape yellow; legs including coxae pale yellow, except apical segment of anterior and middle tarsi, apices of hind tibiae, and their tarsi entirely, which are blackish; broad lateral margins of second and following abdominal tergites, also apex of third, and the entire venter of abdomen testaceous; wings hyaline, stigma and veins brown.

Male.—A little more slender than female, the abdomen in its widest part scarcely wider than thorax; third, fourth, and fifth tergites yellowish, more or less brownish medially; apical tergites brown; antennae of allotype 38-segmented.

Type locality.—Fredonia, N. Y.

Type.—U. S. N. M. Cat. No. 44061.

Host.—*Metallus rubi* Forbes mining leaves of blackberry.

Described from 35 females and 14 males reared by D. M. Daniel.

The number of antennal segments in the paratypes ranges from 34 to 39.

Phanomeris phyllotomae, new species.

Also very similar to the genotype but distinguished especially by the longer antennae, the somewhat longer ovipositor sheath, which is about as long as the basal segment of the posterior tarsus, the absence of lateral reddish-yellow markings on the abdomen, and in having the basal half of the third tergite finely sculptured and opaque. It agrees with all details of the foregoing description of *metalli* except as follows:

Female.—Length 3.5 mm. Temples and cheeks gradually receding, scarcely convex; antennae much longer than body, 41-segmented in type; first flagellar segment nearly one and one-half times as long as second; scutellar furrow not very narrow, distincly foveolate; propodeum completely finely rugulose and opaque, with a poorly defined median longitudinal carina; nervulus postfurcal by about its own length; abdomen broadening to fourth tergite; first tergite very finely, not distinctly longitudinally, rugulose, and behind the smooth basal triangular area with a rather prominent keel which scarcely attains apical fourth of tergite; second tergite completely, finely but closely, longitudinally rugulose and opaque; third very finely rugulose on basal half.

Body entirely black except for a narrow more or less distinct reddish piceous band on third tergite just before apex; scape, pedicel, and basal segments of antennal flagellum brown.

Male.—Abdomen hardly as broad as thorax; the apical margins of third and fourth segments broadly transparently yellow; fifth more or less brownish at apex; rest of abdomen black; antennae of allotype 41-segmented, scape, pedicel, and two or three basal flagellar segments yellow.

Type locality.—Weitersfelden, Austria.

Type.—U. S. N. M. Cat. 44062.

Host.—*Phyllotoma nemorata* Fallén.

Five specimens of each sex reared in June, 1931, at the Gipsy Moth Laboratory, Melrose Highlands, Massachusetts, under No. 13618. A small number of adults was liberated in an infestation of *P. nemorata* at North Conway, New Hampshire.

In the paratypes the number of antennal segments ranges from 38 to 45.

MINUTES OF THE 437TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, APRIL 7, 1932.

[Approved at 438th meeting.]

The 437th regular meeting of the Entomological Society of Washington was held at 8 P. M., Thursday, April 7, 1932, in Room 43 of the new building of the National Museum. Mr. F. C. Bishopp, president, presided. There were present 49 members and 52 visitors.

There was no preliminary business.

The first communication on the regular program was by J. A. Hyslop, and was entitled "Objects and Methods in Insect Pest Survey Work."

Early interest in insect survey work, in evidence as far back as 1889, was obscured by introduction of important pests and by interest in other phases of entomology. The present survey work was begun by the Government in 1921, at the request of the American Association of Economic Entomologists. Notes on current insect conditions are now received from over 100 collaborators in this and adjacent countries, and filed permanently; formerly much of this information was neglected and lost. The system of filing, and of summarizing important information in maps and indices, was described with the aid of lantern slides.

The information thus brought together is available for study of distribution and of association with environmental conditions, and eventually, it is hoped for forecasting. Even with the weakness of some of the information gleaned from so many sources, it is believed that the whole gives a good idea of the insect situation. Predictions in 1923 of the spread of the Mexican bean beetle were cited as an example of successful forecasting.

The second communication was by William Mann, and was entitled "Collecting in British Guiana."

The arrangements for the trip, which was made in 1931, were mentioned. The course of the trip, in which several rivers were ascended, and its results, were outlined. The material collected was mostly vertebrate. The Surinam toad was not found in spite of careful search. The discussion was illustrated by a large series of lantern slides, showing something of living and traveling conditions in the country, and its industry, fauna and flora.

This paper was discussed by Mr. August Busck.

Under the heading, "Notes and exhibition of specimens," Mr. Hyslop called attention to a recent paper by E. C. Van Dyke in volume 20 of the Proceedings of California Academy of Sciences, entitled "Miscellaneous studies in the Elateridae and related families of Coleoptera" in which Plastoceridae is treated as a subfamily of Elateridae; although it has been recently shown to be a subfamily of Cebrionidae.

Mr. C. H. Hadley and Dr. J. L. King, of the Japanese Beetle Laboratory, upon invitation, greeted the Society.

Meeting adjourned at 9.25 P. M.

F. M. WADLEY,
Recording Secretary.

Actual date of publication, June 10, 1932.

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PROCEEDINGS OF THE

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DATA ON CAPTURES OF THE GRASSHOPPER PARATYLOTROPIDIA BEUTENMUELLERI MORSE (ORTHOPTERA: ACRIDIDAE).

By FRANKLIN SHERMAN, *Clemson College, S. C.*[1]

This grasshopper was described by Morse in 1907, and Blatchley in "Orthoptera of Northeastern America" (1920) repeats the description and states that "it is so far known only from three females taken by Beutenmueller near Black Mountain, N. Car., Aug. 30, 1906, and July, 1912,"—and so far as I am aware no additional records of its capture have been published.

On 3 August, 1926, at summit of Pinnacle Mountain (about 3,300 ft. elevation) in Pickins County, S. C., about 50 miles southwest of the type locality, I took one adult female in sparse grassy woods. This specimen was identified by Mr. A. N. Caudell and presented to the U. S. National Museum.

On 2 October, 1926, one adult female was taken at Clemson College, S. C. (730 ft. el.), by Mr. George E. Hudson, then a student majoring in Entomology and Zoology. This was later identified by Mr. Caudell and presented to the U. S. National Museum. This capture was about 100 miles (direct line) from the type locality and in the lower foothills of the mountains.

On 31 August, 1930, I collected on the mountain ridges near the North Carolina-South Carolina state line about 3 miles north of the 4-H Camp at Rocky Bottom, Pickens County, S. C., at about 2,750 ft. elevation. Here I took five adult females and *one adult male*, the latter having been unknown heretofore. Of these the male and one female were sent to Mr. Caudell for the National Museum. This spot is about 50 miles southwest of the type locality, and is just on the North Carolina side of the state line. All six were taken within a space of about an acre in an abandoned orchard pasture, now in grass, weeds and bushes. Females would jump clumsily, but were easily captured when once seen. The single male was caught as soon as seen so its actions in nature were not observed. On 14 September, 1930, I re-visited the spot and searched for several hours without result.

[1]Technical Contribution No. 23 (new series) from the South Carolina Agricultural Experiment Station.

On 31 October, 1930, I took one adult female near Saluda, S. C., in an open grassy glade in mixed woods. This locality is about 175 miles southward from the (mountainous) type locality, and is not even in the foothills, elevation only about 400 ft. or less. This specimen also presented to the U. S. National Museum.

These records add to our information on this species as follows:

(1) the male becomes known, (2) the species is by no means confined to the type locality nor even to the mountains, (3) apparently the females may be reasonably common at proper season and in appropriate habitat, (4) it has been taken from "July" to 31 October, and (5) so far as yet known the females appear greatly to outnumber the males.

DESCRIPTION OF THE MALE OF PARATYLOTROPIDIA BEUTENMUELLERI MORSE.

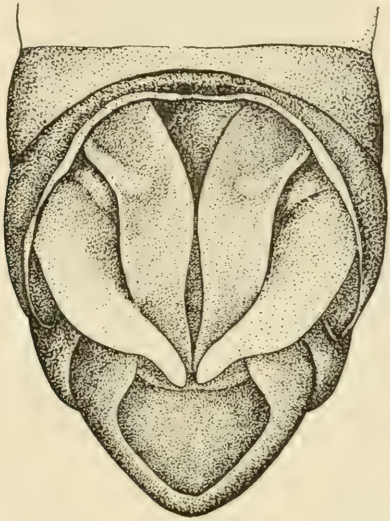
By A. N. Caudell,
Entomologist, Bureau of Entomology, U. S. Department of Agriculture.

The species of the genus *Paratylotropidia* are, so far as yet known, rather rare insects. There are two species, *P. bruneri* Scudd., the genotype, and *P. beutenmuelleri* Morse. Of these species scarcely over a dozen specimens of *bruneri* are known, including two males, and of the last described species there are known three females, including the type, and nine more specimens which form the subject of the faunal paper by Professor Sherman immediately preceding the present descriptive one. Included in this last mentioned lot there is one male, the only specimen of that sex so far known. Following is a description of this specimen:

Head very much as in *bruneri* as described by Scudder except that the frontal costa is rather distinctly sulcate from the ocellus to near the upper extremity, the interocular space is only about twice as broad as the basal segment of an antenna, and the antenna is about as long as the head and pronotum together. Pronotum with distinct and straight lateral carinae, diverging uniformly and decidedly backwards and at the extreme posterior margin more rounded; median carina low but distinct, the pronotal disk feebly tectate, the anterior margin truncate, the posterior margin broadly obtuse-angulate; lateral lobes longer than high and gently sloping; prozona almost twice as long as metazona; prosternal spine squarish, apically pointed and more rounded; mesosternal interspace subquadrate, very slightly longer than the mesial width; metasternal lobes well separated, the pits very distinct.

Legs with anterior and intermediate femora very moderately swollen, the posterior ones more decidedly so; hind tibiae with ten spines on each margin.

Tegmina basally projecting beneath the pronotum, the exposed portion decidedly shorter than the pronotum, about equal in length to the prozona and in shape almost circular, the length no greater than the width, the apex broadly rounded, the base beneath the pronotum somewhat narrowing.



Paratylotropidia beutenmuelleri Morse. Tip of abdomen of male, dorsal view.

Abdomen keeled dorsally and apically strongly curved upwards; last dorsal segment short and without any trace of furcula; supraanal plate somewhat shield-shaped, the expanding basal portion furnished on either side with a diagonal ridge extending about half way from the decidedly raised margins to the median sulcus; the median sulcus deep and precurrent, extending to the extreme tip of the plate and basally expanded into a slightly elongated triangular area, as shown by the accompanying figure; subgenital plate about as described and figured for *bruneri*. General color brownish above merging to lighter yellowish brown beneath; antennae darker in apical half; posterior tibiae rather dark red.

Length, body, 22 mm.; pronotum, 6.5 mm.; antenna, 11 mm.; posterior femora, 12.5 mm.; tegmina, beyond pronotum, 4 mm.; cerci, 2 mm.; width, tegmina, 4 mm.

One specimen from Rocky Bottom, South Carolina, 2,700 ft. elevation, August 31, 1930, by Prof. Franklin Sherman. Through the kindness of the collector this individual is in the collection of the U. S. National Museum.

A NEW BITING CULICOIDES FROM SALTMARSHES IN THE SOUTHEASTERN STATES.

By David G. Hall,
Insects Affecting Man and Animals, U. S. Bureau of Entomology.

One of the most important species of Culicoides occurring along the southeastern Atlantic coast of the United States is the form herein described as new. Heretofore, it has been generally determined as *Culicoides furens* Poey[1], a species based upon female specimens collected in Cuba.

Through the courtesy of Dr. R. H. Painter some male specimens of Culicoides were forwarded to the sand fly laboratory of the Bureau of Entomology at Charleston, S. C. These were collected by him in Honduras, Central America, and were determined for him as *Culicoides furens* Poey by Dr. W. A. Hoffman, a recognized American authority on this group. They differed from male specimens collected along the southeastern Atlantic coast of the United States. The latter is described at this time in order that we may have a usable name for this economic pest.

Since the original description of *Culicoides furens* by Poey was based upon female specimens, the status of this species is a matter of conjecture. Under the circumstances, it seems best to regard a species occurring in the type locality as the true *furens*. It is the writer's opinion that the specimens from Central America may represent a second species, and that from the South Atlantic States a third one. We are confronted with two species which differ in the terminalia, both of which are from areas distantly located from the type locality. The species herein described occurs in areas quite unlike the ecological conditions found in Cuba.

Culicoides dovei, n. sp.

A small blackish gray species with mottled thorax and wings, and banded legs, most commonly collected in those coastal areas having grass or mangrove marshes near brackish water and inlets.

Female.—About 1.50 mm. in length; head with eyes narrowly separated; palpi yellowish and as long as the proboscis; antennae shorter than the length of head and mesonotum combined, grayish yellow. Thorax fuscous, with gray pollinosity and with numerous small spots the shape and size of which vary in different specimens, these connected medially when enlarged; scutellum fuscous. Legs grayish yellow, femora and tibiae medially with darker bands. Wings spotted, the pattern quite distinct, stigmal spot large and definite, with some macrochaetae.

Male.—Colored as in female; antennae plumose; hypopygia as shown in figure one.

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[1]Poey, 1853, Mem. sobre la Hist. de la Isla Cuba, Vol. 1, p. 237 (Oecacta).

Alcoholic specimens lose the grayish polinosity, giving the specimens a dirty yellowish appearance. The above is based upon freshly collected material. This form differs from the Central American form in the structure of certain internal morphological details of the male hypopygia.

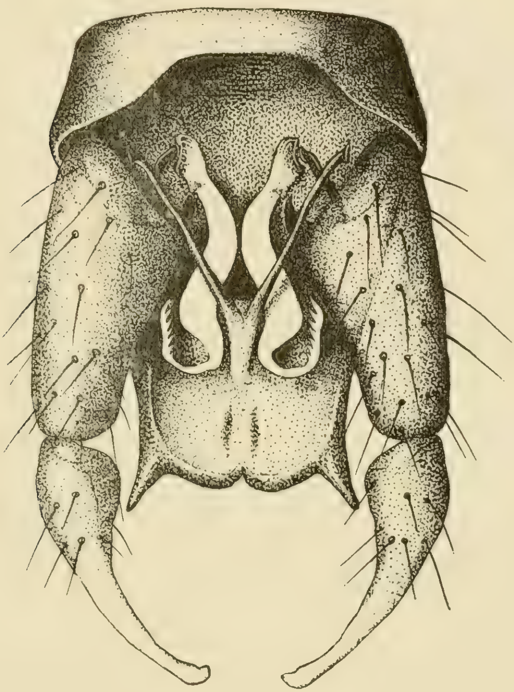


Figure 1.—*Culicoides dovei* Hall, Ventral view of male terminalia.

Described from a long series of both males and females, the females collected while biting warm-blooded animals, and also in light traps and by sweeping along the edges of grass and mangrove marshes in Florida, Georgia, South Carolina, and North Carolina. It occurs in enormous numbers in the mangrove swamps in Florida during most of the year, and in few numbers farther north, where it is an important species during the summer months.

Holotype.—Male, from Brunswick, Ga., Cat. No. 43972, U. S. National Museum.

Allotype and paratypes, as above.

TWO NEW SPECIES OF LAEVICEPHALUS FROM CALIFORNIA.

By P. W. OMAN, *Bureau of Entomology.*

The material upon which the following descriptions are based was taken by Mr. W. B. Cartwright and Mr. C. C. Wilson, mostly by sweeping grass and alfalfa in connection with work on cereal and forage crop insects at the Sacramento, California, laboratory, and transmitted to the writer by Dr. F. W. Poos. Types of the two species are deposited in the U. S. National Museum.

Laevicephalus cartwrighti, n. sp.

Resembling *L. cinerosus* (Van D.) but larger, with the male plates longer and more slender and the oedeagus without processes. Length of male, 4.25 mm.; of female, 4.5 mm.

Color.—General ground color pale greenish. Markings very similar to those of *cinerosus* but much paler and less extensive. Frontal sutures usually fuscous, frons with a pale median line and brown arcs laterally. Vertex with an oblique brown to fuscous line along anterior margins laterally, extending to ocelli, and a pair of longitudinal dashes on the disc. Median suture of vertex dark basally, median area pale, disc laterally usually washed with brownish in males, paler in females. Pronotum mostly dirty yellowish-green with traces of five whitish lines. Elytra subhyaline, cells sometimes very faintly fuscous along margins, veins mostly pale yellowish. Female genital segment black medially on posterior margin; ovipositor dark. Male valve and plates dark on disc, pygofer blackish.

Structure.—Vertex a little longer and more acute than in *cinerosus* (Fig. 1); elytra as in that species but proportionately larger.

External genitalia.—(Figs. 1*a*, 1*b*.) Least ventral segment of female about twice as long as preceding, posterior margin produced, median portion slightly excavated with a narrow, median incision, somewhat similar to that of *cinerosus* but the median incision deeper and the margins either side lacking the short, sharp teeth of that species. Female pygofer with many setae. Male valve quite large, subtriangular, apex rounded. Plates broad basally, tapering sharply, with lateral margins sinuately curved. Inner margins contiguous for over half their length, then gradually separating, apices of plates thus acute and diverging. Pygofer extending well beyond plates. Pygofer and lateral margins of plates closely set with whitish setae.

Internal male genitalia.—(Fig. 1*c*, 1*d*.) Oedeagus extremely long and slender, in lateral view sinuately curved.

The genitalia of either sex should be sufficient to distinguish this species.

Holotype male and *allotype* female from Soughhouse, Calif., May 19, 1931, W. B. Cartwright.

Paratypes.—2 females with the above data; 1 female from Sloughhouse, Calif., April 29, 1931, W. B. Cartwright;

1 female from Sacramento, Calif., April 27, 1931, C. C. Wilson; and 2 males from Roseville, Calif., April 10, 1931, C. C. Wilson.

Types.—Cat. No. 44240, U. S. N. M.

Laevicephalus wilsoni, n. sp.

Larger and with the vertex shorter than in *L. cartwrighti* n. sp. Length of male 4–4.5 mm., of female 4.75–5 mm.

Color.—General ground color pale yellowish-green. Face marked as in *cartwrighti* but with pale median line much less distinct. Vertex with a pair of short, oblique dashes of fuscous or brown at the apex. Pronotum and scutellum without markings. Elytra subhyaline, veins greenish-yellow. Veins of hind wings distinct and dark. Female genital segment with posterior margin dark medially; ovipositor black.

Structure.—More robust than *cartwrighti*, with vertex shorter and broader but very sharply angled (Fig. 2). Male vertex shorter than that of female. Elytra long, venation as in *cinerosus*.

External genitalia.—(Figs. 2*a*, 2*b*.) Last ventral segment of female about twice as long as preceding, posterior margin produced in rounding fashion, with a faint notch either side of the middle, leaving a short median tooth. Pygofer clothed with stout setae. Male valve similar to that of *cartwrighti* but with apex more nearly truncate. Plates broad basally, tapering to truncate tips. Width apically about one-half that at base. Inner margins of plates contiguous for entire length, tips not diverging as in *cinerosus*. Plates exceeded by heavy pygofer. Pygofer and lateral margins of plates closely set with setae.

Internal male genitalia.—(Figs. 2*c*, 2*d*.) Oedeagus short and stout, with a pair of lateral processes near tip similar to those of *cinerosus* but shorter. In lateral view tip of oedeagus with a short dorsal process, and a hook-like process extending ventrad.

The large size, lack of markings, and genital characters will distinguish this species. It has the general appearance of a *Thamnotettix* of the *atridorsum* group but the extremely pointed head and venation of the elytra place it in *Laevicephalus*.

Holotype male and *allotype* female from Sloughhouse, Calif., April 29, 1931, W. B. Cartwright.

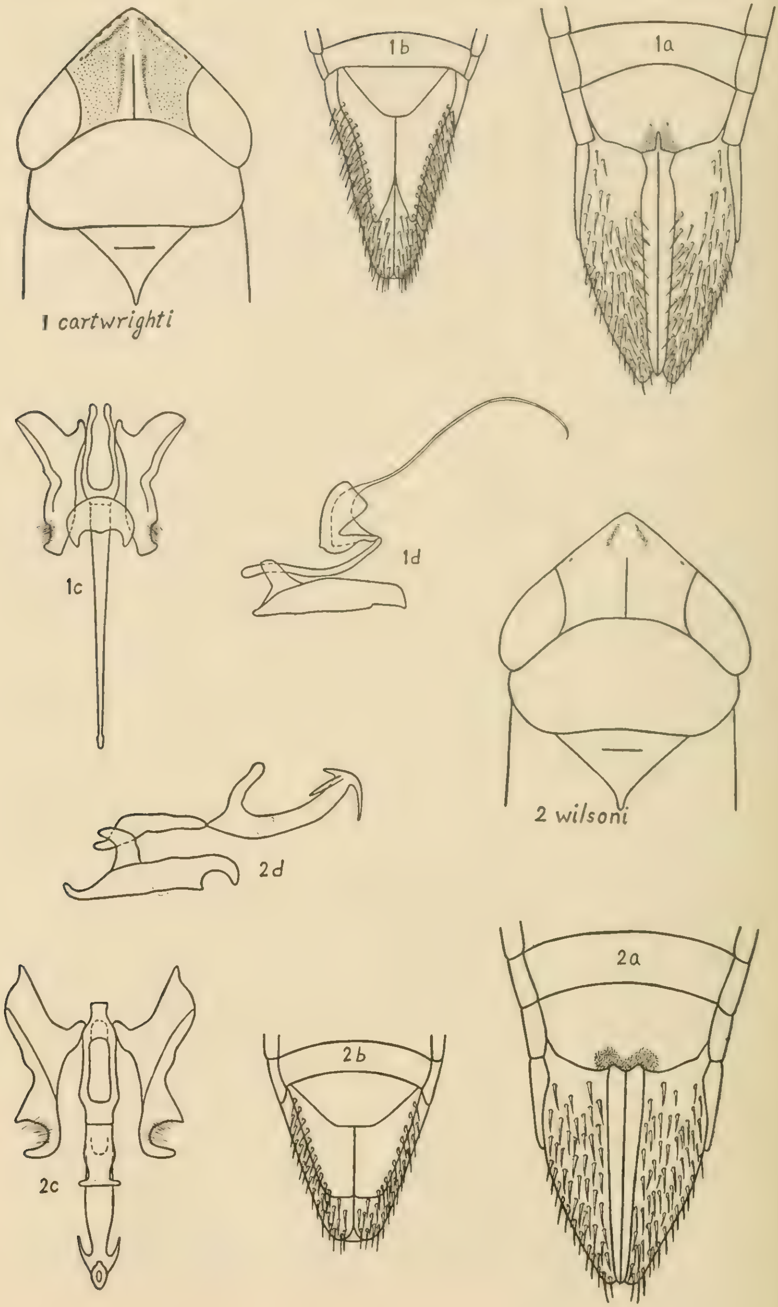
Paratypes.—Numerous specimens of both sexes from the above locality, collected in April and May, 1931, 1 male from Biggs, Calif., April 29, 1931, W. B. Cartwright; and 1 male from Roseville, Calif., April 10, 1931, C. C. Wilson.

Types.—Cat. No. 44241, U. S. N. M.

Explanation of Plate.

Fig. 1. *Laevicephalus cartwrighti* n. sp.: 1*a*, female genitalia; 1*b*, male genitalia; 1*c*, dorsal view of internal male genitalia; 1*d*, lateral view of internal male genitalia.

Fig. 2. *Laevicephalus wilsoni* n. sp.: 2*a*, female genitalia; 2*b*, male genitalia; 2*c*, dorsal view of internal male genitalia; 2*d*, lateral view of internal male genitalia.


1 cartwrighti
1a
1b
1c
1d
2 wilsoni
2a
2b
2c
2d

DESCRIPTIONS OF FIVE NEARCTIC SAWFLIES OF THE TRIBE HEMICHROINI.

By S. A. Rohwer and William Middleton,
Bureau of Entomology, Washington, D. C.

The following five new species of sawflies belonging to the Tenthredinid tribe Hemichroini have been received for identification since the review of the Nearctic species published by the senior author in 1918.[1]

Some of these species are of particular interest because of the association with foodplants. One of them, the new genus, is of special interest because of an unusual structural character which makes it necessary to broaden the description of the subfamily to include forms in which the prepectus is wanting.

SUSANA, new genus.

Although this genus lacks the prepectus—a character of considerable use in classification and heretofore thought to be well defined in all genera of the Nematinae—it is placed in the subfamily Nematinae, tribe Hemichroini. In this tribe it would fall on general habitus, next to the genus *Craterocercus* Rohwer. In addition to the absence of the prepectus it may, however, be distinguished from that genus by having a small erect inner tooth on the tarsal claws, in the truncate clypeus, in the nearly straight inner margin of the eyes, in the somewhat larger hind coxae, and in the better defined ocellar basin. Other than lacking the prepectus the important characters are those common to the tribe Hemichroini—even as to the wing venation, the characters of the pro- and meta-thorax.

Malar space practically wanting; eyes large, their inner margins straight and nearly parallel; anterior margin of the clypeus truncate; ocellar basin well defined; no carina on the hind margin of the head; antenna long and slender in the female, the third and fourth joints subequal but in the male the third is shorter than the fourth and compressed; head and thorax with distinct punctures; prepectus wanting; tarsal claws with an erect inner tooth near the middle; hind coxae large for the group; hind tibia longer than the femur or tarsi; first joint of hind tarsi longer than any of the following but not as long as the second and third; interradius usually present (incomplete in the male); second and third cubital cells each receiving a recurrent vein; nervulus a little basad of middle; anal vein fused with the submedius for a distance about half as great as the length of the first anal cell; anellen cell with a long petiole; cubitellan and discoidellan cells complete; recurrentella antifurcal in the female, postfurcal in the male; abdomen typical.

Genotype.—Susana cupressi, new species.

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[1]Notes on, and descriptions of sawflies belonging to the Tenthredinid tribe, Hemichroini (Hym), Proc. Ent. Soc. Wash., Vol. 20, No. 8, 1918, pp. 161–173.

Fig. 1. *Susanna cupressi*, wings of male allotype.

Susana cupressi, new species.

Female.—Length 7.5 mm. Superaclypeal area prominently convex; median fovea large, well defined, U-shaped; ocellar basin heptagonal, the walls rather sharply defined; lateral ocelli on the supraocellar line; postocellar line slightly longer than the ocellocular line; postocellar furrow present but not sharply defined; postocellar area convex; a rather large depression laterad of each lateral ocellus; head shining with distinct, well separated punctures; mesoscutum shining with widely separated distinct punctures; scutellum with the punctures larger and closer than those of the scutum; posttergite shining with distinct well separated punctures; stigma broadest at basal third, tapering to a subtruncate apex; interradius beyond middle; second recurrent close to the base of the third cubital cell; nates polished; sheath rather narrow, the upper margin straight, the lower slightly tapering to truncate apex. Black; pronotum, mesoscutum, abdomen except first tergite, apical tergite, sternite and sheath rufous; legs black; apices of four anterior femora and bases of hind tibiae rufous; wings subhyaline, venation including the costa and stigma black.

Male.—Length 6 mm. Structural characters agree in general with those described for the female. Antennae longer than the body, strongly tapering; hairy, third joint about three-fourths as long as the fourth, compressed and wider basally; interradius obsolete but presence indicated at the stigma; hypopygium shining, the apical margin depressed, truncate. Color markings as in the female except the thorax is entirely black.

Type-locality.—Santa Susana, Ventura County, California.

Allotype-locality.—Glendale, California.

Described from three (one type) females from the type-locality reared from Monterey Cypress (*Cupressus macrocarpa*), 2–9–31 and bear California Department of Agriculture number 31123; and from one male (allotype) collected 3–26–31 by Williams and coming from the collection of the Los Angeles County Horticultural Commissioner.

Type, allotype and paratypes.—Cat. No. 44063 U. S. N. M.

Platycampus (Anoplonyx) laricis, new species.

This second Nearctic species of the subgenus *Anoplonyx* may readily be separated from the description of *A. canadensis* Harrington by the pale angles of the pronotum.

Female.—Length, 5 mm. Anterior margin of clypeus broadly arcuately emarginate, the lobes broadly rounded; supraclypeal area flat; median fovea elongate, open above; ocellar basin hexagonal in outline, poorly defined below; postocellar furrow curved; postocellar area strongly convex, not defined laterally because of the obsolete vertical furrows; postocellar and ocellocular lines subequal; antenna slender, the third, fourth and fifth joints subequal; stigma broadest at base, tapering to an acute apex; third cubital cell but little longer than apical width; recurrentella antefurcal; sheath broad, truncate apically. Black; apex of clypeus, labrum and palpi piceous; legs below coxae reddish-yellow with a piceous tinge at base of femora; angles of pronotum and the tegulae sordid-whitish; ventral part of ninth tergite ferruginous; wings hyaline, venation dark brown.

Male.—Length 5 mm. Agrees with the above description of the female except as follows: Clypeus, labrum, pronotum, tegulae, femora and tarsi black. Hypopygidium black, broadly rounded; genitalia black.

Type-locality.—Coeur d'Alene, Idaho.

Described from three (one type) females and two (one allotype) males reared from larvae feeding on *Larix occidentalis* and recorded under Bureau of Entomology number Hopk. U. S. 16379[a]. Material collected by H. J. Rust and reared in the laboratory; males emerging April 15, 1922, and females May 18, 1922.

Type.—Cat. No. 25589 U. S. N. M.

The color antigeny is unusual and this coupled with the great difference in the emergence period casts some doubt as to the correctness of the association of sexes. In all structural characters the two sexes agree so well and inasmuch as they were secured from the same collection of larvae it seems best to consider the association correct.

Under the same Bureau number is recorded a single female which was collected on larch May 16, 1922. This specimen is larger than the other females and also differs in a few minor characters so it is not included in the type series.

Platycampus (Anoplonyx) laricivorus, new species.

Allied perhaps more closely to *A. canadensis* Harrington than is the new species described above but differs from Harrington's description in the pale tegulae and the ferruginous lateral spot on the ninth tergite. May be distinguished from *laricis* by the large median fovea and the black pronotum in the female and ferruginous hypopygidium of the male.

Female.—Length 5 mm. Anterior margin of the clypeus broadly, shallowly, arcuately emarginate, the lobes low and rounded; supraclypeal foveae deep, confluent with antennal foveae; supraclypeal area convex; median fovea large, deep, trapezoidal in outline; ocellar basin obsolete; a distinct furrow from anterior ocellus to postocellar furrow; postocellar furrow well defined, straight; postocellar area convex; vertical furrows present anteriorly; postocellar line distinctly longer than ocellocular line; stigma slightly broader at base, rounded on posterior margin; sheath broad, clothed with long hair, rounded apically. Black; tegulae and legs except the infuscate apices of posterior tibiae testaceous; sides of ninth tergite fulvous; wings hyaline; venation dark brown, stigma pale brown.

Male.—Length 4.75 mm. Agrees well with description of female except anterior femora are dusky at base beneath, the hind tarsi are infuscated. Recurrentella antefurcal; hypopygidium narrowly rounded, it and two preceding sternites ferruginous; genitalia ferruginous.

Type-locality.—Coeur d'Alene, Idaho.

Described from one female (type) and three males (one allotype) recorded under Bureau of Entomology number Hopk. U. S. 16379^h. The type and allotype reared from larvae feeding on *Larix occidentalis*, emerging in the laboratory May 15, 1922. The other two males were collected flying May 15, 1922. Material collected and reared by H. J. Rust.

Type.—Cat. No. 25590 U. S. N. M.

The type female lacks antennae, tarsi, left hind leg and the wings are crumpled apically.

Platycampus (Anoplonyx) itascus, new species.

This species like the preceding is more like *P.* (*A.*) *canadensis* Harrington than the first species but like *P.* (*A.*) *laricivorus* it possesses pale tegulae. It may be distinguished from the both preceding species by a distinct paling of the antennae from the third joint through the ninth which are distinctly black and concolorus with the basal two joints in both *P.* (*A.*) *laricus* and *P.* (*A.*) *laricivorus.*

Male.—Length 4.5 mm. Labrum polished; anterior margin of clypeus shallowly emarginate; supracylpeal foveae deep and confluent with antennal foveae; supracylpeal area convex and shining without punctures; median fovea faintly represented by a V-shaped line; ocellar basin wanting; a distinct furrow present from the median ocellus to the postocellar furrow; postocellar furrow distinct and slightly curved; postocellar area slightly convex, poorly defined laterally and undivided; postocellar line but slightly longer than the ocellocular line; head shining and practically impunctate; apical joint of antenna somewhat flattened; thorax shining and practically impunctate; posttergite long, more pointed than the scutellum posteriorly and less shining; intercubitella and recurrentella interstitial; hypopygidium rather narrowly rounded. Black; labrum brown; antennal joints 3–9 brownish, tegulae yellowish, venation yellowish, legs except the coxae yellowish; hypopygidium yellowish brown.

Type-locality.—Itasca Park, Minnesota.

Described from three males (1 type and 2 paratypes) collected

June 3, 1929, by S. A. Graham and received through the U. S. Bureau of Entomology.

Type.—Cat. No. 44064 U. S. N. M.

Hemichroa (Hemichroa) washingtonia, new species.

Like all Nearctic species, the female of this new form is closely allied to the European species *crocea* (Fourcroy). In the European form, however, the apex of the sheath is rounded and other differences are found in the head. Of the Nearctic species the female agrees in the position of the nervulus with the broken type of *H. pallida* (Ashm.). It differs in the much longer third cubital cell and in the dark posterior femora. In this it is like *H. americana* (Prov.) and *H. dyari* Roh. Ignoring the position of the nervulus, the female is more like *H. dyari* Roh.

Female.—Length 7 mm.; length of antenna 5 mm. Clypeus deeply subangulately emarginate, lobes rounded apically; middle fovea not sharply defined, elongate oval; frontal foveae deep, elongate; ocellar basin poorly defined below; antennal furrows interrupted above the frontal fovea; postocellar area gently convex, obscurely demarked, especially anteriorly, about one and one-fourth times as wide as long; third and fourth joints of the antenna subequal; stigma angulate basally, sharply tapering to a narrow apex; second recurrent very close to second intercubitus (there is some variation in this character, in some wings the two veins are interstitial); nervulus approximately in the middle of the first discoidal cell; sheath straight above, narrowly truncate apically, tapering to a broad base. Rufo-ferruginous; antennae, labrum, proepisternum, mesosternum and lower part of mesepisternum, mesepimeron, metapleurae and sheath black or dark brownish; legs black or dark brown, apices of anterior femora, their tibiae and tarsi and the base of the four posterior tibiae, pale brown; wings subhyaline with a brownish cast, darker basally, venation pale brown, stronger veins somewhat darker.

In some of the specimens the intercubiti are obsolete, particularly the second and third.

The male is more closely allied to *H. dyari* Roh. but the median fovea is more sharply defined and the supraclypeal area is less strongly convex.

Male.—Length 5.25 mm.; length of antenna 3.5 mm. Supraclypeal area gently convex; median fovea with a rather indistinct elongate pit at the bottom of a shallower depression; ocellar basin with lateral walls well defined; postocellar area sharply defined laterally, the anterior margin distinct; the other head characters as in the female; nervulus in the middle of the first discoidal cell; stigma rather gently tapering; second recurrent distinctly antifurcal; hypopygidium broadly rounded. Black; legs beyond the coxae except the apices of hind tibiae and the hind tarsi ferruginous; an indistinct ferruginous spot on the sides of the hind coxae; wings brownish, more distinctly so basally, venation pale brown.

Type-locality.—Seattle, Washington. Described from 57 females (one type) and 5 males (one allotype) collected August 25, 1923, by C. V. Piper. All of these specimens were found dead on the leaves of beans and it is thought that they were found after the application of some insecticide.

In addition to the above series there are ten poorly preserved specimens which are undoubtedly this species from Seattle, Washington, collected July 22, 1927, by M. J. Forsell, feeding on alder and assigned Seattle #1033.[1]

Type, *Allotype* and *Paratypes*.—Cat. No. 44087 U. S. N. M.

TWO NEW TERMITES FROM COSTA RICA.

By Thomas E. Snyder,
Senior Entomologist, Bureau of Entomology, U. S. Department of Agriculture.

Recently Mr. F. Nevermann of San Jose, Costa Rica, sent me a collection of termites from Costa Rica containing two new species and one species (*Mirotermes* (*M*). *panamaensis* Snyder) hitherto not recorded from Costa Rica; indeed one termite—a new species of *Neocapritermes*—is the first recorded from Middle America. Descriptions of the new species follow herewith.

Kalotermes (Neotermes) brevinotus, n. sp.

Dealated adult.—Head light castaneous brown, slightly longer than broad, with numerous long hairs. Eyes black, large, projecting, separated from lower margin of head by a distance approximately one-half the diameter of the eye; ocelli projecting, large, not round, hyaline, very close to eyes. Antennae broken, 12 segments, segments bead-like, not much difference in size. Pronotum of same color as head, slightly broader than head, concave anteriorly and slightly emarginate posteriorly, with long hairs. Wing scale slightly longer than pronotum. Abdominal tergites with long hairs at base. Apical tarsal claws with pulvillus.

Measurements.—Length of entire dealated adult: 10.0 mm.; length of head, 2.1 mm.; length of pronotum, 1.2 mm; length of anterior wing scale, 1.45 mm.; length of hind tibia, 1.6 mm. Diameter of eye (long diam.), 0.6 mm. Width of head (at eyes), 1.9 mm; width of pronotum, 2.1 mm.

Soldier.—Head light yellow brown, with darker reddish tinge anteriorly, arched, with oblique slope at front, epicranial suture slightly indicated, with fairly numerous, long hairs. Eye spot small, not distinct, hyaline. Antennae with 12 segments; third segment subclavate but not greatly modified, slightly longer than second or fourth; segments with long hairs. Mandibles piceous, reddish at base, inset from sides of head, elongate, slender, pointed and incurved

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[1]Since describing this species we have examined 3 females from British Columbia, one from White Rock collected by G. Beall, one from Rosedale collected by R. Glendenning and one from Langley collected by Graham; and one male from Milner, collected by K. Graham. These four specimens were forwarded by H. H. Ross. These specimens all have the second recurrent distinctly antefurcal.

at apex. Left mandible with 2 short, sharp-pointed marginal teeth near apical one-third, 2 blunt teeth or a molar near base; right mandible with a molar at oblique angle to margin of mandible in middle and another molar parallel to margin of mandible near base. Gula very narrow in middle, approximately only one-third as wide as at anterior margin. Pronotum pale yellow, very short, nearly 3 times as wide as long, concave, posterior margin broadly, roundly but shallowly emarginate, with long hairs. Abdominal tergites with long hairs at base. Hind femora not swollen; 3 spines at base of tibiae.

Measurements.—Length of entire soldier, 8.0 mm.; length of head and mandibles, 3.5 mm.; length of head to anterior margin, 2.2 mm.; length of left mandible, 1.3 mm.; length of pronotum, 0.5 mm.; length of hind tibia, 0.8 mm. Width of head at anterior margin, 1.4 mm.; width of head at middle, where widest, 1.7 mm.; width of head at posterior margin, 1.5 mm.; width of pronotum, 1.4 mm. Height of head (at middle), 1.3 mm.

Type locality.—Sandalo, Costa Rica.

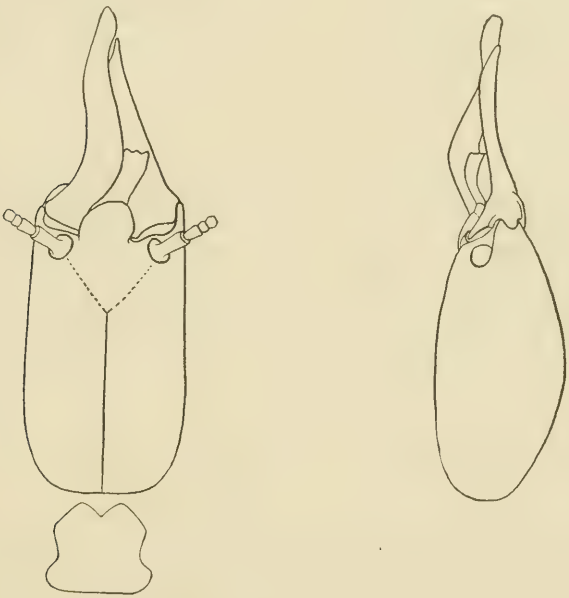

Fig. 1.—*Capritermes* (*Neocapritermes*) *centralis* Snyder, n. sp. Soldier head and pronotum, dorsal view, and head, lateral view. (Enlarged 18 x, drawn by H. B. Bradford.)

Described from one soldier and two dealated adults collected with nymphs at the type locality on April 28, 1930, by C. W. Dodge. *Holotype, soldier.* Cat. No. 44099 U. S. N. M.; morphotypes, dealated adults. The large eye and long hairs on the dealated adult and the short pronotum of the soldier are distinctive characteristics of this species.

Capritermes (Neocapritermes) centralis, n. sp.

(Text Fig. 1.)

Soldier.—Head yellow to pale yellowish-brown, with distinct dark longitudinal median line, head broader posteriorly, with scattered, fairly long hairs. Labrum of same color as head, faintly trilobed, slightly narrowed in middle. Gula elongate, not much narrower in middle than anteriorly. Mandibles piceous, twisted; left mandible longer than right. Antennae with 15 to 16 segments, about as in *C.* (*N.*) *longinotus* Snyder. Pronotum white with tinge of yellow, darker on anterior margin, where markedly emarginate, with scattered long hairs. Abdominal tergites with long hairs.

Measurements.—Length of entire soldier, 6.75 mm.; length of head with mandibles, 3.5–3.6 mm.; length of head without mandibles, 2.0 mm.; length of left mandible, 1.6 mm.; length of pronotum, 0.7 mm.; length of hind tibia, 0.8 mm. Width of head anteriorly, 1.1 mm.; width of head posteriorly, 1.2 mm. Height of head at middle, 0.8 mm. Width of pronotum, 0.7 mm.

Type locality.—Hamburg Farm, Santa Clara Province, Costa Rica.

Described from 4 soldiers collected with workers in decaying wood by F. Nevermann, May 9, 1930, with winged adults, soldiers, and workers of *Cylindrotermes macrognathus* Snyder.

Co-types, soldiers.—Cat. No. 44100 U. S. N. M.

Capritermes (*N.*) *centralis*, n. sp., is the first *Neocapritermes* species recorded from Middle America; it is very small and close to the larger *longinotus* Snyder from Colombia, but is distinctive in width of gula, lighter color, and pronotum markedly less roundly but more angularly emarginate at anterior margin.

THE SUBFAMILIES OF THE BRUCHIDAE (COLEOPTERA).

By John Colburn Bridwell.

From the year ten of the first French republic (1802) when Latreille assembled *Rhinosimus*, *Anthribus*, and *Bruchus* into his family *Bruchèles* (*Bruchelae*), up to this troubled year 1932, the conception of the family *Bruchidae* has been constantly changing and but few of the desirable subdivisions of the old genus *Bruchus* of Linnaeus, Fabricius, and Latreille are as yet commonly recognized. After fifteen years' study of the Bruchidae the writer has arrived at some definite opinions in these matters which he wishes to record. The description of the family here presented excludes *Bruchela* Dejean 1821 (*Urodon* Schoenherr 1823) and *Rhaebus* Fischer von Waldheim 1824 and includes *Eubaptus* Lacordaire 1845, treated as forming the subfamily EUBAPTINAE. The other four subfamilies here recognized are the BRUCHINAE including the greater part of the genera and species of the family; the PACHYMERINAE, dealt with in some detail in these Proceedings, volume 31; the AMBLYCERINAE, including the species usually included in *Spermophagus;* and the KYTORHININAE, including only *Kytorhinus*, represented in the American fauna by *K. prolixus* (Fall 1926).

CHARACTERS OF THE BRUCHIDAE.

The Bruchidae are pubescent, punctate and micropunctulate Phytophaga having cryptopentamerous tarsi, third tarsal joint bilobate, ungues appendiculate except in *Zabrotes;* head closely applied, when at rest, to the pro- and mesosternum, mandibles then directed backward; mandibles elongate, acute, a membraneous flap on the inner margin between the cutting apex and a basal molar mass; a suture separating clypeus from front; eyes emarginate in front; antennae 11-jointed compressed, expanded except basal 2, 3, or 4 joints, and subperfoliate, serrate, pectinate or flabellate rarely subfiliform; antennal sockets in front of and close to the emargination of the eyes; head with a transverse furrow extending across the ventral surface and on either side behind, to the summit of the eyes, setting off the occiput as a neck, which is largely concealed above when the head is extended, and exposed with head at rest; gular sutures distinct behind, abruptly bent inward and joined in the middle behind the transverse furrow; gula at and before the furrow not separated from epicranium, continued forward between the buscal fissures to receive the mentum on the entire anterior margin; front coxae elongate, received in elongate coxal cavities, nearly closed behind by posterolateral pieces which are not joined in the middle line; prosternum short, vertical or nearly so, with lateral wings definitely limited on either side and an intercoxal process partially or completely separating the coxae; elytra punctate-striate with 10 striae (some striae abbreviate and joined at apex), separately rounded at apex, and revealing the pygidium; middle coxal cavities with a trochantin extension; front and middle femora slender; hind femur compressed and more or less incrassate, often flattened on ventral margin, with one or two longitudinal carinae, these often armed with serrations, teeth and denticles, especially near apex; hind tibiae usually longitudinally carinate, truncate and variously armed with fixed spines or teeth at apex, less often bicalcarate; pygidium exposed behind the elytra (in some males an additional tergite exposed between pygidium and last sternite); five sternites visible, first and, usually, fifth longer than one of the three equal intermediate sternites; edeagus with apical portion of tegmen well developed, usually bilobate, connected by lateral commissures with one or two ventral struts, internal sac well developed with sclerotizations on the internal surface characteristic of species; median lobe with characteristic apical structures and usually cucullate basally; ovipositor with two segments supported by sclerotised struts and telescoping one into the other, copulatory bursa usually bearing on its internal surface sclerotizations characteristic of the species; first stage larva with a transverse pectinate plate on pronotum, unknown in other coleopterous larvae; advanced larvae with characteristic modification of the labio maxillary region of the mouth, with oblong head capsule deeply inserted into the thoracic mass, larva curved and grublike and not greatly unlike some Bostrychoid and Curculionoid larvae.

POSITION OF BRUCHELA.

From the Bruchidae as described above the adult *Bruchela* differs in almost every particular. The mandibles somewhat resemble those of the Bruchidae but lack the membraneous flap and molar mass which seems diagnostic of that family. The first stage larva of *Bruchela* is unknown but Dr. Böving has studied the advanced larva and has pointed out to me the characters which show its very close relationship to the Anthribidae and the absence of all the special structures found in the *Bruchidae*. The adult differs in important characters sufficient to exclude it from Anthribidae but agrees with them in the significant absence of gular sutures. Hence the writer is disposed to accept a family Bruchelidae closely allied to Anthribidae, including *Bruchela* (= *Urodon*), *Cercomorphus* Perris 1864, and *Urodoplatus* Motschulsky 1874. Neither family seems to him closely allied to the *Bruchidae*.

RHAEBUS NOT A BRUCHID.

Rhaebus is known to the writer only by descriptions and the weight of authority seems to be against considering it a bruchid. Schoenherr and his associates excluded it from the Bruchidae and Lacordaire, Chapuis and Suffrian all considered it chrysomelid. The only eminent student of *Chrysomelidae* considering it a bruchid seems to be Weise. Its recorded structures agree with the *Bruchidae* in several particulars, but these are all found also in genera universally considered chrysomelid. The mandible is described as having a second tooth near apex and the head as not being capable of being bent down against the breast; either character seems sufficient to exclude it from the *Bruchidae*. The larva is unknown.

EUBAPTUS AS A BRUCHID.

Specimens of a small unidentified yellow-and-black beetle were shown to me in Washington in 1920, by H. S. Barber, and in London in 1924, by K. G. Blair, each considering it a strange bruchid. This has since been found to agree with the description of *Eubaptus palliatus* Lacordaire 1845 (Monogr. Phytoph. 1 : 605–607), placed by him after *Rhaebus* in the *Crioceridae*. On the basis of this description, Chapuis 1874, in Lacordaire Hist. Nat. Col. 10: 49–54, referred it to a tribe *Rhaebites* in the *Sagridae*. While peculiar in form, coloration, and male genitalia *Eubabtus* has all the characters of the Bruchidae as described above, including the peculiar bruchid mandible. The type of the species from Bolivia would appear to be in the D'Orbigny material in the Paris Museum. The United States National Museum has three specimens from Paraguay and one from Trinidad. There are a few individuals in the British Museum from some northern South American locality. Nothing is known of its habits.

Table of Subfamilies.

1. Mesopleural suture obsolescent, joining mesometapleural suture at an acute angle near its middle, leaving mesepimeron remote from coxal cavity; or, less often, mesopleural suture approaching mesometapleural suture closely and running subparallel to it to trochantin extension of coxal cavity so that the mesepimeron attains the coxal cavity very narrowly; tibiae without calcaria; hind tarsus about as long as tibia; hind femur about as wide as coxa.......................... BRUCHINAE.
   Mesopleural suture distinct, free from mesometapleural suture; mesepimeron attaining coxal cavity with about its width at middle; one to three pairs of tibiae sometimes bicalcarate at apex.................................... 2.
2. Prothorax without carina separating flank from dorsum; hind femur never strongly incrassate; hind tibiae straight.. 3.
   Prothorax with carina separating flank from dorsum; hind femur sometimes strongly incrassate, hind tibia then strongly arcuate.......................... 4.
3. Pygidium short, one or two tergites also exposed behind elytra; ♂ antennae flabellate or pectinate; tibiae not calcarate; hind femur narrower than coxa; hind tarsus about as long as tibia.......................... KYTORHININAE new subfamily.
   Pygidium short, covered at base by elytra; antennae alike in sexes, subperfoliate; hind tibia with two very unequal calcaria; hind coxa much narrower than femur and than first sternite behind it; hind tarsus about half as long as tibia................ EUBAPTINAE new subfamily.
4. Hind femur not strongly incrassate, only half as wide as coxa, channelled and longitudinally bicarinate beneath, carinae usually unarmed, never with more than one short blunt tooth; hind coxa very broad, wider than length of first sternite behind it; hind tibia straight, not mucronate, bicalcarate; hind tarsus as long as tibia; front and middle tibiae not calcarate; pronotum without impressed line above lateral carinae.............................. AMBLYCERINAE new subfamily.
   Hind femur strongly incrassate, much wider than coxa, unicarinate beneath with a strong denticulate crista; hind coxa narrower than length of first sternite behind it; hind tibia strongly arcuate, with a trowel-shaped mucro (and paired calcaria in *Caryoborus*) at ventral apex; hind tarsus about half as long as tibia; front and middle tibiae with feeble paired calcaria hidden in apical pubescence; pronotum with distinct impressed line continued from basal margin above lateral carina.. PACHYMERINAE.

Genera of Bruchidae Arranged in the Subfamilies, with Their Genotypes.[1]

BRUCHINAE.

Acanthoscelides Schilsky 1905, Käfer Europa's 41: f, C, no. 95–98.
Genotype, designated by Bridwell 1929 Proc. Ent. Soc. Wash. 31: 42, *Bruchus irresectus* Fahraeus 1839, in Schoenherr Gen. Curc. 5: 5: 18 [=*Bruchus obtectus* Say 1831 N. Am. Curcul. 1 (=Leconte Ed. Say 1: 259)].

Bruchidius Schilsky 1905, Käfer Europa's 41 e, B. no. 36–94.
Genotype, by present designation, *Bruchus quinqueguttatus* Oliver 1795 Ent. (4) 79: 15.

Bruchinus Schilsky 1905, Käfer Europa's 41: no. 38.
Genotype, monobasic, *Laria monstrosicornis* Pic 1904, Échange 20: 40= *Bruchinus walkeri* Schilsky i. l. cited in synonymy of *Bruchidius monstrosicornis* (Pic) Schilsky l. c. Valid and available if needed in dismemberment of *Bruchidius*.

[**Bruchus** Linnaeus 1758, Systema Naturae Ed. 10 1: 1: 356.
Cited in synonymy of *Dermestes pisorum* Linnaeus l. c. According to Opinion 5 of the International Commission *Bruchus* is not here validated. Many practical considerations, too involved to present here, suggest the use of *Bruchus* as of this date.]

Bruchus Linnaeus 1767, Systema Naturae Ed. 12 1^2: 604.
Genotype, designated by Latreille 1810, Consid. Gener. 430, *Bruchus pisi* Linnaeus l. c. [=*Dermestes pisorum* Linnaeus 1758]. (Not *Bruchus* Geoffroy 1762 Hist. Abreg. Ins. Paris. 1: 163–165. Genotype, by present designation, *Cerambyx fur* Linnaeus 1758, Syst. Nat. Ed. 10 1: 393. Not *Laria* Scopoli 1763, Ent. Carniol. Index [2], 21–22. Genotype, by present designation, *Laria dulcamarae* Scopoli l. c. 22=*Pria dulcamarae* auctorum, to accord with first revision Linnaeus 1767, removing *salicis* to *Bruchus*, accepted by Goeze 1777.

Mylabris Geoffroy 1762, Hist. Abreg, Ins. Paris 1: 266–269.
Genotype, by present designation, *Bruchus pisi* Linnaeus 1767, first named species included, by Linnaeus 1767.

Callosobruchus Pic 1902 Rev. d'Ent. 22: 6.
Genotype, designated by Bridwell 1929, Proc. Ent. Soc. Wash. 31: 40, *Bruchus scutellaris* 'Fabricius 1792, Ent. Syst. $1^2$372 [=*Curculio chinensis* 1758, Syst. Nat. Ed. 10 1: 386] (Sharp 1914 Zool. Rec. 50: Ins. 260 cited *B. chenensis* [=*Curculio chinensis* as type of *Callosobruchus* Pic 1912, Échange 28: 92]).

Caryedes Hummel 1827, Essais Ent. 6: 11.
Genotype, monobasic, *Bruchus faldermanni* Mannerheim in Hummel l. c.

Pachymera Berthold 1827, Latreille Fam. Nat. Tierreich 378. No species included. Based on *Pachymerè* Latreille 1825, a vernacular French name without standing in zoological nomenclature. Believed to be subsequent to *Caryedes* but not certainly so.

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[1]Genera designated by an Asterisk (*) have been placed from the literature, no material representing them being available to the writer for study.

Pachymerus "Latreille" Schoenherr 1833, Gen. Curc. 1:2, 84–92.
Genotype, originally designated, *Bruchus brasiliensis* Thunberg 1816 Vetensk. Acad. Handl. 1816:45, congeneric, and perhaps conspecific with *Bruchus faldermanni*.

Andromisus des Gozis 1881 (as *Adromisus* typ. err.), Ann. Soc. Ent. France (6) 1:CXIII. Substitute name for *Pachymerus* "Latreille" [Schoenherr], therefore isogenotypic.

Pseudopachymerus Pic 1913, Col. Cat. 55:10.
Substitute name for *Pachymerus* Schoenherr, therefore isogenotypic, also originally designated, *Bruchus brasiliensis*.

Cosmobruchus Bridwell 1931, Proc. Ent. Soc. Wash. 33:41.
Genotype, monobasic, originally designated, *Cosmobruchus russelli* Bridwell l. c.

Dahlibruchus Bridwell 1931, Proc. Ent. Soc. Wash. 33:40.
Genotype, originally designated, *Cosmobruchus sharpianus* Bridwell l. c. =*Bruchus longulus* Sharp 1885, Biol. Centr.-Am. Col. 5:482 (not Kraatz 1868).

Falsobruchus Pic 1913, Échange 29:110.
Genotype, monobasic, *Bruchus* (*Pachymerus*) *cristatus* Fahraeus 1839, in Schoenherr Gen. Curc. 5:122.

Gibbobruchus Pic 1913, Échange 29:110.
Genotype, by present designation, *Bruchus* (*Pachymerus*) *speculifer* Gyllenhal 1833, in Schoenherr Gen. Curc. 1:87.

***Impressobruchus** Pic 1910, Échange 26:95.
Genotype, monobasic, *Impressobruchus semiruber* Pic l. c.

Megacerus Fahraeus 1839, in Schoenherr Gen. Curc. 5:34.
Genotype, monobasic, *Bruchus pescaprae* Fahraeus l. c.

Pachybruchus Pic Pic 1912, Échange 28:92.
Genotype, designated by Bridwell 1929, Proc. Ent. Soc. Wash. 31:113, *Bruchus coryphae* Olivier 1795, (4) 79:16.
[The genotypes may well be considered as subgenerically distinct.]

Phelomerus Pic 1912, Échange 28:92.
Genotype, designated by Pierce 1930, Proc. Ent. Soc. Wash. 32:37, *Phelomerus ochropygus* Pic. l. c.

***Pygiopachymerus** Pic Échange 27:134.
Genotype, monobasic, *Pygiopachymerus theresae* Pic. l. c.

Rhipibruchus new name for *Megalorhipis* Philippi 1869, An. Univ. Chile 16 :668 (not Lacordaire 1857).
Genotype, monobasic, *Megalorhipis leiboldi* Philippi l. c. [=*Bruchus picturatus* Fahraeus 1839, in Schoenherr Gen. Curc. 5:2].

KYTORHININAE.

Kytorhinus Fischer von Waldheim 1809, Mem. Soc. Nat. Moscou 2: 298–304.
Genotype, designated by Crotch 1870, Trans. Ent. Soc. London 1870:222, *Kytorhinus karasini* Fischer l. c.

Pygobruchus Sharp 1886, Ann. Mag. Nat. Hist. (5) 17:38.
Genotype, monobasic, *Pygobruchus scutellaris* Sharp l. c. [not *Kytorhinus scutellaris* (Fabricius) Motschulsky 1874 (=*Kytorhinus sharpianus* new name)].

EUBAPTINAE.

Eubaptus Lacordaire 1845, Monogr. Phytoph. 1:605.
Genotype, monobasic, *Eubaptus palliatus* Lacordaire l. c.

AMBLYCERINAE.

Amblycerus Thunberg 1815, Nova Acta Upsal. 7:121–122.
Genotype, designated by Bridwell 1930, in Pierce Proc. U. S. Nat. Mus. (77) 17:29, *Bruchus robiniae* Fabricius 1781, Spec. Ins. 1:75, cited by Thunberg as *Amblycerus robiniae.*

Euspermophagus Zacher 1930, Arb. Biol. Reichsanst. Land-u. Forstwirtsch. 18:237.
Genotype, originally designated, "*sericeus* Geoffroy" [=*Bruchus cardui* Boheman 1829, Mem. Soc. Nat. Moscou 7:117 (=Nouv. Mem. 1:117) =? ? *Mylabris sericea* Geoffroy 1785 in Fourcroy Ent. Paris 112 (not *Mylabris sericea* (Pallas 1782) Tauscher 1812)].

*__Pygiospermophagus__ Pic 1917, Mél. Exot. Ent. 26:8.
Genotype, monobasic, *Pygiopachymerus brevicornis* Pic. l. c.

Spermophagus Schoenherr 1833, Gen. Curc. 1:2, 102.
Genotype, originally designated, *Spermophagus titivilitius* Boheman 1833, op. cit. 1:106.

Spermatophagus Gistl 1856, Myster. Europ. Insectenw. 375.
Emendation of *Spermophagus*, therefore isogenotypic.

Zabrotes Horn 1885, Trans. Am. Ent. Soc. 12:157.
Genotype, designated by Zacher 1930, Arb. Biol. Reichsanst. Land-u. Forstwirtsch. 18:237, *Zabrotes cruciger* Horn l. c.

PACHYMERINAE.

Caryedon Schoenherr 1823, in Isis von Oken 1823:1134.
Genotype, originally designated, *Bruchus serratus* Olivier 1790, Encycl. Meth. Ins. 5:199 [=*Bruchus fuscus* Goeze 1777, Ent. Beytr. 1:332.]

Caryoborus Schoenherr 1833, Gen. Curc. 1:2, 92–97.
Genotype, originally designated, *Bruchus serripes* Sturm 1826 Cat. Ins. 74.

Caryobruchus Bridwell 1929, Proc. Ent. Soc. Wash. 31:148.
Genotype, originally designated, *Dermestes gleditsiae* Linnaeus 1763, Amoen. Acad. 6:392.

Caryopemon Jekel 1855, Ins. Saund. Curc. 25–29.
Genotype, monobasic, originally designated, *Caryopemon hieroglyphicus* Jekel l. c. 27–29.

*__Diegobruchus__ Pic 1913 Échange 29:110.
Genotype, monobasic, *Bruchus suarezicus* Pic. 1904, Échange 20:35 (*soarezicus*, typ. err.).

Pachymerus Thunberg 1805, Goeting. Gel. Anz. 28:281.
Genotype, monobasic, *Dermestes bactris* Linnaeus 1763, Amoen. Acad. 6:392, cited as *P. bactris.*

MINUTES OF THE 438TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, MAY 5, 1932.

The 438th regular meeting of the Entomological Society of Washington was held at 8 P. M., Thursday, May 5, 1932, in Room 43 of the new building of the National Museum. Mr. F. C. Bishopp, president, presided. There were present 36 members and 20 visitors. The minutes of the previous meeting were read and approved.

Mr. A. Edison Badertscher of McCormick & Co., of Baltimore, Md., was admitted to membership by unanimous vote of the society.

Under the heading, "Reports of Officers," the Corresponding Secretary referred to the meeting of the 5th International Congress of Entomology to be held in Paris, July 16 to 23, discussing briefly the plan of representation followed by the various societies when the 4th International Congress met at Ithaca. He suggested that it would be desirable for the Society to follow a similar plan for the coming meeting and name some one to officially represent the Society and extend its greetings to the Congress. He indicated that there was uncertainty who would attend the Congress from Washington and felt the Society could better be represented by some one well identified with Washington. He moved that Doctor L. O. Howard be appointed as delegate from the Entomological Society of Washington to the 5th International Congress of Entomology; that proper notification of this action be sent to the President of the Congress; and that Mr. August Busck be named as an alternate to act in event Doctor Howard is unable to serve and Mr. Busck attends the Congress. The motion was carried.

The Corresponding Secretary called attention to the forthcoming centennial meeting of the Entomological Society of France, to be held in Paris, in July, immediately preceding the meeting of the 5th International Congress. He stated that Doctor Howard had expressed a desire to be authorized to represent the Society at this meeting, and that he knew of no one who could do this with more credit to the Society. He moved that Doctor Howard be named as a delegate to the centennial Meeting of the Entomological Society of France and that proper notice be sent to the responsible officer. The motion was carried.

The President spoke of next month's meeting, which will probably be held outdoors. Mr. Hambleton invited the society to hold this meeting at the Bee Culture Laboratory at Somerset, Md. A motion was passed that the invitation be accepted and that the entertainment committee be instructed to make needed arrangements.

The first communication on the regular program was by Floyd F. Smith, and was entitled "Studies on the Gladiolus thrips (*Taeniothrips gladioli* M. & S.)"

The discussion, based on studies by Dr. C. A. Weigel, Dr. H. H. Richardson, and the author, described the injury by the feeding of the thrips; i. e., russetting of corms, silvering of foliage, and spotting and malformation of flowers. Breeding of the thrips occurs throughout the year on the growing plant and on corms in the storage, a generation developing in 10 days at 80° F., in 17 days at 70° F. and in 4 weeks at 60° F. Unfertilized females produce only male offspring. The thrips are doubtless widely distributed because of extensive shipment of corms, but records now include California, Florida, and the general area from Virginia northward and from Michigan and Indiana eastward. Corms were effectively treated by vapor heat or hot water immersion, fumigation with calcium cyanide, ethylene dichloride-carbon tetrachloride mixture, or naphthalene or submerging in the fungicidal dips, semesan or mercuric bichloride. (Author's abstract.)

This paper was discussed by Rohwer, Wood and Benjamin.

The second communication was by H. S. McConnell, and was entitled "Biological notes on the strawberry leaf-roller (*Ancylis comptana*)."

The role of *Ancylis comptana* as a host of *Macrocentrus ancylivora*, the peach moth parasite, in Maryland was studied. Only 2 specimens of Macrocentrus were reared from this host in a long period. The studies were conducted at Glenburnie, Salisbury and Marion, Md. A large number of parasites which were reared from Ancylis were named. There were 20 species of primary parasites, 6 occurring in some numbers: of these, *Cremastus cooki* was most important and appears to be a controlling factor. There were 3 species probably both primary and secondary, and 7 species of secondary parasites, with one species of an uncertain order of parasitism. Charts were shown illustrating percentages of parasitism and hyperparasitism, and species relations were discussed.

The paper was discussed by Clausen, Gahan, Bridwell, Rohwer, Muesebeck and Wood.

Under the heading "Notes and Exhibition of Specimens" Mr. Heinrich exhibited a set of color drawings of Coleoptera and Lepidoptera by Mr. Francis Noyes, with specimens of the insects for comparison.

This contribution was discussed by Snodgrass.

Dr. J. W. Bulger gave a brief note in which he stated that grasshopper eggs (probably *Melanopus differentialis*), which had been kept in moist sand in cold storage for 18 months, had been recently taken from storage, and were found to hatch and apparently to develop normally.

This note was discussed by Bridwell.

Mr. Snodgrass spoke of the honey bee's method of stinging, sketching the organs concerned on the blackboard. The sting is extruded and retracted apparently by varying internal pressure exerted against its base, since it has no specific protractor muscles. The finer movements of the piercing elements are caused by the muscles of the sting mechanism.

Dr. White submitted lantern slides showing methods of rearing sterile maggots for flies from which eggs are obtained in producing surgical maggots.

Mr. C. W. Collins of the gipsy moth laboratory; Mr. W. A. Thomas of the Chadbourn, N. C., laboratory; and Dr. P. M. Gilmer, of the Wichita fruit insect laboratory, upon invitation greeted the society.

Meeting adjourned at 10.07 P. M.

F. M. WADLEY,
Recording Secretary.

NOTE.

The address of Stansbury Hayden as given in Proc. Ent. Soc. Wash. v. 33, no. 9, p. 234, should be corrected to read as follows: Stansbury Hayden, Natural History Society of Maryland, 605 St. Paul Street, Baltimore, Md.—J. S. WADE.

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PROCEEDINGS

OF THE

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PROCEEDINGS OF THE
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TWO NEW SPECIES OF PHYTOPHAGOUS EURYTOMIDAE (HYMENOPTERA : CHALCIDOIDEA).

By C. F. W. Muesebeck, *Bureau of Entomology.*

Prodecatoma diospyri, new species.

Most similar to *brunneiventris* Ashmead and *spermophaga* Lima, but distinguished from both by the slender marginal vein, the more nearly uniform ciliation of the anterior wing, the relatively longer ocellocular line, which is nearly or quite equal to the postocellar line, and the longer abdominal petiole, which is about as long as broad. The male is further distinguished by a conspicuous swelling on lower side of scape.

Female.—Length 3.8 mm. Head strongly transverse, umbilicately punctate, viewed from in front broadly truncate below; eyes prominent; malar space nearly vertical, but strongly rounded off on lower fourth, fully three-fourths as long as eye; face broad, scarcely convex, with strong rugae converging toward mouth; cheeks faintly reticulate or irregularly lineolate; frons with a prominent, strongly compressed elevation between bases of antennae; median ocellus less than its diameter from lateral ocelli; postocellar line twice diameter of an ocellus and as long as, or indistinctly longer than, ocell-ocular line; antennae 11-segmented, composed of scape, pedicel, one ring-joint, 5-jointed funicle, and 3-jointed club; scape inserted very slightly above level of lower eye margins and extending a little above ocelli, slender, tapering slightly toward base and apex; pedicel distinctly less than one-third as long as scape; ring-joint much narrower than pedicel, a little broader than long; funicle cylindrical, first joint almost twice as long as pedicel, twice as long as broad at apex; second and third subequal, distinctly shorter than first; fourth and fifth successively slightly shorter; club not thicker than funicle, about as long as last two funicle joints combined.

Thorax stout; pronotum, mesoscutum, and scutellum covered with large, closely placed, umbilicate punctures, propodeum coarsely rugose reticulate, broadly impressed down the middle, the impressed area less strongly sculptured, shining, and margined by irregular raised lines; mesopleura shining, mostly smooth but with a broad oblique shallow impression crossed by numerous low rugae; surface of anterior wing closely ciliate, without a large hairless area below apical part of submarginal vein; marginal vein not thickened, more than one and one-half times as long as stigmal; stigmal slender at base, gradually thickened to apex, slightly curved; postmarginal longer than stigmal but a little shorter than marginal; posterior coxae slightly longer than propodeum.

Abdomen very strongly compressed, oval in form as seen from the side, its dorsal surface reduced to an edge; petiole about as long as broad, rugose; remainder of abdomen smooth and shining; ovipositor sheath a little exserted.

Head yellow; antenna brown, except scape, which is yellowish; thorax yellow, the dorsum more or less piceous; wings hyaline; legs yellow, hind tibia blackish except at base; abdomen yellow, first segment and apical margins of the following more or less piceous.

Male.—Under side of scape with a conspicuous swelling which is thickest beyond the middle of scape and thicker than the funicle; funicle long and slender, the first joint more than three times as long as broad and three-fourths as long as scape, the following successively slightly shorter and more slender; first four funicle joints narrowly constricted at apex; club about as long as first joint of funicle, its first joint about equal to the other two combined; funicle and club covered with long hairs; abdomen smaller and less compressed than in female, with petiole at least as long as posterior coxa and more than three times as long as its greatest transverse diameter; color somewhat darker than that of female.

Type-locality.—Madrigal, Teretan, Michoacan, Mexico.

Type.—No. 44285, U. S. N. M.

Described from seven females and two males (type, allotype, and seven paratypes) reared by Dr. Alfons Dampf, in 1931, from fruits of *Diospyros ebenaster* Retz at the type locality, one female paratype from seed of same plant, from Mexico, intercepted at Laredo, Texas, by M. G. Vincent, of the Plant Quarantine and Control Administration, Feb. 2, 1931, under Laredo No. 208, and four female and two male paratypes from Guanajuato, Mexico, collected March, 1903, by Dr. A. Dugès. The paratypes range from 3.2 to nearly 5 mm. in length, and there is considerable variation in color, the palest specimens being entirely yellow except for the darkened apical two-thirds of hind tibia, and the darkest individuals having the dorsum of thorax and abdomen blackish.

Harmolita opuntiae, new species.

Differs markedly from all described species of *Harmolita* with which I am familiar and possibly should not be included in this genus. It is apparently more closely related to *Harmolita* than to any other genus of Eurytomidae, however, and owing to the poorly classified condition of the family it seems advisable to describe it here rather than to propose a new generic name for it at this time. The thorax and abdomen are stouter than in *Harmolita*, the cheeks are strikingly swollen, the propodeum is relatively shorter and broader and is abruptly declivous, the head and thorax are unusually densely hairy, the wings are without a marginal fringe, and the marginal vein is not longer than the postmarginal. In the absence of the marginal fringe of wings, in the sculpture of mesonotum, in the relatively short marginal vein, and in the structure of the male antennae, it approaches *Isosoma californicum* Ashmead, which Phillips and Emery[1] specifically excluded from *Harmolita* because of the occurrence of scattered umbilicate punctures on the mesonotum, although these authors did not indicate their opinion concerning its proper position beyond stating that it belongs in the tribe Eurytomini.

Female.—Length 5 mm. Head strongly transverse but not broader than thorax, immargined and scarcely excavated behind, viewed from in front very short and broad; cheeks conspicuously swollen; distance between antennal scrobe and eye equal to greatest transverse diameter of eye; surface of head rugulose punctate, the face finely granular down the middle; median ocellus separated by about its diameter from lateral ocelli; postocellar line fully twice diameter of an ocellus and slightly longer than ocell-ocular line; antennae short, not clavate; scape extending to median ocellus, half as long as funicle and club combined; pedicel obconical; longer than broad at apex but slightly shorter than first funicle joint; apparently two poorly separated transverse ring-joints, the second very short; five funicle joints, the first much longer than broad, the second about as long as broad, much shorter than first, the following not distinctly as long as broad; club three-jointed with the first joint loosely attached and almost as distinctly a part of the funicle.

Thorax very stout, rugulose punctate, densely hairy; axillae widely separated; scutellum as broad as long, its apex projecting slightly over metanotum; propodeum abruptly declivous, strongly convex at sides, coarsely rugose, without a median groove but with a median longitudinal carina; all femora conspicuously thickened; wings without a marginal fringe; marginal vein a little thickened, only slightly longer than stigmal and not distinctly longer than postmarginal.

Abdomen very stout, about as broad as thorax and about as long as head and thorax combined; petiole reduced to a scale-like plate; second segment (the first after the petiole) the longest; third to sixth subequal; seventh longer, narrowing apically; eighth half as long as seventh, conical; surface of abdomen delicately reticulated, most strongly on seventh tergite; last tergite polished; ovipositor sheath broad, projecting very slightly beyond last tergite.

Black; mandibles brown except at tip; scape brown; pronotum with a small but distinct yellowish spot on each side in front; wings subhyaline with a poorly defined yellowish cloud below marginal vein; legs reddish brown except all coxae, which are black; ovipositor sheath brown.

Male.—Essentially like the female except as follows; Antennal scape broader and shorter and black in color; flagellum tapering to apex; funicle 6-jointed, the joints narrowly incised at base and apex, and each with two whorls of long hairs; club not distinctly segmented, narrow, conical, ending in a stout apical spine; wings milky white, discal cilia very short and inconspicuous; scutellum faintly longer than broad; pronotal spots wanting; legs mostly black, the apices of all femora, anterior tibiae entirely, and bases and apices of middle and

[1]Proc. U. S. Nat. Mus., vol. 55, p. 436.

posterior tibiae, brown; abdomen scarcely as long as thorax; petiole not scale-like, broadening behind, more than half as long as broad at apex.

Type-locality.—Douglas, Arizona.
Type.—No. 44286, U. S. N. M.
Six females and one male reared by W. W. Jones from *Opuntia spinosior* (Engelm.) Toumey, on which it is said to form galls.

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THE IDENTITY OF CERTAIN WHITEFLY PARASITES OF THE GENUS ERETMOCERUS HALD., WITH DESCRIPTIONS OF NEW SPECIES (HYMENOPTERA : APHELININAE).

By Herbert L. Dozier.

The discovery of *Eretmocerus serius* Silvestri, a parasite of the notorious Citrus Black Fly, *Aleurocanthus woglumi* Ashby, at Singapore, and its introduction and successful establishment by Dr. Clausen in Cuba in 1930, in Panama in 1931, and by the writer in Haiti in 1931, creates immediate interest in the genus *Eretmocerus*. All members of this genus that have been reared in various parts of the world have proved to be primary parasites of aleyrodids.

The genus now contains the following described species: *Eretmocerus corni* Haldeman, *californicus* Howard, *paulistus* Hempel, *haldemani* Howard, *australis* Girault, *diversiciliatus* Silvestri, *serius* Silvestri, *orientalis* Silvestri, *mundus* Mercet, *portoricensis* Dozier, *pallidus* Dozier, and *illinoisensis* Dozier.

The type species of the genus, *Eretmocerus corni* Haldeman, was described in 1850 and since that date has remained a lost species. Although careful search has been made the original type material has never been located and it is the purpose of this paper to establish the validity and easy recognition of the genotype, of *E. paulistus*, and to describe three interesting additions.

Eretmocerus corni appears to be limited in distribution to the northeastern portion of the United States and is the most northern in distribution of any of the known members of the genus. The species was originally described briefly by Haldeman in the following statement: "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 *Chelonus;* head, thorax, and abdomen closely united, thorax large, abdomen with sides parallel and the apex obtusely rounded; in one specimen (♂ ?) the abdomen seems but half the width of the thorax, and in the other its sides form straight lines with it; antennae (see annexed figure) 5-articulate, shorter than the body, scapus 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*."

The inadequate description and original drawing of the female antenna accompanying same has led to much confusion. In order to establish the true identity of *Eretmocerus corni* Hald., the writer made a special endeavor to collect and rear out material from Pennsylvania, as the species was originally described from that state. Haldeman's statement that the eyes are hairy refers undoubtedly to the hairs on the margin of the vertex adjacent to the eyes, although these hairs are not very conspicuous in balsam-mounted specimens. The eyes appear hairless except when examined under high magnification when they are seen to have sparse very short setae that are scarcely visible. He also mentions that in what he dubiously concluded was the male, that the abdomen seems but half the width of the thorax and this is true in one of the three males of the present series.

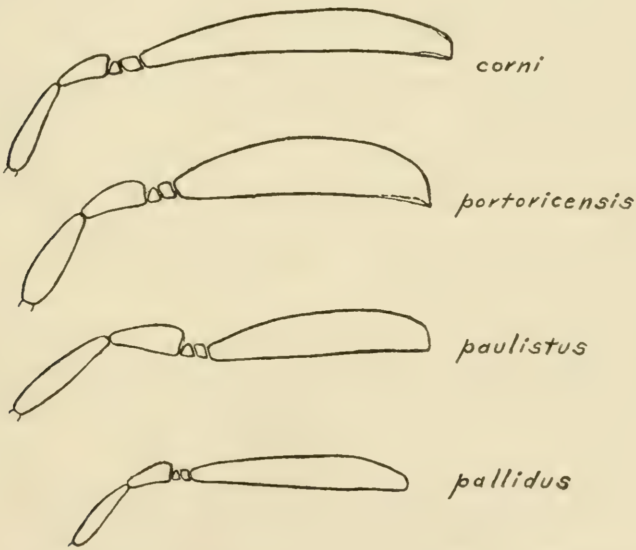

FIG. 1.—Outline drawings of female antennae of *Eretmocerus corni* Haldeman, *portoricensis* Dozier, *paulistus* Hempel, and *pallidus* Dozier (made with camera lucida).

Eretmocerus corni Haldeman.[1]

Female.—Length, including the ovipositor, 0.544–0.616 mm.; expanse 1.29 mm.; greatest width of the forewing 0.178 mm. General color of fresh living material a distinctly golden yellow; mounted in balsam the color becomes yellowish-orange, lighter on the sides and tip of abdomen; a median longitudinal vitta or stripe extending the entire length of the thorax and onto abdomen to tip of the endophragma, and short oblique vitta covering the parapsides, of a much lighter or lemon yellow; the contents of the alimentary tract show through to soil or darken the color of the abdomen; legs and antennae pale yellowish; eyes black; ocelli reddish. Antennae five-jointed, long and well built; scape long and rather slender, enlarging to base; pedicel short, triangular, distinctly wider, followed by two short and narrow ring-joints; club with faint longitudinal sensoria present, very long, about four and a half times longer than the pedicel, narrow at base and starting slightly wider than the ring-joints, gradually widens and then narrows just before the truncated apex; along the anterior and posterior margins near the tip narrow clear areas can be noted under high magnification; length of the club 0.201 mm., its greatest width 0.029 mm. Apex of the vertex slightly incised or notched at the middle; a grouping of inconspicuous hairs or setae on margin of the vertex adjoining the eyes. Under high magnification, the vertex and thorax appear distinctly reticulated. All tarsi four-jointed. The ovipositor rather short but distinctly exserted beyond the abdomen. The eyes appear to be bare but under high magnification show the presence of very short and inconspicuous setae, very sparse in numbers, and very difficult to make out so that they are easily overlooked.

Male.—Length 0.488 mm.; expanse 1.19 mm.; greatest width of forewing 0.172 mm. Differs from the female at once by different structure of the antennae and the slightly more constricted abdomen. Scape rather long, the ring-joints of the female are lacking, and the club is flexible and bent curvingly backwards; club very long, almost three-fifths of the length of the entire body, distinctly wider at base than the pedicel, narrows just perceptibly and then increases slightly wider and continues same width to near the tip, which is semi-pointed; length of club 0.30 mm.; abdomen slightly constricted; oedeagus exserted or protruded, grayish in color. The general color is a more soiled yellowish-orange than the female, the longitudinal vitta or stripe is scarcely discernible, and the tarsi differ in being distinctly grayish.

Above description made from a series of fifteen females and three males, reared by the writer from whitefly, *Trialeurodes morrilli* (Britton) on jewel weed, *Impatiens biflora*, at White Clay Creek, Pa., September 16, 1929, and a female taken on window at Newark, Delaware, September 5, 1929.

One slide containing two females and one male, mounted in balsam, is deposited in the U. S. National Museum collection. One of these females is outlined in India ink and is designated as the neotype of *Eretmocerus corni* Hald. until the type is located, which is unlikely.

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[1] 1850, Haldeman, American Journal of Science, vol. IX, May, pp. 110–111, fig.

Eretmocerus illinoisensis, new species.

Differs at once from the other described American members of the genus by having the basal portion of the forewing faintly infumed out to the beginning of the marginal vein. In fresh living material the color is a rusty yellow instead of the golden yellow of *E. corni*.

Male.—Length, exclusive of the exserted oedeagus, 0.545 mm.; expanse 1.39 mm.; greatest width of the forewing 0.214 mm. In life the color is distinctly rusty yellow instead of the golden yellow of the eastern species, *E. corni* Hald.; mounted in balsam the color becomes dark brownish, the legs almost concolorous but with the tarsi darker and gray. The apex of vertex slightly incised or notched at the middle; margin of vertex with grouping of inconspicuous hairs; the eyes, under high magnification, supplied with short inconspicuous setae; these are more distinct, however, than in the case of *E. corni* Hald. Antennae characteristic of the males of the genus, having the scape rather long, peicel short, the club flexible and bent curvingly backwards; club slightly wider at base than the pedicel, increasing in width gradually, provided with numerous long, conspicuous sensoria. Forewing with from 9–10 long setae in bare area beneath the marginal vein. Oedeagus distinctly exserted.

Female.—Unknown.

Described from six males taken by the writer sweeping low weed and grass in middle of creek bed near Elizabethtown, Illinois, August 5, 1932. An effort to collect females was fruitless. A number of adult whiteflies were taken sweeping at the same time and undoubtedly represent the host of this parasite.

The type male on slide in balsam and a paratype male mounted in euparol are deposited in the collection of the Illinois State Natural History Survey and a paratype male in the U. S. National Museum.

Eretmocerus portoricensis, new species.

Closest to *Eretmocerus paulistus* Hempel but distinguished immediately from that species and all other described members of the genus by the distinctive width and beaked shape of the antennal club. So far as known the species appears to be endemic to Porto Rico, where it is an abundant and effective parasite of the Woolly Whitefly.

Female.—Length, including ovipositor, 0.459–0.617 mm.; expanse 1.18 mm.; greatest width of forewing 0.20 mm. General color of material mounted in balsam is yellowish-orange with a faint dirty olive cast in some specimens; a lighter median longitudinal vitta or stripe extends the entire length of the thorax and to tip of the endophragma, and an oblique vitta on the parapsides; legs distinctly paler; ocelli prominently reddish. Eyes very prominent, black.

Apex of vertex distinctly incised or notched at the middle. Antennae presenting a short and compact appearance; the scape slightly over twice as long as the pedicel, somewhat flattened and broad; pedicel subtriangular, followed by two ring-joints; club comparatively short and compact, wider than in all other known species, commencing narrow at base, about width of the second ring-joint and enlarging to its greatest width about the middle, then gradually rounding to apex; the apex shaped somewhat like a parrot's beak, differentiating it immediately from all other species; along the posterior margin near the tip a clear area can be noted under high magnification that accentuates the beak-like resemblance; the club shows inconspicuous longitudinal sensoria but these are decidedly less distinct than those present and so characteristic of *E. californicus* Howard; length of club 0.129–0.143 mm.; greatest width 0.036 mm. The mesonotum and scutellum show slightly granular under high magnification and with the reticulation much less distinct than in the case of *E. corni* Hald. All tarsi four-jointed. Forewings, including the venation, clear. Ovipositor short and only slightly exserted but plainly visible from above.

Male.—Unknown.

Described from a series of forty-five females mounted in balsam on three slides, reared from *Aleurothrixus floccosus* (Maskell) on "Almacigo," *Elaphrium Simaruba* (L.) at Bayamon, Porto Rico, January 21, 1925; and eighteen females on three slides, reared from the same aleyrodid on Lignum-vitae, *Guajacum officinale* L., at Central Aguirre, Porto Rico, July 23–26, 1925, by the writer.

Type slide containing thirteen females, reared from *Aleurothrixus floccosus* (Maskell) on *Elaphrium simaruba*, Bayamon, Porto Rico, January 21, 1925, is deposited in the U. S. National Museum collection.

This species was erroneously determined for the writer in 1925 as *Eretmocerus californicus* Howard, but upon comparision with the type material of that species in the U. S. National Museum since it appears to be very distinct and easily separated from that species on antennal characters alone. The statement in Circular No. 88 of the Porto Rican Insular Experiment Station, in regard to the efficient work of *E. californicus* in checking the Woolly Whitefly on that island should refer to the above new species.

Eretmocerus pallidus, new species.

The smallest known member of the genus and recognized immediately by its small size, very pale color, and shape of antennal club.

Female.—Length, including ovipositor, 0.359–0.430 mm.; expanse 0.846–0.918 mm.; greatest diwth of forewing 0.108–0.129 mm. General color of living or freshly mounted material in balsam is very pale yellowish-white, distinctly lighter than in any known species; the head is distinctly darker with a faint indication of reddish tint in the pale brown; the scape pale, the pedicel and club pale-yellowish; legs pale. Antennae long and slender in general appearance, the scape slightly over twice as long as the pedicel, slender; pedicel short, subtriangular, distinctly longer than wide; two ring-joints small; club comparatively long, rather slender, commencing with same width at base as the second ring-joint, gradually widening with a slight bulge and then narrowing to the somewhat truncated tip; length of club 0.116–0.129 mm.; its greatest width 0.022 mm.; tip of club with distinct setae. Mesonotum longer than the scutellum; under high magnification the surface of the mesonotum, scutellum, and endophragma with a characteristic longitudinal effect of being striated. Wings hyaline, the venation pale. All tarsi four-jointed. Ovipositor rather short but distinctly exserted.

Male.—Unknown.

Described from a series of forty-two females reared by the writer from one of the smallest known aleyrodids, *Tetraleurodes* n. sp., on "Cachiman canelle," *Annona squamosa*, at Port-au-Prince, Haiti, April 11–17, 1931. These were reared in association with a very small species of *Thysanus* that greatly resembles *T. aleyrodis* (Ashm.), but which is apparently distinct, and is most probably secondary.

Type slide, containing four females mounted in balsam, is deposited in the U. S. National Museum; paratypes in the collection of the Museo Nacional de Ciencias Naturales, Madrid, Spain, and the writer.

Eretmocerus paulistus Hempel.[2]

This long lost species was described in 1904 in Portuguese, from two males and a female reared from *Aleurodes horridus* Hempel (= *Aleurothrixus floccosus* Maskell) in Brazil. Since that date the description has been overlooked. Haitian material, reared from the same host, agrees well with the original description and figure of the female antenna.

Female.—Length, including ovipositor, 0.473–0.559 mm.; expanse, 1.16 mm.; greatest width of forewing 0.172 mm. General color yellowish, in some balsam-mounted specimens there is a slight dirty olive cast, the head becoming a pale reddish-brown; a median longitudinal vitta of a lighter color runs the entire length of the thorax to the endophragma, and a short oblique vitta on the parapsides as in *E. corni* Hald. Apex of vertex slightly incised or notched at the middle. Antennae with the scape nearly twice as long as the triangular pedicel; first ring-joint somewhat triangular, narrower than the second; club five times as long as greatest width, starting at base with same width as the second ring-joint, gradually widens, reaching its greatest width just slightly beyond the middle, then gradually curving to the rather broad, truncated apex; faint

[2]1904, Hempel, Bol. Agr. Sao Paulo, Brazil, Ser. 5, No. 1, p. 19, fig. 2.

sensoria are present; apex with inconspicuous pale setae; length of club 0.129-0.143 mm.; its greatest width 0.028 mm. Under high magnification the mesonotum and scutellum present a somewhat granular appearance with only a very faint indication of reticulation in contrast to the distinct reticulation that is present in *E. corni* Hald. Ovipositor short, slightly exserted but plainly visible from above.

Male.—No males have been reared by the writer but Hempel states that the male is also pale yellow in color and figures the male antenna as being three-jointed; the pedicel triangular, the club long and cylindrical with numerous sensoria present.

The above description is based on six females reared from *Aleurothrixus floccosus* (Maskell) at Damien, Haiti, June 17, 1930, and fifteen females reared from the same aleyrodid on Lignum-vitae, *Guaiacum officinale*, at Sarthe, Haiti, January 31, 1931 by the writer.

TWO UNDESCRIBED CHALCID PARASITES OF THE WOOLLY WHITEFLY, ALEUROTHRIXUS FLOCCOSUS (MASKELL), FROM HAITI.

By Herbert L. Dozier.

The two new species described in the present paper were reared as primary parasites of the Woolly Whitefly, *Aleurothrixus floccosus* (Maskell), by the writer while Entomologist for the Service Technique de l'Agriculture at Port-au-Prince, Haiti. Both species are abundant at times in that country and are second only to *Encarsia cubensis* Gahan in efficiency in checking the increase of their host.

In addition, a full description is given of both sexes of *Prospaltella brasiliensis* Hempel, reared from the same host. This represents the rediscovery and first recognition of this species since the description of the female in 1904, published in Portuguese and in an obscure and inaccessible publication. Both Drs. Howard and Mercet seem to have overlooked the description of this species. The male is now associated with the female and described herewith. The species appears to be correctly placed in *Prospaltella* and the writer suspects that what Prof. Stuardo records (Carlos Stuardo, Revista Chilena de Historia Natural, vol. xxxii, pp. 154–157, 1928) as *P. conjugata* Masi, reared from *Aleurothrixus porteri* Quaint. in Chile, represents the male of this species.

Encarsia haitiensis, new species.

Belongs to the group of *Encarsia* having the middle tarsi 4-jointed. In general appearance and size very close to *E.*

basicincta Gahan from the same host in Porto Rico but distinguished at once by its distinctly larger and wider forewing, lack of vitta at base of abdomen, and four-jointed tarsi. It is perhaps closest to *meritoria* Gahan but distinguishable at once by its darker yellow color and especially by the longer ovipositor (measured from origin to apex).

Female.—Length, including ovipositor, 0.53 mm.; expanse 1.06 mm.; greatest width of forewing 0.165 mm. General color a dirty pale yellow, almost white; the vertex distinctly brown with sometimes a reddish cast; the pro- and mesonotum slightly more yellowish; the scutellum, the axillae, propodeum, and basal segment of abdomen narrowly, as well as the distal third of abdomen, clouded with light brown giving a somewhat soiled or dirty indistinct coloring. Antennae dirty yellowish-testaceous, the scape somewhat paler. Legs pale. Tip of ovipositor fuscous. Antennae long and slender, slightly over half the length of the body; not clavate, all funicle and club joints subequal in width and in length except the first funicle joint, which is short, narrower than the pedicel, slightly more than half as long as the second funicle; the terminal joint somewhat pointed; scape long and rather slender; pedicel almost twice as long as wide. Head and mesonotum granular and slightly wrinkled. Eyes bare. Mesonotum distinctly longer than the scutellum. Mesonotum with two pairs of very pale and very inconspicuous setae. Scutellum very lightly reticulate under high magnification; a pair of pale setae discernible with difficulty, located just adjacent to and to the outside of the pair of circular spiracles which resemble bases for the setae that are found on the disk of the scutellum; a second pair of larger but inconspicuous setae are located near the posterior margin of the scutellum. Forewings fairly broad, hyaline, marginal fringe rather short, the longest cilia about one-fourth as long as the breadth of the wing; distal two-thirds of wing more or less completely covered with cilia, without distinct bare areas. Middle tarsi four-jointed, the others five-jointed. Ovipositor distinctly exserted, clearly visible to its base.

Male.—Unknown.

Described from eighteen females on eight slides, reared by the writer from *Aleurothrixus floccosus* (Maskell) on *Spondias mombin*, at Damien, Haiti, December 13–16, 1930; and two females on slide, reared from same host on lignumvitae, *Guajacum officinale*, at Sarthe, Haiti, January 16, 1931. There are at hand three females, reared by the writer from *Aleurothrixus* n. sp. on *Catalpa longissima* at Damien, Haiti, March 6–9, 1931, which although somewhat deeper colored appear to be this species.

Type female mounted in balsam on slide together with one paratype female and a female of *Prospaltella brasiliensis* Hempel, Damien, Haiti, Dec. 15, 1930, and a second slide containing three paratype females, deposited in U. S. National Museum collection.

Euderomphale Girault.[1]

The genus *Euderomphale* was described by Girault in 1916 and placed in the Eulophidae (Omphalini). The genotype species *E. fuscipennis* Gir. was synonymized with *Pteropterix flavimedia* Howard by P. H. Timberlake. Essig in his "Insects of Western North America" places *Euderomphale flavimedia* (Howard) under the family Entedontidae. According to Nowicki, Howard's interpretation of *Pteropterix* was not correct and he has proposed (Neue Beitrag System. Inseckenkunde, vol. 4, pp. 155–160, 1929) a new name for *Pteropterix* Howard (not Westwood), calling it *Aleurodiphagus*. As *Euderomphale* is the older name and is certainly *Pteropterix* Howard it must be employed for all those species described by Dr. Howard from the Islands of Grenada and St. Vincent in the West Indies under the generic name *Gyrolasia*, namely *Euderomphale bicolor*, *ciliata*, *femorata*, *metallica* and *flava*. The species described herewith from Haiti appears to be very distinct from any of these.

To date the only published information we have of the habits of the members of this genus is the record of *E. flavimedia* Howard, reared in California and New Mexico from different species of aleyrodids, and Nowicki's notes. In addition to the new species, the writer has also reared two other undescribed species of Euderomphale from West Indian aleyrodids, further strengthening the evidence that members of this genus are all primary parasites of aleyrodids.

Euderomphale aleurothrixi, new species.

Female.—Length 0.587–717 mm.; expanse 1.286–1.362 mm.; greatest width of forewing 0.229 mm. General color of head and thorax yellowish-orange, the pronotum and anterior margin of the mesonotum at middle, infuscated; lateral margins of the mesonotum and posterior margins of the scutellum and metanotum narrowly infuscated; abdomen of a more flavous color with the apical half fuscous, darkest across the middle; antennae and legs pale grayish; eyes black; ocelli red. Antennae sparsely hairy, scape long and slender, a short seta at tip; pedicel longer than wide, provided with three very distinct setae; two ring-joints very narrow and short and easily overlooked; funicle joint following, shorter than pedicel but slightly wider; club three-jointed, the first joint the widest, the second and third tapering to a point; the funicle joint and club with longitudinal sensoria. Eyes naked, the margin of the vertex with eight prominent setae and the middle ocellus with three less prominent setae adjacent. Anterior margin of mesonotum provided with setae, one situated on each side of the mesonotum just behind the anterior margin; about midway on the scutellum, on each side a short distance in from the margin is placed a very prominent bristle or seta. The forewing is hyaline except for a clouding across

[1]1916 Girault, Canadian Entomologist, vol. 48, p. 410.

the middle beneath the grayish-yellow marginal vein. Abdomen sessile, conic-ovate, the ovipositor scarcely visible from above.

Male.—Length, exclusive of exserted genitalia, 0.417–.545 mm. Decidedly smaller in size than the female and its general color is darker. The fuscous markings of the thorax of the female are much darkened in the male. The abdomen is slightly more ovate and soiled in appearance, the apical half dark fuscous; the exserted genitalia paler in color.

Described from a series of forty males and thirteen females, reared by the writer from *Aleurothrixus floccosus* (Maskell) on *Guajacum officinale* at Sarthe, Haiti, February 3–4, 1931. From this same material *Encarsia cubensis* Gahan, *Encarsia haitiensis* Dozier, and *Eretmocerus paulistus* Hempel issued at the same time. A single female reared by the writer from the same host on Lignum-vitae at Central Aguirre, Porto Rico, June 28, 1925 is undoubtedly the same species but the general color is a shade deeper. A series of twenty-three badly shriveled and broken females, reared by Dr. S. C. Bruner from the same host at Santiago de las Vegas, Cuba, January, 1931, also appear darker but are undoubtedly the same species. This shows that the species is widely distributed in the West Indies.

The type slide containing holotype female and allotype male together with a paratype male is deposited in the U. S. National Museum collection.

Prospaltella brasiliensis (Hempel).[2]

The following redescription of the species is based on a translation of the original description from Portuguese and a series of thirteen females and eight males, reared by the writer from *Aleurothrixus* n. sp. on *Prunus myrtifolia* at Kenskoff, Haiti, November 5–8, 1929, and eight females reared by the writer from *Aleurothrixus floccosus* (Maskell) on *Spondias mombin* at Damien, Haiti, December 11–15, 1930.

Female.—Length, exclusive of ovipositor, 0.47 mm.; ovipositor 0.06 mm.; expanse 1.47 mm.; greatest width of forewing 0.165 mm. General color a clear yellowish-orange except the vertex, pronotum and anterior portion of the mesonotum, and a broad horizontal band covering about one-third the length of the abdomen just before its tip, light brown; antennae pale brown, the scape pale yellowish-white; ocelli red; legs yellowish-white; the ovipositor prominent, distinctly exserted, yellowish in color, becoming black at the tip. Eyes hairy. The first funicle joint only half as long as and distinctly narrower than the pedicel or the second joint, the remaining funicle joints being subequal in length, increasing only slightly in width; the pedicel characteristically elongately reticulated, the other joints supplied with numerous setae. Mesonotum under high

[2]1904 Hempel, Bol. Agr. Sao Paulo, Brazil, Vol. 5, fig. 3, *Prospalta*.

magnification appears granular, very coarsely and indistinctly reticulate, a pair of long pale colored setae located in the upper angles close to the lateral margin and a second pair on the lower portion. Scutellum similar, with two pair of pale setae. Forewings hyaline, venation clear, finely ciliate except at base, marginal fringe very short, the longest cilia only about one-sixth as long as the greatest width of wing. Abdomen almost twice as long as the thorax, widest at base, tapering gradually, then cut off rather truncately, leaving the ovipositor very prominent and distinctly exserted. All tarsi five-jointed (the original description states that the middle tarsi are four-jointed).

Male.—Length 0.35–0.43 mm. Similar to the female but differentiated at once by the antennae. General color is a more soiled or clouded yellowish-orange and the abdomen is almost completely fuscous instead of the distinctive horizontal band. The anterior portion of the mesonotum is more clouded with fuscous. The venation of forewing grayish. Antennae distinctly eight-jointed, with a rather broad, flat general appearance; pedicel short, about one-third the length of the scape, with distinct longitudinal lineate reticulations or markings; remaining joints all with very prominent longitudinal sensoria, those of the first funicle arranged in a slightly more oblique revolving manner with numerous small setae between the sensoria; the first funicle distinctly wider and darker than the others.

AUTOSERICA BRENSKE PRO ASERICA LEWIS (COLEOPTERA: SCARABAEIDAE).

By Edward A. Chapin,
Taxonomic Investigations, Bureau of Entomology.

In recent years there has been a lack of uniformity in the generic name used for that genus of melolonthine scarabs which includes the Asiatic garden beetle, *Autoserica castanea* Arrow, some writers using *Autoserica*, others *Aserica*. Gilbert J. Arrow, in 1927, published his reasons for dropping the name *Autoserica* and substituting *Aserica* for it. Mr. Arrow's conclusions have not been universally accepted and the writer has been asked to examine the case in connection with the International Code and the Opinions rendered by the International Commission on Zoölogical Nomenclature and, on these bases, to recommend the name to be used by the various organizations within the Federal Department of Agriculture. After a study of the case, the writer accepts *Autoserica* Brenske as the correct name for this genus.

The generic name *Aserica* was established by G. Lewis in 1895 for two species, *Serica japonica* Mots. and *S. orientalis* Mots. *Serica japonica* Mots. was definitely designated as genotype by Lewis in the original publication.

The generic name *Autoserica* was established by E. Brenske in 1897 to include 22 species. No genotype was designated in the original publication. The type of *Autoserica* was first designated by Arrow, 1927, as *Serica piceorufa* Fairmaire. This was one of the originally included species and in the absence of a previous valid designation of type must be accepted as the genotype of *Autoserica* Brenske.

Mr. Arrow examined the type specimen of *Serica japonica* Mots. and found, first, that it is a typical *Serica* and, second, that it is a different species from that identified as *S. japonica* by Lewis and Brenske. It was because of the misidentification of *japonica* by both Lewis and Brenske that Arrow suppressed Lewis's type fixation and selected *Autoserica secreta* Brsk., the species which was apparently before Lewis in 1895, as genotype.

Under the rules of the Code, however, we must accept Lewis's designation of *S. japonica* Mots. as type of *Aserica*, regardless of misidentification, unless it can be shown that Lewis based the name on certain definite specimens, rather than upon a species. One paragraph of the Code and the summary of Opinion 65 are pertinent and are here quoted.

Code; Article 30, I, a: "When in the original publication of a genus, one of the species is definitely designated as type, this species shall be accepted as type, regardless of any other consideration. (Type by original designation.)"

Opinion 65; Summary: "If an author designated a certain species as genotype, it is to be assumed that his determination is correct; if a case presents itself in which it appears that an author has based his genus upon certain definite specimens, rather than upon a species, it would be well to submit the case, with full details, to the Commission. At the present moment, it is difficult to lay down a general rule."

It is here maintained that Lewis did not base his genus upon "certain definite specimens," for had he done so, he would have indicated the fact and would have given detailed information concerning his specimens. An examination of the original publication discloses but two statements, both trivial, and a sketch drawing, which refer to Lewis's own material. The statements are: "My measurements are 9–11 millim"; and "Some of my specimens are in colour light brown." The sketch is of the metasternum of a beetle; certainly not of a *Serica* but of some other sericoid form. No one would presume to identify the species depicted in the absence of the original specimen.

Therefore, since Lewis definitely selected the species *Serica japonica* Mots. as the genotype of *Aserica* and since there is nothing in the original account to show that Lewis intended to base his generic name on "certain definite specimens rather than upon a species," it is clear under the established rules of zoölogical nomenclature that Lewis's type designation must stand. The names involved will then take the following status:

Serica MacLeay 1819.
Syn.: *Aserica* Lewis 1895.
Autoserica Brenske 1897.
Syn.: *Aserica* Arrow 1927, not Lewis 1895.

LITERATURE CITED.

1819. MacLeay, W. S., Horae Entomologicae, p. 148.
1895. Lewis, G., Ann. Mag. Nat. Hist. Ser. 6, Vol. 16, p. 394, fig.
1897. Brenske, E., Berl. Ent. Zeit., Vol. 42, pp. 356, 377.
1905 and other dates. The International Code of Zoölogical Nomenclature, various editions.
1914. International Commission on Zoölogical Nomenclature, Opinion 65, Smithsonian Institution, Publ. 2256, pp. 152–169.
1927. Arrow, G. J., Proc. Ent. Soc. Wash., Vol. 29, pp. 69–70.

NEW SYNONYMY (LEPID., PHALAENIDAE[1] AND LASIOCAMPIDAE.[1]

By Foster H. Benjamin,
Bureau of Entomology, United States Department of Agriculture.

The notes in this paper are the result of the incorporation of certain names and their types in the National Collection.

One generic and four specific names are sunk as straight synonyms, and one specific name is placed as a minor colorational form.

PHALAENIDAE.

Lygranthoecia accessa Sm.

Schinia accessa Smith, Jour. N. Y. Ent. Soc., vol. 14, 1906, p. 25.—Barnes and McDunnough, Contrib. Nat. Hist. Lep. N. Amer., vol. 1, no. 4, 1912, p. 43, pl. 20, f. 9.
Lygranthoecia viridens Walter, Proc. Ent. Soc. Wash., vol. 30, 1928, p. 137.

A "cotype" of *accessa* is in the National Collection, together with a short series of specimens from Arizona and Texas. The Walter type agrees perfectly with these.

The species is on the border line between *Lygranthoecia* and *Schinia*, possibly better placed in the former.

Timora toralis Grt.

Botys toralis Grote, Papilio, vol. 1, 1881, p. 178.
Pyrausta toralis (Grote), Fernald, in Dyar, List N. Amer. Lep., cat. no. 4449, 1903, p. 392.

[1]Noctuidae Auct.

Prothymia rosario Barnes, Can. Ent., vol. 36, 1904, p. 264.—Barnes and McDunnough, Contrib. Nat. Hist. Lep. N. Amer., vol. 1, no. 4, 1912, p. 25, pl. XI, f. 8.

Timora toralis (Grote), Barnes and McDunnough, Check List, cat. no. 1212, 1917, p. 40.

Pseudacontia unicolor Walter, Proc. Ent. Soc. Wash., vol. 30, 1928, p. 138.

The Walter type, described in the wrong sub-family, falls here. This type lacks pink on the fore wing, and the name may be saved as a minor colorational form of *toralis* for those who desire to split so finely.

The species is a very variable one, some specimens showing much pink on the fore wings (as on the type of *rosario* Barnes), others showing only a small amount of pink (as on the types of *toralis* Grote), and others showing no pink on the fore wings (like type *unicolor* Walter). This variation appears to have no relation to the geographical distribution of the species.

PHOENICOPHANTA HAMPS.

Type, **Phoenicophanta flavifera** Hamps.

Phoenicophanta Hampson, Cat. Lep. Phal. B. M., vol. 10, 1910, p. 653, *flavifera* sole species and designated type.—Barnes and Benjamin, Bull. Bklyn. Ent. Soc., vol. 24, 1929, p. 170.

Callostolis Dyar, Proc. Ent. Soc. Wash., vol. 30, 1928, p. 138, *polyrrhoda*, Walter, sole species and designated type.

The genotypes being congeneric, *Callostolis* falls to *Phoenicophanta*.

Phoenicophanta bicolor B. & McD.

Phoenicophanta bicolor Barnes and McDunnough, Contrib. Nat. Hist. Lep. N. Amer., vol. 3, no 1, 1916, p. 15, pl. III, f. 15.—Barnes and Benjamin, Bull. Bklyn. Ent. Soc. vol. 24, 1929, p. 171.

Callostolis polyrrhoda Walter, Proc. Ent. Soc. Wash., vol. 30, 1928, p. 138.

The Barnes and McDunnough and the Walter types are identical.

The genus and species appear to fit better into the Acontiinae[1] (Erastriinae) than into the Apatelinae (Acronyctinae).[2]

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[1]See Barnes and Benjamin, Bull. Bklyn. Ent. Soc., vol. 21, 1926, p. 182.—l. c., vol. 24, 1929, p. 170.

[2]See references cited in the generic synonymy; also Dyar, Ins. Inscit. Menstr., vol. 12, 1924, p. 16.

Abrostola parvula B. & McD.

Abrostola parvula Barnes and McDunnough, Can. Ent., vol. 48, 1916, p. 225.—Ottolengui, Jour. N. Y. Ent. Soc., vol. 27, 1919, p. 124, pl. XV, f. 11.
Abrostola mariana Walter, Proc. Ent. Soc. Wash., vol. 30, 1928, p. 139.

The types of both names are practically identical. The Walter type, being a comparatively fresh specimen, is very slightly darker in appearance. The genitalia, of the male types of each name, are identical. The author has only seen the species from Arizona.

The closely related *microvalis* Ottolengui, sometimes considered identical with *parvula*, possesses a narrower and differently shaped harpe. This species was the "*parvula*" of the National Collection at the time *mariana* was described. Specimens are before the author from Kerrville and Shovel Mt., Tex., and from Tehuacan, Mexico.

LASIOCAMPIDAE.

Tolype brevicrista Dyar.

Tolype brevicrista Dyar, Can. Ent., vol. 27, 1895, 246.—Olive Cockerell, The Entom., vol. 46, 1913, p. 73, pl. V, fig. 8.
Tolype nigrocristata Walter, Proc. Ent. Soc. Wash., vol. 30, 1928, p. 139.

Tolype brevicrista was described by Dyar based on the following material: "Types: A male in my collection probably from Mexico; one from Mr. T. D. A. Cockerell, Las Cruces, New Mexico (R. R. Larkin). Also a specimen in the Edwards Collection labeled Arizona."

The specimen labeled "Type" in the National Collection is a male, and bears the Dyar number 11308 which is listed in the Dyar accession book as having been received, together with a quantity of Mexican species, from Mr. J. Doll in exchange. A note on the pin of this specimen indicates the existance of an Arizona example in the Edwards Collection. Olive Cockerell, 1913, figured a so-called "cotype" which may or may not represent the same species. To avoid any chance of confusion the Dyar specimen is hereby designated the lectotype for the name *brevicrista*. It represents the species ordinarily going under that name in collections.

Tolype nigrocristata was described from a "male" type and a female paratype, from Tempe, Ariz., Tempe No. 5128, Cat. No. 41022, U. S. N. M., both types stated to be 45 mm. in expanse.

These two specimens are in the National Collection and are both females, as might have been deduced from the wing expanse.

A male, also from Tempe, Ariz., with a wing expanse of 31 mm., possesses markings and habitus which are identical with the female (so-called male) type of *nigrocristata*. This specimen agrees well with the Dyar type of *brevicrista* except for being fresher and hence somewhat darker. The male genitalia are identical, as are also the shapes of the last abdominal tergites and sternites.

BOOK REVIEWS.

"A Naturalist in the Guiana Forest," Major R. W. G. Hingston, 384 pp., 16 plates and 150 text illustrations. Longmans Green & Co., $5.00.

This work, by the brilliant author of "Problems of Instinct and Intelligence," constitutes a partial report on an expedition sponsored by the Oxford University Club for the purpose of investigating the fauna of the tree-tops in the equatorial forest. In the narrative which makes up Part 1 of the book, Major Hingston has succeeded admirably in satisfying the reader's curiosity regarding the general character of the forest and its inhabitants from its floor to the topmost twigs of its tallest trees. The author's modest account of the methods used to overcome the almost insuperable difficulties met in the attempt to reach favorable points of observation compels one's sincere admiration. From an entomological point of view the book is largely for the Arachnologist, as about 150 pages of the text proper are devoted to the spiders and their nests. Those interested in mimicry and protective resemblance will find much material here. Some very interesting notes on the behavior of tropical ants, termites, and other insects are also included. In addition to this there are hidden away in an appendix of fifteen pages (of which there is no hint in the title) descriptions of no less than twenty-seven new species of spiders belonging to seven genera.

—*W. R. Walton.*

A Textbook of Practical Entomology, Frank Balfour-Browne, 191 pp., with numerous illustrations in line; $5.00, Longmans, Green & Co., New York.

Although the title of this quarto volume will suggest to the American student a treatise on applied entomology, it is really devoted to an entirely different purpose. The work is primarily a class-book of elementary insect morphology with the inclusion of some fundamental principles of taxonomy. It is excellently printed on fine stock and well illustrated with many line drawings of a diagrammatic character.

For the purpose intended the work is excellent. From a taxonomic point of view it is decidedly elementary and incomplete as the system of veination discussed is confined in all orders to that proposed by Comstock and Needham. No mention is made of the principles of chaetotaxy so important in the taxonomy of the Diptera, although the setal system of the Lepidoptera is discussed at some length.

The work would seem to be better adapted to the use of secondary schools rather than the college in this country. —*W. R. Walton.*

MINUTES OF THE 439TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, JUNE 2, 1932.

The 439th regular meeting of the Entomological Society of Washington was held at 8 P. M., Thursday, June 2, 1932, at the Bee Culture Laboratory of the Bureau of Entomology at 432 Dorset Avenue, Somerset, Maryland, following a picnic supper for members and their friends. Mr. F. C. Bishopp, president, presided. There were present about 135 members and visitors. The minutes of the previous meeting were read and approved.

There was no preliminary business.

The first communication of the regular program was by James I. Hambleton, and was entitled "The Work of the Division of Bee Culture."

The society was welcomed and invited to inspect the station, which was arranged for exhibit. The work of the Division with its several stations was outlined. The bee disease work includes the question of the identification of various brood and adult bee diseases; and the problem of treating the various diseases, especially American foulbrood, the most serious disease of bees in the United States. The work on honey grading, economics of beekeeping, bee behavior, honey plants, pollination, queen-breeding, and the package trade, was touched upon. (Author's abstract.)

The second communication was a 4-reel motion picture film entitled "The Realm of the Honey Bee," in which the life and habits of the bee, procedure in apiculture, and uses of honey, were shown.

The third communication was an informal talk by Doctor Marlatt, in which he recalled his own early experiences in bee culture, and spoke with appreciation of the work of the Bee Division.

A motion was passed extending a vote of thanks to Mr. Hambleton for making possible such a pleasant and interesting program.

Meeting adjourned at 9.45 P. M.

F. M. WADLEY,
Recording Secretary.

Actual date of publication, October 25, 1932.

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DAYTIME RESTING PLACES OF ANOPHELES MOSQUITOES IN THE PHILIPPINES.[1]

(SECOND REPORT.)

By Paul F. Russell,

International Health Division of the Rockefeller Foundation.

INTRODUCTION.

In a previous paper[2] there was presented a brief review of the problem of catching adult anopheline mosquitoes in their daytime resting places in the Tropics. Some observations were included as to the situation in the Philippines; and the results of the first routine catches in such places as stone walls and undercut stream banks were presented. The purpose of this paper is to present additional data regarding routine daytime catches of anopheline imagoes in the Philippines.

As noted in the first report, Walker and Barber[3] made fair daytime catches of imagoes in houses in Mindoro and at Iwahig, Palawan. In another paper, Barber[4] rightly attached much importance to the house-visiting habits of mature anophelines. Catches were reported from various barrios of the San Jose Estate, Mindoro, and from bed nets at the Iwahig Penal Colony, Palawan. Two anopheline imagoes were caught lurking among matted tree roots along a brook in San Jose.

[1]The data on which this paper is based were obtained at the Calauan field laboratory for Malaria Investigations, which is jointly supported by the Bureau of Science, Manila, and the International Health Division of the Rockefeller Foundation. The routine catches were made by Mr. Domingo Santiago, Field Inspector of Malaria Investigations.

[2]Russell, P. F.: Daytime Resting Places of Anopheles Mosquitoes in the Philippines. First Report. Phil. J. Sc. 1931, **36**, 639–649.

[3]Walker, E. L., and Barber, M. A.: Malaria in the Philippine Islands I. Experiments on the Transmission of Malaria with *Anopheles* (*Myzomyia*) *febrifer* Sp. Nov., *Anopheles* (*Pseudomyzomyia*) *rossii*, *Anopheles* (*Myzorhynchus*) *barbirostris*, *Anopheles* (*Myzorhynchus*) *sinensis*, and *Anopheles* (*Nyssorhynchus*) *maculatus*. Phil. J. Sc., 1914, **9**, Sec. B, 381–439.

[4]Barber, M. A., Raquel, Alfonso, Guzman, Ariston, and Rosa, A. P.: Malaria in the Philippine Islands II. The Distribution of the Commoner Anophelines and the Distribution of Malaria. Phil. J. Sc., 1915, **10**, Sec. B, 177–247.

Lane,[5] at the request of the Medical Director of the League of Nations Secretariat, recently reviewed the literature dealing with the general subject of housing and malaria. This recalls the fact that, speaking from the viewpoint of European conditions, the Malaria Commission of the League[6] considers the destruction of adult mosquitoes in houses as one of the two indispensable primary measures of malaria control. It has stated, "The Commission is convinced that that measure, if it could be effectively carried out, would have very remarkable results." This was not an original idea. Le Prince[7] in the early days of the Panama Canal construction, working under the direction of Gorgas, found that the destruction of engorged anophelines within houses and barracks was a feasible and apparently effective method of attacking malaria.

We have no doubt that, as Lane[5] concludes, the house is a factor of primary importance in the acquisition and spread of malaria in the Philippines as elsewhere. But there is abundant evidence that in the Philippines the "if" clause in the statement of the League Commission given above is potent enough to forestall any "very remarkable results" in the local control of malaria by the destruction of adult anophelines in houses. Here again, as in most phases of malariology, a principle which might apply in one place does not necessarily have value in another.

As demonstrated in the first report,[2] it is unusual to find *A. minimus*, the local vector of malaria, resting by day in, on, or under Filipino habitations. This does not mean that the mosquito fails to enter, for *A. minimus* may be trapped in houses in considerable numbers. In regions where this mosquito breeds abundantly, a man sleeping in a screened room with the doors open can usually trap fair numbers of *A. minimus* if he rises at about 2 A. M. to close the doors.

Manalang[8] wrote of *A. minimus* "The adult mosquitoes are typically wild in that they are but seldom found in the ordinary nipa houses at night, much less in the daytime. The only occasions on which they have been caught during the daytime were when they were imprisoned inside wire screens." In the same article Manalang[8] mentioned two cases of "preferential harbourage" and pointed out that in these two houses which

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[5]Lane, Clayton: Housing and Malaria. League of Nations Health Organization, Official No. C. H. Malaria 169, Geneva, June, 1931.

[6]Principles and Methods of Antimalarial Measures in Europe. Second General Report of The Malaria Commission. League of Nations Health Organization, Official No. C. H. Malaria 73, Geneva, 1927.

[7]Le Prince, J. A., and Orenstein, A. J.: Mosquito Control in Panama, G. P. Putnam's Sons, New York, 1916.

[8]Manalang, C.: Notes on Malaria Transmission. Phil. J. Sc., 1928, **37**, 123–131.

yielded the largest catches in the trapping there were new malaria cases, a point probably not without significance.

Therefore, although from my first paper[2] and again from this report, it will be seen that *A. minimus* adults are rarely taken in Filipino habitations, it must not be inferred that infections do not take place in houses. In all probability they do and, in view of Manalang's[9] subsequent findings, the time of infection is apt to be between 10 P. M. and 2 A. M. Whether, in line with the findings reported in the first paper[2] and herein below, it will ever be feasible to add to the Paris green treatment of streams a spraying of the undercut banks to kill adult mosquitoes can not here be debated. It is quite possible, however, that in some places it would be profitable to use in this way the cheap and unusually effective spray recently devised by Holt and Kintner.[10]

ROUTINE CATCHES.

In Table 1 are given the results of routine daytime catches of anopheline mosquitoes inside Filipino habitations during 1931. It will be seen that only two *A. minimus* mosquitoes, one male and one female, were caught. These were taken in a well shaded, relatively cool house, not over thirty meters from a prolific breeding place of *A. minimus*. (Figure 1, Plate 11.) The catch was made in a dark corner of a bedroom, seldom used in the daytime and entered not from the rest of the house as is usual but from the ground by a short ladder and a separate doorway.

In Table 2 are shown the results of routine catches made inside and under the Calauan Hospital. This is a substantial building made of cement and located about fifty meters from the nearest *A. minimus* breeding place. (Figure 2, Plate 11 and Figures 1 and 2, Plate 12.) The catches made under this building are, I believe, the first to be reported made in such a location in the Philippines. It will be noted that *A. minimus* was caught also inside the hospital. This is perhaps because the poor screening acts as a trap, allowing entrance but obstructing exit.

In Table 3 are given the results of routine catches made in small undercut caves along stream banks, favorite daytime resting places for several species of anophelines. (Figure 1, Plate 13.) In Table 4 are given the results of routine daytime catches made on the sides of an old stone wall in the Calauan cemetery.

[9]Manalang, C.: Malaria Transmission in the Philippines VI. The dark-night factor. Phil. J. Sc. 1931, **46,** 371–375.

[10]Holt, R. L. and Kintner, J. H.: Antimosquito Sprays. Phil. J. Sc., 1932, **47,** 433–438.

Because of the distance between the Calauan branch laboratory and Manila, mosquitoes caught were not routinely dissected. During the last quarter of 1931, however, 279 mosquitoes were sent alive by mail to the central laboratory for dissection. (Figure 1, Plate 14.) These included:

A. barbirostris	1
A. minimus (typical)	195
A. subpictus v. indefinitus	51
A. tessalatus	10
A. vagus v. limosus	22

Of these, one, *A. minimus* (typical), taken from an undercut bank of the Ilat River in Masiit, was found to have both gut and glands infected.

SUMMARY.

Following a brief mention of the relations between housing and malaria in the Philippines and of the local difficulties in catching adult anophelines in the daytime, there are presented the results of a year's routine daytime catches of anopheline mosquitoes in houses, in and under a concrete hospital building, in small undercut caves along the banks of stream, and on the side of an old stone wall.

Table No. 1.

ADULT ANOPHELES CAUGHT INSIDE HOUSES IN DAYTIME ROUTINE WEEKLY COLLECTIONS, CALAUAN AND MASIIT, 1931.

SPECIES	MALE	FEMALE	TOTAL
A. barbirostris	1	0	1
A. minimus (typical)	1	1	2
A. subpictus v. indefinitus	1	14	15
A. vagus v. limosus	4	11	15
Totals	7	26	33

Note: These are the total catches made in 125 separate houses in 223 visits of ten minutes each. *A. vagus v. limosus* was twice caught in the same house.

Figure 1.—Filipino rural house well shaded by coconut trees. *A. minimus* is breeding in large numbers about 30 meters beyond this house. On one occasion adults were caught in the daytime inside this house.

Figure 2.—Calauan Hospital, substantially built but poorly screened.

Figure 1. —Base of Calauan Hospital showing height above ground.

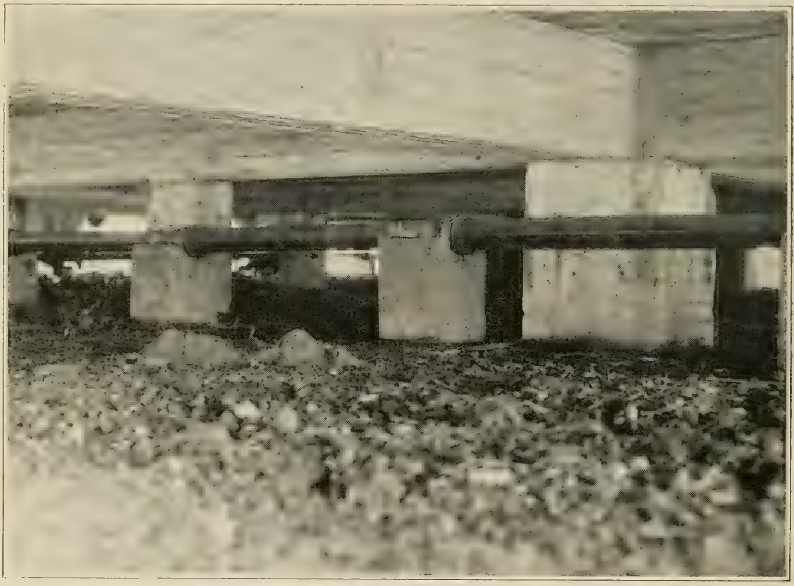

Figure 2.—Underneath the Caluan Hospital, showing daytime resting places of anopheles mosquitoes. (Time exposure.)

Figure 1.—Daytime resting places for anopheles imagoes along the banks of a stream.

Figure 2.—Stone wall in Calauan Cemetery a daytime resting place for anopheles. (Time exposure.)

Figure 1.—Shipping box and cage for anopheles adults (modeled after Barraud's box used in India).

TABLE NO. 2.

ADULT ANOPHELES CAUGHT IN THE DAYTIME INSIDE AND UNDER THE CALAUAN HOSPITAL, 1931.

SPECIES	INSIDE			UNDER			TOTAL		
	M.	F.	T.	M.	F.	T.	M.	F.	T.
A. barbirostris	....	....	....	5	16	21	5	16	21
A. filipinae	....	....	....	....	1	1	....	1	1
A. hyrcanus v. nigerrimus	....	....	....	1	1	2	1	1	2
A. hyrcanus v. sinensis	....	....	....	....	3	3	....	3	3
A. kochi	....	....	....	....	2	2	....	2	2
A. minimus (typical)	....	3	3	1	16	17	1	19	20
A. subpictus v. indefinitus	1	8	9	39	128	167	40	136	176
A. tessalatus	....	1	1	9	14	23	9	15	24
A. vagus v. limosus	2	16	18	129	280	409	131	296	427
Totals	3	28	31	184	461	645	187	489	676

Notes: Catches were made both inside and under this hospital thirty times, with ten-minute catching periods in each location each time. The hospital is built of concrete in a substantial fashion. The Calauan church, also substantially built, was visited twice and a total of 6 mosquitoes were found, as follows: male *A. kochi* 1, female *A. tessalatus* 1, male and female *A. vagus v. limosus* 2 each.

TABLE NO. 3.

ADULT ANOPHELES CAUGHT IN THE DAYTIME IN STREAM BANK UNDERCUTS, CALAUAN AND MASIIT, 1931.

SPECIES	MALE	FEMALE	TOTAL
A. barbirostris	6	10	16
A. filipinae	3	7	10
A. fuliginosus	....	2	2
A. hyrcanus v. nigerrimus	1	3	4
A. hyrcanus v. sinensis	....	1	1
A. kochi	8	15	23
A. minimus (typical)	119	610	729
A. subpictus v. indefinitus	93	279	372
A. tessalatus	43	77	120
A. vagus v. limosus	174	443	617
Totals	447	1,447	1,894

Note: A total of forty visits were made to these undercuts; three or four undercuts were visited each time for a catching period of ten minutes each.

TABLE NO. 4.

ADULT ANOPHELES MOSQUITOES CAUGHT IN THE DAYTIME ON THE SIDES OF AN OLD STONE WALL, CALAUAN CEMETERY, 1931.

SPECIES	MALE	FEMALE	TOTAL
A. barbirostris	2	1	3
A. filipinae	-------	1	1
A. hyrcanus v. sinensis	-------	4	4
A. kochi	4	24	28
A. maculatus	-------	1	1
A. minimus (typical)	1	-------	1
A. philippinensis	-------	1	1
A. pseudobarbirostris	-------	1	1
A. subpictus v. indefinitus	12	37	49
A. tessalatus	8	17	25
A. vagus v. limosus	52	179	231
Totals	79	266	345

Note: This stone wall was visited twelve times, with a catching period of ten minutes each time.

A DESCRIPTION OF THE LARVA OF ANOPHELES ATROPOS D. & K., WITH BIOLOGICAL NOTES ON THE SPECIES.

By E. HAROLD HINMAN.[1]

DESCRIPTION OF THE FOURTH LARVAL INSTAR.

Head.—The head is rounded, its maximum width slightly greater than the length. The antenna is rather profusely spined, slightly expanded near its base and the tufted hair is located at the basal third, with 3–5 branches in the tuft, of approximately one quarter of the length of the antenna. The sub-antennal hair is well developed. The anterior internal clypeal hairs are long and frequently one or both have two or three branches at the tip, the bases of these hairs vary from well separated to a close approximation. The anterior external clypeal hairs are single, never thickly branched or fan-like but occasionally have 2–3 (rarely as many as 5–6) branches at the apical end; they are much shorter than the anterior internal clypeal hairs. The posterior clypeal hairs are located in a direct line behind the anterior external clypeals; they are short and single, occasionally with 2–3 branches at apex of either or both hairs. Six well developed frontal hairs are present. There are four moderately long occipital hairs, single, but frequently have 2–3 branches at the apical end; they are, however, never plumose (one larva was found with 5 single hairs).

[1]National Research Fellow in the Biological Sciences. From the Parasitology Laboratory, Department of Tropical Medicine, Tulane Medical School, New Orleans, La.

Thorax.—There seem to be no characters of specific importance on the thorax.

Abdomen.—The abdomen has lateral tufted hairs on abdominal segments 1–3, double on 1–2 and single on 3. The palmate hairs on segments 4–7 are well developed, of nearly equal size and heavily chitinized; on segment 3 they are variable in size but not distinctly chitinized; the palmate hair on segment 2 if present is rudimentary. The individual leaflet of the palmate hairs is gradually tapering at the end and is not drawn out into a spine. The single pair of antepalmate hairs on segments 4 and 5 are usually unbranched and there are rarely 2 branches near the apex. The lateral plate of the 8th abdominal segment is composed of 18-20 teeth, 9–10 of which are long, 4–6 moderately long and the remainder are short; there is considerable variation in the arrangement of these teeth and they may differ on the two sides. The anal gills are short and bud-like, being less than half the length of the anal segment.

Length of larva.—7–8 mm. (preserved material).

This description is based on a study of 60 larvae, 36 of which were cast skins of reared adults. The terminology is that used by Russell (1925).

The larva of this species differs markedly in several respects from our other Southern species, despite the statement of Dyar (1929) that it can not be separated from *A. quadrimaculatus*. Through the courtesy of the United States National Museum the writer was able to examine their two specimens, collected by Dr. G. E. Beyer from Terrebone Bay, Louisiana, presumably in 1923. There is no doubt that the species Beyer dealt with is the same as that of the writer.

The most striking characteristic of the larva of *Anopheles atropos* is the presence of simple anterior external clypeal hairs in contrast to their fan-like nature in other Southern anophelines. There is also a very marked tendency toward the apical forking of many of the head hairs (frontals and sub-antennals excepted)—this condition is found in the internal and external anterior and the posterior clypeal hairs in addition to the occipital hairs. The latter are plumose in most of the other species or at least branched at the base. Another feature is the presence of only 4 distinct pairs of palmate tufts (abdominal segments 4–7 inclusive); those on segment 3 may on occasion be large but are not chitinized so do not appear conspicuous. The anal gills are much shorter than in other species and the lateral plate of the 8th abdominal segment bears teeth, the length of which may be divided into three classifications. The latter is not true of other Anophelines examined by the writer, since there is considerable regularity in their length, with little or no intergrading between the long and the short teeth. The separation of *A. atropos* from *A. pseudopunctipennis*[2] is not at all difficult, since

[2]The writer is indebted to Dr. Robert Matheson for the loan of material of this species.

the latter species has plumose occipital hairs, a single, spine-like antennal hair and the individual leaflet of the abdominal palmate hair drawn out into a fine, elongated spine.

BIOLOGICAL NOTES ON ANOPHELES ATROPOS D. & K.

This species was originally described from females in 1906 from the Florida Keys, although Beyer had discovered specimens in 1901 in Louisiana which had been incorrectly identified as *Anopheles walkeri*. The status of the species remained in doubt until Beyer (1923a, 1923b) rediscovered it at Terrebonne Bay, Louisiana, and obtained considerable life history data. He found that the eggs were capable of withstanding desiccation, that they are probably deposited on the wet mud and not on water, that the larvae are almost exclusively mud denizens and feeders, developing in sea water, and have a life cycle at least one week shorter than that of either *A. quadrimaculatus* or *A. crucians* (14 days from the hatching of eggs to the emergence of adults). Their distribution was found to be entirely littoral and restricted to a very narrow belt along the Gulf Coast.

Komp (1927) found *A. atropos* along the Louisiana Gulf Coast, the adults being vigorous biters and attacking during the day. This worker had females survive a journey of over 100 miles and subsequently lay fertile eggs. Griffitts (1927) obtained larvae of this species from various points along the Gulf Coast, finding it in pools showing a salinity as high as 12 per cent (Salinometer with direct salinity reading). According to this author "the preferential breeding place of *A. atropos* is water of a salinity of from 3 to 12 per cent, in permanent salt pools or in shallow water on muck or alluvial marshes." Griffitts (1928) states that *atropos* continues oviposition, larval development and emergence throughout the winter months, though, of course, not so intensively as in the warm season.

During the past two years the writer has encountered *Anopheles atropos* on a number of occasions along the Louisiana Gulf Coast. Adults were first obtained at Buras on April 3, 1931, but larvae were not discovered till a year later—April 7, 1932—at the same locality. About 50 larvae in various stages of development were secured from a small depression (containing approximately 2 quarts of water) in a salt marsh. The water had a salinity of 5 per cent saturation (1.85 per cent salinity). May 4, 1932, an abundant supply of freshly hatched larvae were taken in about two inches of water (0.8 per cent salinity) on a salt marsh (*Spartina stricta*-predominant grass) at Grand Bayou, La. These breeding grounds were typical of those in which *Anopheles crucians* (coastal variety) occur, and larvae of this species as well as those of *Aedes sollicitans* and *Culex salinarius* have all been taken from these habitats. Adult

Anopheles atropos have been reared from these larvae by different methods—all employing yeast (as recommended by Dr. Mark Boyd). Development took place as readily in fresh or distilled water, to which sodium chloride had been added in an amount equivalent to that found in the original habitat, as in the pool water, provided a supply of yeast was maintained at the surface. Considering Griffitts' observations it would seem that *A. atropos* has very wide tolerance limits for salinity. Doubtless it must be able to adjust itself from brackish water (following heavy rains) to water of very high salt content when the breeding pools begin to evaporate. The life cycle, under experimental conditions, was comparatively short. Freshly hatched larvae pupated in as short a time as 7 days and the first adult emerged on the eighth day. It is possible that the tiny larvae captured in the field were 48 hours old or even slightly older, but under optimum conditions the cycle may probably be completed in ten days or less.

Females have been captured in the field, fed immediately, and brought into the laboratory on numerous occasions in the hope of obtaining fertile eggs. Even when supplied with blood and moisture kept in the cage there is an extremely high mortality within the first 24 hours. Eggs have been secured several times but only once have they hatched. The writer's single observation on fertile eggs would confirm Beyer's statement that they are able to withstand desiccation. The eggs were deposited on the surface of the water in a beaker and not on wet cloth as reported by Beyer.

The seasonal distribution of this species seems somewhat variable, differing during the two years under consideration. The maximum density encountered during these studies was on November 27, 1931, at Buras, La. A marked diminution in numbers occurred during July, August and September, and it would seem that the species is most abundant during the late fall, winter or spring. It is, however, quite probable that rainfall, height of tides, etc., may markedly influence seasonal abundance, and it is also possible that there is a wide variation in local abundance in different parts of its range.

The writer is in a position to vouch for the bloodthirsty habits of the females. When one enters their resting quarters, in spite of bright sunlight or wind, *Anopheles atropos* readily attack and are exceedingly difficult to dislodge. By night they are equally ferocious and are attracted to lights.

While the distribution of this species is rather limited, yet it may become extraordinarily abundant within its range, and as it exhibits such a marked preference for human blood its malaria transmitting potentialities are important. Mayne and Griffitts (1931) have shown that *Anopheles atropos* is capable of infection in 87 per cent of the specimens tested. According to the map given by Faust (1932) illustrating malaria mortality in the Southern States for the year 1930, malaria is not a serious infection, with a few exceptions, throughout the range of *A. atropos*. However, it is quite possible that this mosquito may occur in considerable numbers in certain localities at various seasons where it may be important in the epidemiology of malaria. There would seem to be no vital reason why this insect should not be encountered in the coastal parts of Texas or the Southern Atlantic States. Its final incrimination as a malarial transmitter will rest upon the recovery of infected specimens in nature. The few dissection results of the writer to date have all been negative.

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THE LARVA OF CATAPIESTUS INDICUS FAIRM. (COLEOPTERA: TENEBRIONIDAE).

By J. C. M. GARDNER,
Forest Research Institute, Dehra Dun, U. P., India.

The larva and pupa of *Catapiestus indicus* Fairm. were first described and figured by Gravely[1]; the original figures were somewhat indistinct and the same writer later[2] provided a very

[1]1915, Rec. Ind. Mus., 11: 363–365; pl. 21, figs. 20–25.

[2]1916, Rec. Ind. Mus., 12: pl. 20, fig. 5.

good figure showing a ventral view of the caudal segments of the larva. Mr. R. A. St. George has asked me to describe the larva in more detail and, by the kindness of the Zoological Survey of India in lending me the original material, I have been able to do so.

LARVA.

Length about 20 mm. Body (fig. 6) rather strongly depressed, parallel sided, slightly narrower at extremities. Testaceous-brown, slightly darker towards extremities. Setae sparse but usually long and conspicuous, lateral or sub-lateral.

Head strongly depressed, about twice as wide as long, with strongly curved sides and with several long lateral setae and a pair of epistomal setae; frontal sutures distinct, widely lyriform; epicranial suture rather short.

Ocelli in a group of four on each side of head; each group consists of an anterior row of three with the fourth ocellus larger, posterior and nearer the dorsal surface.

Antenna (fig. 1) approximate to base of mandible, with distinct basal connecting membrane and three segments; the first segment slightly expanded on distal half, larger than wide and half as long as the second; the second segment nearly cylindrical, rounded apically, and slightly more than three times as long as wide; apical segment slender, nearly cylindrical, nearly one-third as long as the second segment, with a moderately long apical seta. There is no distinct supplementary appendage on the second segment, which, however, is provided on its apical third or so with a longitudinal ellipitcal membranous zone divided into about six parts, each with minute sensillae, by obliquely transverse bars continuous with the rest of the antennal derm.

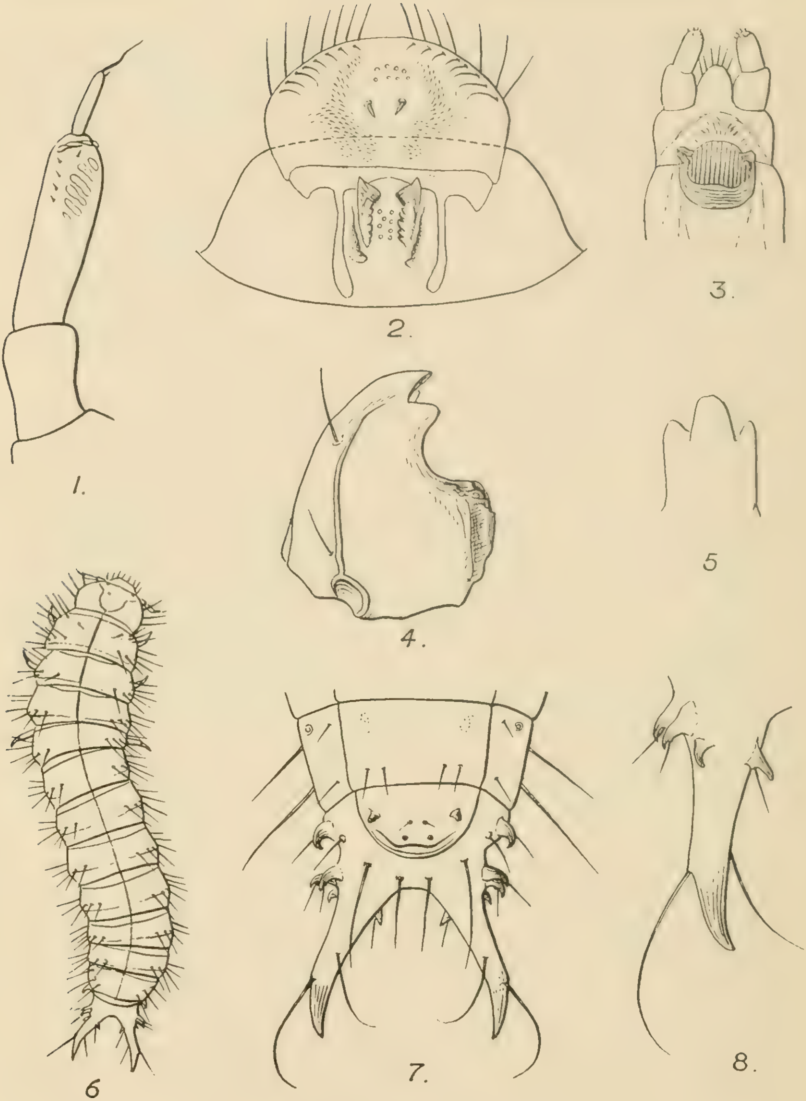
Clypeus large, clearly defined by anterior and posterior sutures; with a pair of setae on each side.

Labrum transversely sub-oval, with one pair of discal setae and several marginal setae.

Epipharynx (fig. 2) with seven or eight curved setae on extreme antero-lateral margin of each side; behind apex and near the middle line are eight sensory pores followed by a pair of short stout setae; on each side are fine dense hairs; nearer the oesophagus is a pair of longitudinal sclerotised structures each with the inner margin divided into small teeth, except anteriorly where the structure is more solid; between the two rows of teeth are eight sensory pores.

Mandibles (figs. 4, 5) with three apical teeth (the middle tooth the larger) and without postapical teeth; molar part well developed, slightly more prominent on left mandible; back (lateral face) of mandible without membranous elevation, rounded except for a ridge or obtuse carina extending from dorsal fossa towards the apex; there are two lateral setae, one near the base, the other nearer the apex.

Maxilla: Mala widely rounded apically and with numerous stout setae along inner margin. Palpiger indistinctly defined, with a pair of setae. Palp stout, with three segments, of which the second is slightly the longest; the bluntly rounded apex of the third joint with numerous minute sensillae. Cardo triangular, apparently simple, the lateral margin thickened.



Larva of *Catapiestus indicus* Fairm.

Labial palp (fig. 3) stout, with two nearly cylindrical segments, the apex resembling that of the maxillary palp. Ligula prominent, rounded.

Hypopharyngeal sclerome (fig. 3) sub-rectangular, each antero-lateral angle with a slight boss; otherwise with no marked projections.

Thoracic and first eight abdominal terga fairly strongly sclerotised, distinctly transverse, each distinctly margined laterally; with a fine median line, and without distinct punctures; these terga are somewhat vaguely transversely striate.

Ninth abdominal (fig. 7) segment with tergum (excluding urogomphi) transverse, slightly shorter than eight; on each side, near the junction with the eighth segment, is a curved corneous tooth; ventrally with a curved row of six setae arising from slight tubercles, the extreme tubercles are larger however. Sternum of ninth segment with a median sub-quadrate group of four small corneous tubercles and with a larger tubercle near each lateral angle.

Urogomphi (figs. 7, 8) divergent, long, nearly horizontal but capable of elevation by retraction of ninth tergum, tapering, with the acute apex slightly recurved; beyond the middle of each are two setae with very small basal tubercles; each urogomphus, near the base with an almost transverse row of four strong spines (fig. 8), three dorsal and one lateral, each of these spines with a seta with the exception of the middle one of the dorsal three.

The tenth or anal segment completely hidden from above by the ninth segment; without pseudopods.

Spiracles simple, subcircular, situated near the fine lateral margins of the appropriate segments.

Legs well developed, nearly equal in size, the coxae of the anterior pair separated from one another by a distance rather less than the width of the coxa. The second and third pairs more widely separated. Legs with sparse setae, without distinct granules.

Prothoracic presternum a rather narrow transverse strip; eusternum triangular.

Explanation of Plate.

Larva of Catapiestus indicus Fairm.

Fig. 1.—Antenna.
Fig. 2.—Epipharynx.
Fig. 3.—Labium and hypopharyngeal sclerome.
Fig. 4.—Left mandible, dorsal view.
Fig. 5.—Left mandible, lateral view of apex.
Fig. 6.—Larva, dorsal view.
Fig. 7.—Caudal segments, ventral view.
Fig. 8.—Left urogomphus, dorsal view.

REVIEW OF ROBERTSON'S "FLOWERS AND INSECTS."

"Flowers and Insects," by Charles Robertson. 8 vo. 225 pp. Cloth. Carlinville, Ill. 1928. (Reissued Sept., 1932. Lancaster, Pa. Science Press Pub. Co.) $3.00.

This volume gives records of 15,172 visits by insects (including 232 new species) to 453 flowers observed between September, 1887, and July, 1899, within ten miles of Carlinville, Ill., and cites bibliographical references to a considerable number of other such insects already on printed record. The subject-matter includes first a general synonymical list (pp. 7–20 inc.) of all the insects considered in the volume, these arranged by order, then alphabetically by family and genera; then follows (pp. 20–221 inc.) a list of the insects arranged under the respective plants, the insects being grouped by order, then alphabetically by family and genera, the plants being listed by family, then alphabetically by genera, the 7th edition of Gray's "Manual" being used as authority for the plant names. There is also appended a brief list of flower and insect papers cited in the text. Unless otherwise indicated the listed insect has been considered as actually obtaining nectar and effecting plant pollination. The periods of time within which observations were made on individual insects also have been indicated. There are evidences that considerable care has been exercised in obtaining authentic identifications of the listed insects and due acknowledgment of assistance of designated specialists has been made. Instances of doubtful identityare indicated, while the introduction contains discussion of difficulties and uncertainties experienced in obtaining authentic determinations from specialists and in finding adequate information from collectors' notes. No general index to the volume is included. —*Joe S. Wade.*

MINUTES OF THE 440TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, OCTOBER 6, 1932.

The 440th regular meeting of the Entomological Society of Washington was held at 8 P. M., Thursday, October 6, 1932, in Room 43 of the new building of the National Museum. Dr. F. C. Bishopp, President, presided. There were present 42 members and 22 visitors. The minutes of the previous meeting were read, and approved with a slight rearrangement.

Under the heading "Reports of Officers" the President called attention to the untimely death of George W. Ellington on August 23, while carrying on some experimental fumigation with hydrocyanic acid gas. On motion, the President was authorized to appoint a committee to draft suitable resolutions, and to prepare a biographical sketch of Mr. Ellington for publication in the Proceedings. The chair appointed Dr. E. A. Back, Dr. F. L. Campbell and Mr. E. H. Siegler to this Committee.

The President reported information from Dr. L. O. Howard that he had delivered the Society's greetings to the Entomological Society of France at its centenary. In commenting on the meeting, Dr. Howard expressed his regret that the greetings were not enclosed in an appropriate cover, and that they did not bear the seal of the Society. In view of the formality and dignity of the occasion, Dr. Howard had the greetings enclosed in a suitable leather binding prior to presentation, to overcome the apparent informality of the document. The President suggested that the Society give consideration to the question of adopting a seal, and recommended that Dr. Howard be reimbursed for expenses incurred in connection with securing a cover for greetings he presented for the Society. The Corresponding Secretary-Treasurer referred to previous discussions regarding the selection of a seal for the Society. He stated that this question had been discussed on a number of occasions, and that many of the older members of the Society had looked upon the illustration of the male of *Rheumatobates rileyi*, formerly used on the outside cover of the Proceedings, as the seal of the Society, although it had apparently never been officially designated as such. This emblem is now used only on the title page of the complete volume. The original engraving of this emblem was made as a wood cut by one of the past presidents of the Society, the late Mr. Otto Heidemann. On a motion duly made and seconded, the Society adopted as its official seal the illustration of the male *Rheumatobates rileyi* enclosed in a circle, with the words "Entomological Society of Washington" surrounding it and enclosed in another circle; and the Corresponding Secretary-Treasurer was requested to inquire as to the cost of securing the dies which could be used to impress this seal on formal documents. The Corresponding Secretary-Treasurer was directed on motion to reimburse Dr. Howard for expenses incurred in securing the binding for the Society's greetings to the Entomological Society of France.

The first communication on the regular program was by Mr. R. E. Snodgrass, and was entitled "The Fifth International Congress of Entomology at Paris during the summer of 1932."

The itinerary as presented in this account included the voyage across the Atlantic in company with a party of entomologists and their wives, organized by Dr. Claassen of Cornell, a few days spent in England in order to visit entomologists at London and Cambridge, the Congress at Paris, and its social events, and a final trip to the Bureau's corn borer laboratory at Hyeres in the south of France. A brief description was given of the town and colleges of Cambridge. The principal points of interest in Paris and accommodations for visitors were described, and located with the aid of a map drawn on the blackboard. Special attention was given to the reception on the afternoon of July 16 in the amphitheater at the Jardin des Plantes, where the Entomological Society of France formally welcomed the delegates of the Congress, and received the congratulations of the latter in honor of the hundredth anniversary of the French Society. There were present at this assembly the President of the Republic, the Minister of Agriculture, the Minister of Public Health, and the Minister of National Education. On the evening of the same day the delegates were guests of the Society at a banquet at the Hotel Claridge. After describing these events, the speaker gave a brief account of the Congress, the representation of the various countries, and the opportunities to meet entomologists. It was pointed out that the importance of international scientific congresses arises from the international nature of science itself. Side trips and social features in connection with the congress, including a reception by Dr. Howard, were given in their appropriate places, and a few remarks of general interest were added. The talk was illustrated with lantern slides. (Author's abstract.)

Under the heading "Notes and Exhibition of Specimens" Dr. Austin H. Clark discussed local occurence dates of several species of butterflies and a moth, and spoke of the local appearance of certain seasonal and varietal forms.

Mr. J. C. Bridwell spoke of an earwig (*Labidura riparia*) associated with an army worm on rice in India, noted in 1926; and of larvae of Carabidae, and of Pheropsorus, a bombardier-beetle, parisitic in the egg-capsules of the earwig.

Mr. F. H. Benjamin spoke of receipt of a gift of type specimens of Catocala species for the National Museum, from Mr. Otto Buchholz. Members showed great interest in this gift.

Mr. R. A. Cushman exhibited a collection of Ichneumonidae from Madagascar, and a copy of a recent paper on the subject, which he had received from M. Andre Seyrig as a gift to the National Museum. The collection constitutes a part of the material on which was based M. Seyrig's recent excellent paper on the Pimplinae of Madagascar. It consists of 74 specimens, representing 45 species and varieties, and 26 of the 32 genera and subgenera discussed in M. Seyrig's paper. With the exception of a few species described by Saussure and Brulle, all of the specimens are paratypes of new species described in M. Seyrig's paper. This gift forms a very notable addition to the collections of the National Museum. Members of the society showed much interest in this gift to the Museum.

Mr. A. C. Davis exhibited specimens of *Cicindela nevadica* Lec., and mentioned that in the arid southwest Cicindela occurs only near water and sometimes in very isolated situations.

Mr. C. T. Greene exhibited specimens of the rare *Anastrepha daciformis* Bezzi collected at Sao Paulo, Brazil, Dec. 26, 1931, by Mrssrs. Kisliuk and Cooley. The immature stages are unknown.

Meeting adjourned at 10:37 P. M.

F. M. WADLEY,
Recording Secretary.

Actual date of publication, November 23, 1932.

VOL. 34 DECEMBER, 1932 No. 9

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OF THE

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OF WASHINGTON

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OFFICERS FOR THE YEAR 1932.

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

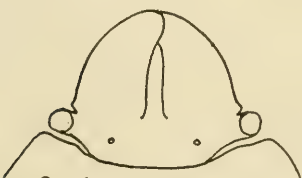
VOL. 34 DECEMBER, 1932 No. 9

A NEW SCIOCORIS FROM TEXAS (HEMIPTERA-HETEROPTERA: PENTATOMIDAE).

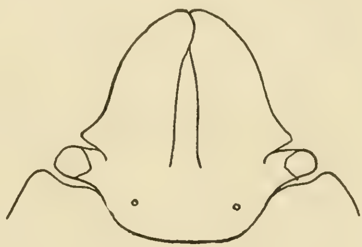
By H. G. BARBER, *U. S. Bureau of Entomology.*

Sciocoris longifrons, n. sp.

Grayish-testaceous; rather densely punctate with fuscous. Connexivum alternated with yellow-testaceous and fuscous bands. Head beneath, pleura, venter, and legs strongly punctate with fuscous; punctures often aggregated into clusters. Disk of venter infuscated. Antennae and rostrum pale testaceous.



S.microphthalmus



S. longifrons

Head but little wider than long (9:8); the portion before the eyes more elongate than in *S. microphthalmus* Flor.; lateral margins before eyes provided with a distinct obtuse tooth; margins before this very plainly concavely sinuate, thence plainly converging anteriorly to form a rather narrowly rounded apex; surface closely and coarsely punctate. Antennae with the short basal segment a little over one-half as long as second, third segment shortest of all, fourth two-fifths longer than third, fifth segment a little longer than second. Bucculae rather strongly elevated anteriorly, thence gradually diminishing in height posteriorly. Apex of rostrum nearly reaching posterior coxae; second segment but little longer than basal, third and fourth segments subequal, each very short, taken together about one-half as long as second. Pronotum nearly two and one-half times as wide as long (23:9); surface, except on cicatrices, closely and coarsely punctate; plainly transversely impressed at the middle, less distinctly so a little behind anteror margin; lateral margins broadly expanded; outline of edge nearly straight or very gently rounded; anterior angles anteriorly produced to middle point of eyes, apex narrowly rounded; anterior margin at base of head strongly, concavely arcuate; humeral angles broadly rounded or obtusely angulate; posterior margin before scutellum gently concavely arcuate. Scutellum but little longer than wide (15:14), the lateral margins subparallel for a little over one-third the way from base, thence very gently concavely arcuate; apex bluntly rounded; a small, smooth, calloused, yellow spot just within each basal angle. Corium a little shorter than scutellum; outer and inner apical angles rounded, apical margin truncate; space between costal margin and Sc+R nervure plainly narrower than space between this nervure and inner margin. Membrane reaching apex of abdomen. Length 7.40 mm.; diameter 3.08 mm.

Type male.—U. S. N. M. No. 44581, Victoria, Texas (J. D. Mitchell).

Paratypes males.—One with same data as type, two "Tex." (C. V. Riley); "Tex." (Belfrage); females: two "Tex." (C. V. Riley); Austin, Tex.

Somewhat larger than *S. microphthalmus* Flor. Easily differentiated from that species by the longer and narrower frontal region; more prominent tooth before each eye, more strongly elevated bucculae, and strongly produced anterior angles of the pronotum.

TWO NEW SPECIES OF EULACHNUS DEL GUERCIO (APHIDIDAE).

By Ryoichi Takahashi,
Department of Agriculture, Research Institute, Formosa.

The aphids of the genus Eulachnus Del Guercio feed on the leaves of Pinus and are widely distributed in the world. As far as my observations extend seven species including two new forms are now known, of which six are distinguished as follows:

Key to Species of Eulachnus.

(viviparous female.)

(1) Hairs on the front nearly as long as or shorter than the first antennal joint .... (2)
— Hairs on the front much longer than the first antennal joint .... (3)
(2) The third antennal joint of the apterous form with about 12 capitate setae .... *E. americanus* n. sp.
— The third antennal joint of the apterous form with about 20 slightly capitate setae .... *E. taiwanus* n. sp.
(3) Head with capitate setae .... *E. tuberculostemmata* Theob.
— Head without capitate setae .... (4)
(4) The third antennal joint longer than the fourth and fifth taken together, lacking sensoria in the alate and apterous forms .... *E. rileyi* Williams

— The third antennal joint nearly as long as the fourth and fifth taken together, with sensoria in the alate form .... (5)

(5) The third antennal joint of the alate form with 6-9 sensoria .... *E. agilis* Kalt.

— The third antennal joint of the alate form with 1 or 2 sensoria .... *E. piniformosanus* Takah.

Eulachnus thunbergii Wilson (Ent. News, XXX, 1919, p. 3) has been described from only the sexual forms and is not included in the key. It may be identical with *E. piniformosanus* Takah. (1921), the latter sinking as a synonym.

Eulachnus americanus n. sp.

(Apterous viviparous female) Brownish yellow. Eyes red. Antennae of the same color as the body, but paler, somewhat dusky on the distal half of the fifth joint and on the sixth. Legs brownish yellow, somewhat dusky on the tarsi. Hairs pale yellow. (Color notes from specimens not treated with potash and mounted in balsam.)

Body elongate, narrow, with many stiff setae which are a little capitate and slightly or scarcely curved. Head divided on the dorsum, with some capitate stiff setae; those on the front longer, but a little shorter than the first antennal joint. Eyes protruding, without ocular tubercles. Antennae slender, with some capitate setae which are shorter than those on the front and nearly as long as those on the vertex; the first joint longer than wide, as long as the second, with 2 rather short capitate setae on the mesal side; the second with 2 similar, but longer, setae; the third provided with some 12 capitate setae, wanting sensoria; the fourth with about 7 similar setae; the fifth with a large apical sensorium and about 6 similar setae; the sixth with about 4 similar setae on the basal part, 3 very short stout capitate setae at the tip, and a large oval sensorium on the basal half of the distal part; the relative length of joints about as follows: III—62, IV—32, V—41, VI—24+20. Rostrum obtuse, reaching the hind coxae. Capitate setae on the posterior part of abdomen longer, nearly as long as those on the front. Cornicles small, very short, not on cones. Cauda rounded, with many very long fine hairs not capitate. Legs very long, slender, with many capitate stiff setae, most of which are nearly as long as those on the front; some simple setae also present on the distal parts of tibiae; hind tarsi as long as the fifth antennal joint, the basal segment with 2 fine capitate setae and about 5 shorter simple setae, the distal segment twice as long as the basal, with a few fine capitate and simple setae.

Length of body—about 1.55 mm. Width of abdomen—about 0.6 mm. Width of head including eyes—about 0.39 mm. Length of antenna—about 1.1 mm. Capitate seta on front—about 0.05 mm. Capitate seta on vertex—about 0.037 mm. Hind tibia—about 1.0 mm.

(Alate viviparous female) Color almost as in the apterous form. Mesothorax dark brown. Wings hyaline, veins and stigma pale yellowish brown. (Color notes from specimens not treated with potash and mounted in balsam.)

Body elongate, narrow, with many a little capitate setae. Head divided, with some capitate stiff setae which are as long as the first antennal joint and slightly or scarcely curved. Antennae slender, with some capitate stiff setae a little shorter than those on the head; the first joint with 2 short mesal capitate setae; the second as long as the first, with 2 similar, but a little longer, setae; the third with 2–4 rather large circular sensoria in a row on the distal half and some 10 capitate setae; the fourth with 1 or 2 similar sensoria and about 5 capitate setae; the fifth with a large oval sensorium and about 4 similar setae; the sixth with about 2 similar setae on the basal part, a large oval sensorium about the middle of the distal part, and 3 short capitate setae at the tip; the relative length of joints about as follows: III—68, IV—36, V—45, VI—25+20. Rostrum reaching beyond the middle coxae, obtuse. Cornicles and cauda as in the apterous form. Legs very long, slender, with many capitate stiff setae which are as long as or a little longer than those on the front; tibiae stouter than the third antennal joint; hind tarsi as long as the fifth antennal joint, the distal joint twice as long as the basal. Wings narrow; media on the front wings obsolete on the basal part, once branched, faintly indicated; stigma normal; hind wings with 0-2 obliques and 2 or 3 hooklets.

Length of body—about 1.72 mm. Width of head including eyes—about 0.4 mm. Length of antenna—about 1.1 mm. Fore wing—about 2.0 mm. Hind tibia—about 1.2 mm. Capitate seta on front—about 0.06 mm. Longer capitate seta on antenna—about 0.046 mm.

Host.—Pinus tanyosho.

Hab.—Wyomissing, Pa., U. S. A.

Some specimens were collected by F. M. Trimble on Sept. 15, 1921, and were sent to me for study by Dr. T. L. Guyton. The type specimens will be preserved in the collection of the Department of Agriculture, Research Institute, Formosa.

Eulachnus taiwanus n. sp.

Eulachnus rileyi Takahashi (nec. Williams), Aphididae of Formosa, part 2, p. 47 (1923); Ibid., part 6, p. 25 (1931).

(Apterous viviparous female) Yellowish brown. Eyes brown. Antennae pale yellowish brown, apices of the third, fourth and fifth joints and distal half of the sixth somewhat dusky. When placed in balsam many small dusky spots visible on the dorsum, from each of which arises a long yellowish brown bristle. Legs yellowish brown, tarsi somewhat dusky. Cornicles and cauda yellowish brown.

Body elongate, narrow, slightly covered with a powder, with many stiff setae which are straight or slightly curved and slightly or scarcely capitate. Head divided, with 4 long setae on the front arranged in a transverse row, and 14 dorsal setae a little shorter than those on the front; the setae on the front as long as the first antennal joint. Eyes large, protruding, without ocular tubercles. Antennae slender, with many slightly capitate setae which are shorter than those on the front; the second joint as long as the first, with about 5 setae around the middle; the third a little striate on the distal half, wanting sensoria, with about 20 setae; the fourth wanting sensoria, with about 10 setae; the fifth with a very large circular sensorium and about 10 setae; the sixth with a large circular sensorium on the basal half of the distal part, about 3 very short apical setae slightly capitate, and about 5 setae on the basal part; the relative length of joints about as follows: III—90, IV—46, V—51, VI—24+17. Rostrum reaching beyond the middle coxae, obtuse. Posterior abdominal setae a little longer, but slightly shorter than the frontal ones. Cornicles very small, short, not on cones. Cauda broadly rounded, with many long setae not capitate. Legs very long, with many stiff setae which are slightly or scarcely capitate and slightly shorter than those on the front; tibiae stouter than the third antennal joint; hind tarsi striate, as long as the fifth antennal joint, the distal segment nearly twice as long as the basal.

Length of body—about 2.25 mm. Width of head including eyes—about 0.46 mm. Width of abdomen—about 0.74 mm. Length of antenna—about 1.2 mm. Hind tibia—about 1.2 mm. Seta on front—about 0.074 mm. Dorsal seta on basal part of abdomen—about 0.047 mm.

Host.—*Pinus massoniana.*

Hab.—Taihoku, Taiwan (Formosa).

Some apterous females were collected by me on July 30, 1922. This species was regarded as *Eulachnus rileyi* Williams in my previous papers, but differs from it as stated in the key. Closely allied to *E. americanus* Takah., differing, however, in the larger body, in possessing more setae on the antennae and legs, in the setae less distinctly capitate, etc. The winged form has not been collected. The type specimens will be preserved in the collection of the Department of Agriculture, Research Institute, Formosa.

A NEW MELANOPLUS (ORTHOPTERA : ACRIDIDAE) OF THE TEXANUS SERIES.[1]

By V. A. Little, *Texas A. and M. College, College Station, Texas.*

Melanoplus angularis, new species.

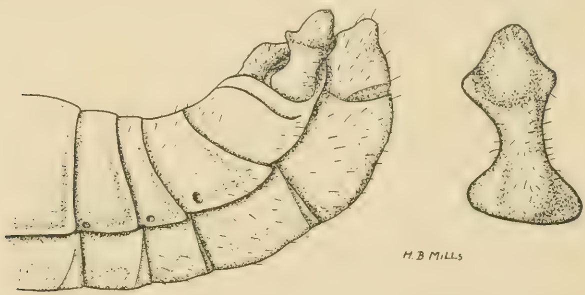
This is the most striking species of the Texanus series due to its angular and peculiarly shaped cerci, the presence of bullations on the supra-anal plate and its large size. The investigator is acquainted with three species of the series in Texas. *Texanus* is confined to the western areas, *warneri* is found in the post oaks of the east central section, while this species is found in the pine woods of east Texas. All three are found only in the spring and early summer.

Type.—Male: Walker County, Texas, May 28, 1930.

Size large for series; form robust. General color dark grayish brown dorsally, lighter ventrally. Antennae rusty brown about equal to the combined length of the head and pronotum. Eyes moderately large, oval, the width equaling

[1]Contribution No. 28, Department of Entomology, Texas A. and M. College, College Station, Texas.

about two-thirds the length. Fastigium of the vertex moderately declivent, enlarging apically; shallowly sulcate. Frontal costa about equal, plane above, shallowly sulcate around and below the median ocellus, slightly punctate. Pronotum enlarging but little posteriorly, the hind margin rounded; the metazona about four-fifths the length of the prozona. Median carina very distinct with faint lateral carinae. Post-ocular band extending to the metazona, widening posteriorly. Disk of the prozona marked on either side of the post-ocular band and along its sutures by a dirty gray color. Prosternal spine subconical, mesially enlarged, retrose. Epimera of the meso- and meta-thorax black. Interspace between the mesosternal lobes slightly more than twice as long as broad; lobes of the metasternum attingent. Tegmina short, overlapping, ovate with their apices roundedly pointed, faintly maculate; length less than the combined length of the head and pronotum. Extremity of the abdomen upturned, somewhat clavate. Supra-anal plate triangular, broader than long; sides nearly straight, raised; a sub-quadrate bullation found on either side of the median line near the base. Furcula short, sub-quadrate sub-attingent, inconspicuous. Cerci spatulate, incurved, about three times wider at the widest portion than at the narrowest; the apical half with two angular obtusely rounded projections, the superior process being in a different plane than the inferior one and more prominent. The apex rounded; the area between the projections and the apex concave. Subgenital place subconical, longer than broad, apically entire. Hind femora exceeding the tip of the abdomen, crossed by three ill-defined fuscous bands; lower and inner surfaces reddish. Hind tibiae red, faintly infuscated basally, with twelve black tipped spines in the outer series.



Tip of abdomen and cercus of male.

Measurements in Millimeters.

	Length of Antennae	*Length of Pronotum*	*Length of Body*	*Length of Tegmen*	*Length of Hind Femur*
Type	9	6.25	25	7.5	14
Paratypes (21)	9–10.5	5.75–6.8	23–28.25	7–9.5	13–14.8

Allotype.—Female. Walker County, Texas, May 28, 1930.

Size large for series, considerably larger than the male; form robust. General color as in male except somewhat duller. Antennae infuscated apically; length less than that of the combined length of the head and pronotum. Eyes oval with the width equaling about three-fourths the length. Fastigium of the vertex as in male, almost plane. Frontal costa sub-equal; shallowly sulcate around the median ocellus, sparsely punctate. Pronotum enlarging posteriorly, slightly arched; hind margin rounded. Metazona three-fourths the length of the prozona; median carina distinct; lateral carinae sub-obsolete. Post-ocular band reaching the metazona, broadening posteriorly. Prosternal spine sub-conical, retrose. Pleura marked with black. Interspace between mesosternal lobes broader than long; that of the metasternal lobes wedge-shaped. Tegmina oval, slightly overlapping with their apices bluntly pointed; length slightly less than combined length of the head and pronotum, faintly maculate. Ovipositor moderately exserted. Hind femora reaching tip of abdomen, marked by three indistinct fuscous bands; color beneath reddish. Hind tibae red, somewhat infuscated, with eleven or twelve black tipped spines in the outer series.

Measurements in Millimeters

	Length of Antennae	*Length of Pronotum*	*Length of Body*	*Length of Tegmen*	*Length of Hind Femur*
Allotype	9.5	7.75	33	9	17.5
Paratypes (9)	9.5–11	7.5–8.5	29.75–35	8.75–10	16–18

The type, allotype, and paratypes are being deposited in the U. S. National Museum, Washington, D. C.

THE LINNEAN TYPES OF ICHNEUMON FLIES: By A. Roman, *Entomologisk Tidskrift, 1932, Separate, pp. 1–16.*

For over a century hymenopterists have made little effort to ascertain the exact identity of the Linnean species of Ichneumonoidea, although for many, at least, the types have been easily accessible since the acquisition of the Linnean collection by the Linnean Society of London.

It has remained for the student best equipped for the study to examine and report on the Linnean types of Ichneumonoidea. To this study Dr. Roman brought not only his fine discrimination and judgment but also his long experience and intimate knowledge of the fauna that was the source of nearly all of Linne's species of Ichneumonoidea. Probably few, if any, will find cause for disagreement with Dr. Roman's expressed opinions as to the identity of Linné's species.

Comparatively few radical changes in nomenclature will result although the failure of the European authors properly to identify the Linnean species results in much synonymy of species. Probably the most startling change is the transfer of the specific name *praerogator* from the genus *Dyspetes* in the Tryphoninae to *Angitia* in the Ophioninae, with the necessary renaming of a species that has gone under the name *praerogator* for more than a century. Another surprise is the fact that the species that has come traditionally to be known as *manifestator*, genotype of *Ichneumon*, does not occur in the collection at all, and that the name must be applied to a species that has gone under another name for more than a century and a half.

It would seem to behoove the specialists in other groups of insects to make similar studies of the collection that is the basis of all zoological nomenclature.

The ichneumonologists of the world owe Dr. Roman a debt of gratitude for this piece of work. —*R. A. Cushman.*

REVIEW OF MATHESON'S MEDICAL ENTOMOLOGY.

Matheson's Medical Entomology, by Robert Matheson, Ph. D., 489 pp., cloth, Springfield, Ill., and Baltimore, Md., 1932 (Charles C. Thomas, $5.00).

Although the science of Medical Entomology, as emphasized by Dr. L. O. Howard, in his admirable History of Applied Entomology, is but a mere half century old, the qualities of the present volume will impress the thoughtful reader with the fact that it has remained with the vanguard in the general advance of applied entomology.

In his present publication, Dr. Matheson presents an admirable and thoroughly practical epitome of the subject. While the emphasis throughout the work is laid upon entomology, the medical phases of the subject are so well treated as to render it most useful both to the physician and the general biologist.

The book begins with a brief general discussion of the relations of the Arthropoda with human disease, arranged chronologically according to the name of the disease. Thereafter, however, the arrangement is ordinal throughout the phylum. In many cases, synopses of the higher groups are given. A vastly useful feature, and one which is sure to evoke the applause of the student, is that of appending to each chapter a generous list of references to the literature of the subjects treated in the immediately foregoing pages. This adds great value to the work which evinces a familiarity with recent literature that is refreshing.

The closing chapters on "Poisonous and Urticating Arthropods" and "Collecting, Preserving and Mounting Insects" respectively, contain information that forms a welcome addition to the usual content of such works. The format is excellent and the work is well illustrated; it contains both author's and general indexes. Although one can not call the duck binding of this octavo volume handsome, its potential durability is obvious. —*W. R. Walton.*

MINUTES OF THE 441ST REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, NOVEMBER 3, 1932.

The 441st regular meeting of the Entomological Society of Washington was held at 8 P. M., Thursday, November 3, 1932, in Room 43 of the new building of the National Museum. Dr. F. C. Bishopp, president, presided. There were present 33 members and 12 visitors. The minutes of the previous meeting were read and approved with a slight rearrangement.

The following individuals were unanimously elected to membership on recommendation of the executive committee: Mr. H. Shepard Fuller of 3704 Huntington St., Washington, and Mr. C. P. Clausen and Dr. P. N. Annand, both of the Bureau of Entomology.

Under the heading "Reports of Officers" the President read a notice from Prof. H. B. Hungerford, secretary of the Entomological Society of America, urging attendance at the coming Atlantic City convention. The President remarked on the desirability of attendance of the meetings of both national societies by Washington entomologists. Mr. Cushman discussed the closing hour of the society, urging that programs be not cut short simply to adjourn at 10 P. M., and suggesting that adjournment be on motion.

Under the heading "Notes and Exhibition of Specimens," Dr. J. M. Aldrich exhibited adult specimens of two species of Melanderia (Dolichopodidae), found along the Pacific seashore, and possessing processes similar to mandibles.

Dr. S. B. Fracker discussed pink bollworm infestation in Florida, exhibiting a map of its known extent; and stated that infestation in Arizona and New Mexico was much reduced.

Mr. Middleton stated that the elm-leaf beetle was very numerous in New England in 1931, but less abundant there in 1932; and that it was numerous around Washington in 1932. In the latter infestation an egg-parasite, *Tetrastichus xanthomelaenae*, was liberated under favorable conditions.

Mr. Bridwell showed specimens of *Neoharmonia venusta*, a lady-beetle he had observed to be predaceous on *Phratora americana* and *Plagiodera versicolor* on willow.

Mr. C. P. Clausen mentioned recent work in exportation of parasites. Mediterranean fruit fly parasites were successfully sent from Hawaii to Spain, crossing America by air-mail and receiving special care on ocean steamers. Other cases include enemies of cottony-cushion scale introduced into Puerto Rico and woolly aphis parasitized by *Aphelinus mali* sent to Ecuador.

Dr. B. A. Porter explained the change in the order of the program, putting notes first in order to give this phase of the program greater emphasis. He discussed recent work of the New York Experiment Station with light traps in apple orchards for the control of the coddling moth, bud moth, and leaf-rollers.

Mr. Rohwer stated that a public service patent had recently been issued to Mr. Foster H. Benjamin, for the device which he invented for extracting the larvae from fruits. The device patented was developed by Mr. Benjamin in connection with his work on the Mediterranean fruit fly, and was used as a means of determining the presence of this pest, as well as other maggots that might live within the fruit. Mr. Benjamin had exhibited the machine, and discussed its principal features, as well as the factors which led to its development, at one of the earlier meetings of the Society.

Mr. Rohwer also stated that the egg parasites of the elm leaf beetle received from laboratories in Europe represented two species, both of which belonged to the genus Tetrastichus, one previously known and the other an apparently non-described species. Both of these parasites had been studied at the Melrose laboratory of the Bureau, and were found to be primary. In addition to the liberations in the vicinity of Washington, specimens have been liberated in California in cooperation with Harry S. Smith; in Ohio in cooperation with J. S. Houser; and in a number of places in the New England states.

Dr. F. C. Bishopp spoke of an outbreak of a mosquito, *Psorophora columbiae*, in Florida. It was very sudden, following heavy rains which flooded large areas in and near the Everglades, and caused severe injury to livestock. According to reliable reports, about 200 head, mostly cattle, were killed.

Mr. Cushman exhibited a copy of a paper by Dr. A. Roman, on the Linnean types of ichneumon flies. His remarks on this paper appear on another page of these Proceedings. This note was discussed by Busck.

Mr. August Busck reported on his trip to Europe to the International Congress of Entomology, and spoke of visits with Edward Meyrick, F. N. Pierce and other European entomologists, and of obtaining valuable specimens in English museums. He exhibited a photograph of the banquet of the Centennial of the Societé Entomologique De France, attended by the delegates.

The first communication on the program, following "Notes and Exhibition of Specimens," was by R. A. Cushman, and was entitled "The Oviposition habits of Chelonus sericeus Say." This paper will be published in the December number of the Proceedings.

The paper was discussed by Clausen and Bridwell.

The second communication was by William Middleton and was entitled "Insect injury to shade trees as related to environmental conditions."

This paper was presented to show that a large number of environmental conditions tend to produce insect injury to shade trees and hardy shrubs. For example, the kinds of trees, their natural requirements and ages are all of considerable importance from the standpoint of insect attack, and in addition another group of factors, involving the management and care of the trees, is likewise important. Under this latter heading the amount of ground allotted to shade trees, the methods of planting and transplanting them, and changes that occur in their surroundings, such as grading, filling and the thinning out of groups of trees, all tend to induce insect attack; and finally, attack by one insect also favors infestation by some other species. (Author's abstract.)

This paper was discussed by Cushman and Bishopp.

Meeting adjourned at 10.15 P. M.

F. M. WADLEY,
Recording Secretary.

CORRECTION.

On pages 110–112 of the Proceedings of the Entomological Society of Washington, vol. 34, 1932, I described *Harmolita opuntiae* and, through a misunderstanding, remarked that the type series had been reared by W. W. Jones from *Opuntia spinosior*. After the publication of the description I received a communication from Mr. Jones to the effect that the host plant from which his specimens had been obtained was not *Opuntia* but rather *Hilaria mutica* (Buckl.). I am therefore publishing this note to call attention to my unfortunate error in the host record. —*C. F. W. Muesebeck.*

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