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NOTE ON A PUERTO RICAN SPECIES OF EULOPHIDAE (HYMENOPTERA).

By A. B. GAHAN,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The following note will help to clarify the taxonomic relationship of an interesting species of Eulophidae described by Ashmead.

Ceratoneura femorata (Ashmead), new combination.

Tetrastichodes femoratus Ashm., Journ. Linn. Soc. Lond. Zool., vol. 25, p. 183, 1894.

More than one hundred specimens of a species of *Ceratoneura* reared by Prof. J. G. Needham from seedpods of *Jussiaea angustifolia* taken at Rio Piedras, Puerto Rico, during the winter and spring of 1940, have been examined. These have been compared with a male specimen in the United States National Museum collected by H. H. Smith on the island of St. Vincent, British West Indies, which bears the label "*Tetrastichodes femoratus* Ashm., ♂ Type" and which agrees with the original description. The actual type of Ashmead's species is believed to be in the British Museum, but since the species was described from a male and a female there appears to be no reason to believe that the male specimen referred to is not the male type. The male specimens reared by Prof. Needham seem to agree very completely with this type specimen and the females of his series do not differ from the description.

The species has a short but distinct abdominal petiole and the antenna of the female has four transverse ring joints. The fourth ring joint is no larger than the others, in which respect it differs from other species of the genus. The antenna of the male also differs to some extent from that of typical *Ceratoneura*. This consists of a fusiform scape which has a slight swelling on the ventral margin near apex, a pedicel nearly half as long as the scape, three transverse ring joints, a four-jointed funicle. and a three-jointed club. The first funicular joint is subquadrate, narrower than the others, and probably is merely the fourth ring-joint enlarged. The second funicle joint is about one and one-half times as long as broad, while the third and

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fourth joints are about as broad as long. The club is indistinctly three-jointed, distinctly broader than the funicle, nearly as long as the three preceding funicular joints combined, and terminates in a short spine. None of the funicular joints is provided with whorls of long hairs, the hairs being instead somewhat shorter than the segments and more or less evenly distributed.

Typical *Ceratoneura* has the fourth ring joint in the female subquadrate and longer than the other three ring joints combined, somewhat resembling a funicular joint. The male antenna has three small transverse ring joints, a 5-jointed funicle, and a 2-jointed club, each funicular joint bearing a whorl of long hairs.

Despite these obvious differences, especially in the male antenna, I believe the species is best placed in the genus *Ceratoneura*, which is the only genus of Tetrastichinae in which the abdomen is petiolate, so far recorded from North America.

The exact host relations of the species are not known to me. *Ceratoneura indi* Girault (Descriptiones Hymenopterorum Chalcidoidicarum Variorum cum Observationibus, V, 1917, p. 10), according to labels on some of the specimens in the type series, makes galls in the flowerheads of *Sesbania aegyptica* although other specimens of the series are merely labeled "from galls" on this plant. *C. pretiosa* Gahan (Proc. U. S. Nat. Mus., vol. 48, 1914, p. 165), as stated in the description, was reared from galls on *Mimosa* at Brownsville, Tex. A label on one specimen of the type series, however, reads "Gall-making Chalcidid on *Mimosa*, associated with *Asphondylia*." These records have been considered dubious. If actually correct, then it is probable that *femoratus* is likewise a gall maker, as Prof. Needham suspects. Not having seen the evidence in any of these instances, I am not in a position to say whether or not they are really gall makers.

INSECTS FROM SEED PODS OF THE PRIMROSE WILLOW, JUSSIAEA ANGUSTIFOLIA.

By James G. Needham.

This primrose willow is a lusty annual weed that is commonly found growing in the wet soil in the bottom or roadside ditches in Puerto Rico. Because of its long, narrow cylindric seed pods it is there called by the Spanish name of *Yerba de clavo*. During the spring of 1940 while residing in Rio Piedras, I was attracted by the bright yellow flowers that decorate the ditches in the early morning, and that shed their petals in days of bright sunshine before mid-forenoon. Thus I came to notice the swollen condition of many of the seed pods.

I could find no records of any gall-makers affecting Jussiaea, so I set about rearing the larvae of insects found in the pods. I soon had adults of two gall-makers and three associated parasites.

The slender seedpods of this species of Jussiaea are nearly two inches long. They are eight-ribbed lengthwise and are capped with the four persistent wide-spreading sepals (fig. 1). In each of the four cells of the capsule there is a mushroom-shaped axial placenta (as seen in cross-section, fig. 2) with the minute seeds overspreading the top and sides of the mushroom cap. These seeds are very numerous, often as many as 500 in a single pod.

Infested pods are easily recognized by their bulging irregularities of form. The galls within them are disclosed by stripping away a bit of the capsule wall from one of the bulges. Two kinds of galls may thus be found attached to the placenta: one larger, replacing several seeds, oval in form, loose-fitting, made by a gall-midge larva; one smaller, developed in a single seed, spherical in form, tight-fitting, made by a gall wasp.

My studies of these were in the nature of field observations made in the intervals between hours of teaching, with brief opportunities for laboratory examination of the materials collected and reared. Though incomplete, I offer them for publication because they add something to the knowledge of the habits of the species concerned and because none of these has hitherto been reported from Puerto Rico.

The Midge Gall.

The commonest deformation of the pods is caused by the larva of an obscure little Cecidomyiid midge, *Asphondylia rochae* Tavares.[1] The signs of its work are very apparent just after the adults emerge, for they leave their abandoned pupal skins sticking half way out of their emergence holes, as shown in figure 1. Often there are three zones of emergence, as shown in that figure, with corresponding swellings. Often the infestation is only on one side and then the pod is bent at an angle. I have reared as many as thirty midges from a single pod.

Very young larvae are of the usual Cecidomyiid form, slender, straight and dorsally depressed. Grown larvae appear very different, for they are stout, bulging with fat, and bent double like gall wasp larvae. However, their curvature is the reverse of that of the wasp; for though bent head to tail, the *ventral side is outermost*, next the inner wall of the gall. In that position the "breast bone" may be used to prod the surrounding plant tissues, stimulating them to overgrowth. When I first

[1] Kindly determined for me by Dr. E. P. Felt.

found grown larvae in completed galls I did not recognize that they were the elders of the little fellows. The youngest larvae that I found were very minute and lay extended among the seeds with the ventral side of the prothorax, bearing the "breast bone" applied to the placenta.

I did not observe the beginning of gall development. I did not see just how the over-growth of the plant tissue that causes the bulging of the pods comes to inclose the larva. I found the walls of completed galls composed of a dense brownish tissue with a filmy white lining. Externally the tissue is greenish, and merges gradually into the normal plant parenchyma, with considerable swelling of the surrounding very-much-crowded seeds.

The larva transforms to a pupa within the gall cavity with the head end next to the wall of the pod. The head is armed with sharp spines, as shown in figures 3 and 4. These seem well adapted to tearing a hole for the emergence of the adult. Backwardly directed spines on the rings of the abdomen doubtless assist in pushing it out through the hole.

The galls are generally placed well apart, but sometimes they may have contiguous walls. Sometimes they are partly overarched at the sides by the remains of partly excavated seeds. Apparently, this insect is an incipient gall-maker, only a little converted from seed-devouring habits.

On a trip to Lake Tortuguero, some fifty kilometers northwest of Rio Piedras and almost at sea level, I gathered a handful of heavily infested pods of *Jussiaea angustifolia* (incidentally I may mention that *J. leptocarpa*, growing along side, showed no infestation whatever) and took them back to my cages in Rio Piedras. From them I reared many adults of *Asphondylia rochae*, and two Chalcidoids that I suppose to be its parasite: the relatively large reddish *Rileya megastigma* Ashmead in great numbers, and *Callimome montserrati* (Crawford), a single specimen.

The Chalcid Gall.

The second type of gall, the one that is developed from a single seed, appears to be caused by the larva of *Ceratoneura femorata* (Ashmead).[2] Galls of this type I found less generally distributed than the one above described but often occurring in much greater numbers in single pods, and never found singly. They grow in compact clusters bound together by a white webbing tissue that hardly allows their individual separation in an uninjured condition. They are thick walled and tight-fitting, and each single gall when grown occupies about the space of four normal seeds. The stimulus of the gall-maker

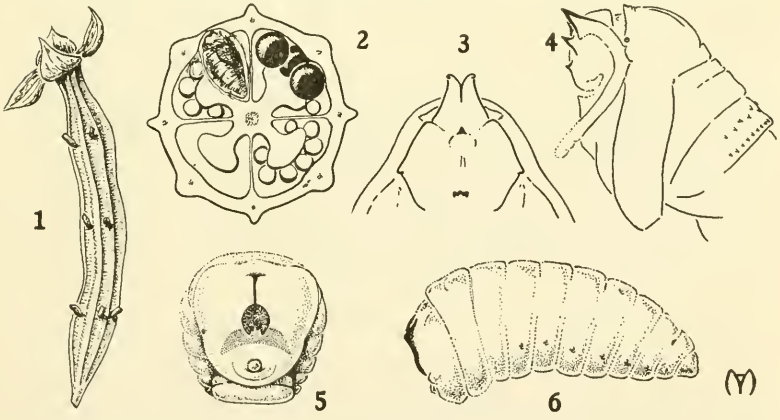
[2] All determinations by A. B. Gahan.

extends to the nearest neighboring seeds, causing their overgrowth and crowding. These adjacent untenanted seeds become much enlarged but do not mature. The webbing tissue adheres externally like cotton to the cotton seed, but merges peripherally into ordinary green parenchyma. The individual galls are white and remain so until about the time of pupation.

I raised no single *Ceratoneura femorata* in isolation, but I give this in evidence of the correctness of the reference of the galls to that species. I first found infested galls on the campus of the University of Puerto Rico on February 5th. On examining them I found them to contain only this single type of gall. Inside were pupae in all degrees of progressive coloration: some entirely white, some white with red eyes, some white with black eyes, and some wholly black and about ready for emergence. I put them in a rearing cage and the next morning I had my first adults. In a few days I had dozens of additional adults. Nothing was seen of Asphondylia at this time nor at any time, in galls from this collecting place. The only other insects appearing in my cages from this material were two specimens (male and female) of another Chalcidoid, *Tetrastichus marylandicus* Girault.

Other Insects from the Seed Pods.

Two well-known foliage destroying Chrysomelid beetles were observed eating the seed pods: the larger and commoner one was *Homophocta* (*Oedionychis*) *cyanipennis* (Fabr.) which lays its eggs in clusters of a dozen or more on the under side of the leaves; and the smaller one, a flea beetle, *Haltica occidentalis* Suffrain, which lays its eggs by twos and threes at the end of the pods, close up in the angle underneath the base of the divergent



sepals. Some of the latter, emerging in one of my cages, made a first meal by eating holes in soft spots in the wall of the pod.

Two sucking insects of small importance were occasionally found feeding on the pods: an aphid of which only very immature individuals were seen, and a Lecanium (?) scale.

Explanation to the Figure.

At *1* is shown a single seed pod of *Jussiaea angustifolia* (X 2) with three zones of infestation and three corresponding swellings, and with empty pupal skins of *Asphondylia rochae* sticking out of the emergence holes. At *2*, a cross-section of a pod (diagrammatic), its two upper cells infested, the one on the left by *Asphondylia rochae*, the one on the right by *Ceratoneura femorata:* webbing tissue omitted from both. At *3* and *4*, two views of the front end of the Asphondylia pupa. At *5* and *6*, two views of the Asphondylia larva: at 5 uprolled, head and tail meeting, and the four-toothed "breast bone" pointing downward; at 6, in lateral view, body extended. (Drawings by Dr. May K. Gyger.)

THE SIPHONAPTERAN THORAX.

By Irving Fox.

A study of descriptions of nearly all the known species and genera of North American fleas has made evident the confusion of describers in regard to the thorax. Although nearly every worker has been at pains to describe the thoracic sclerites, which are of significance in both generic and specific delineation, there is available no adequate morphological treatment with the result that inappropriate and erroneous terms have come into general usage. This paper is therefore written with the aim of providing a terminology in keeping with modern interpretations of the sclerites as well as doing service towards comprehension of the flea thorax. To contribute towards this end, some of the various conditions found among the North American genera, with the exception of the members of the family Hectopsyllidae, are illustrated and discussed.

One of the largest fleas occurring in our fauna is *Stenoponia americana* (Baker), hence it is particularly desirable for morphological investigation. Since its sclerites are arranged in a fashion more or less common to most fleas, it is considered to be representative of the usual type (Fig. 4). Variation from this type most often involves fusion and loss of some of the sclerites but sometimes vestiges of other sclerites are present and these give some clue to the lines of development.

The Prothorax.

Pronotum.—The flea notum is not regarded as being divided into a scutum and a scutellum, although two distinct areas may be readily discerned. The latter of these areas is considered to be a flange or posterior reduplication rather than a scutellum.

The flange of the pronotum is present or absent depending upon whether or not the flea has a pronotal comb. When the pronotal comb is absent, as in *Pulex* or *Xenopsylla*, the flange is present; but when the pronotal comb is present, as in most genera, the flange is absent, its place being assumed by the comb. The spines of the comb vary in number, size, shape and pigmentation among different groups, as is shown in Figs. 2, 3, etc. pc.

Propleuron.—The propleuron exhibits considerable modification both in shape and position. The ventral portion of the pleuron has moved forward carrying with it the coxa which is articulated at the pleural suture (Figs. 2, 3, etc. ps_1, cx_1). The pleural suture, therefore, occupies an oblique position or even a horizontal one. The proepisternum is very much reduced or entirely absent, exhibiting different degrees of reduction among the different genera. Thus in the bat flea genera *Sternopsylla*, *Myodopsylla* and *Eptescopsylla* (Fig. 9, es_1), the proepisternum is manifest but in a reduced condition, while in *Stenoponia* (Fig. 4) and many other genera it seems to be wholly absent. The proepimeron is invariably well developed and forms most of the propleuron (Figs. 2, 3, etc., em_1).

It has been customary on the part of some writers of larger taxonomic works, who have followed C. Fox (1929, p. 113), to call the proepimeron the prosternum. This is a label hardly in keeping with a modern interpretation, particularly in view of the fact that the true prosternum is well developed and assumes its proper ventral position (Fig. 1). It is visible, however, only in specimens whose ventral aspect may be studied, such as those examined in alcohol under a dissecting microscope, and is almost completely hidden from view when the specimen is mounted on a glass slide. The movement anteriorly of the lower portion of the propleuron has occasioned a curious shifting of the prosternum so that it is fused to the lateral aspect of the proepimeron.

Prosternum.—The sternum of the prothorax assumes relatively large dimensions, not being reduced as is the case in the meso-, and meta-thorax. It is formed by the fused basisternum and sternellum, the latter structure apparently being more or less telescoped into the former (Fig. 1, bs, fs). The base of the furca forms a median longitudinal ridge in the sternellar region which is easily seen as a dark discoloration on the outside. The furca of the prosternum is large and prominent and has the shape shown in Fig. 1, fu_1 and Fig. 5, fu_1. The prosternum of a flea has also been figured by Crampton (1926, Pl. XVII, Fig. 118).

The Mesothorax.

Mesonotum.—The notum of the mesothorax, as in the case of the other nota, consists of two areas of which the posterior is the

flange or reduplication. The mesonotum is closely associated with the mesepimeron, and in some cases seems to be in a condition approximating fusion with it. The mesonotum is without a comb of spines in all the fleas examined.

Mesopleuron.—In nearly all cases the mesopleuron is divided by a pleural ridge and suture into episternal and epimeral regions (Fig. 4, em_2, es_2). In the genera *Pulex*, *Corypsylla* (Fig. 2) and *Corypsylloides* (Fig. 8) the pleural suture and ridge are absent. The posterior region of the mesepimeron is much thinner than the anterior and may possibly form another sclerite (Fig. 4, pem_2), but since the line of separation between the two areas is not very prominent, it seems hardly necessary to name the posterior one. An apodeme is present on each side between the two areas (Figs. 2, 3, etc. ap).

The region anterior to the pleural suture seems to have been formed by the fusion of the mesepisternum with a sclerite of the mesosternum. How this fusion has taken place is perhaps shown by various members of the Ischnopsyllidae which exhibit a ridge between the two sclerites (Fig. 9, es_2, ls). In *Myodopsylla* and *Rhinolophopsylla* this sclerotized ridge is quite distinct, but in *Sternopsylla* and *Eptescopsylla* it is vague and indefinite. Since no such sclerotized ridge is shown in most genera, the use of the term mesepisternum for the region anterior to the pleural suture is unlikely to lead to confusion (Fig. 4, es_2). In the case of the family Ischnopsyllidae, whose members possess indication at least of another sclerite, the term latero-sternite (Fig. 9, ls) may be used to designate it.

The mesopleuron has been called the mesosternite by a number of workers who have followed C. Fox in the use of terminology (Liu, 1939, p. 10, I. Fox, 1940, Pl. I, etc.). Although a portion of the sternum seems to have become fused with the pleuron, the use of the term mesosternite for the pleuron or a part thereof is inadvisable because of the presence of a portion of the sternum in its ventral position which, with more justification, can be called the mesosternite (Figs. 2, 3, etc. ms_2).

Mesosternum.—The portion of the mesosternum remaining in a ventral position is greatly reduced, and offers little indication as to what sclerite of the sternum is involved. Hence the term mesosternite is here used to designate it. Crampton (1931, Fig. 1) has indicated, however, that this region is the basisternum. The furcal arms, which are readily seen in the dissected specimens, are closely associated basally and distally but are separated in the middle region (Fig. 6). When seen laterally, the apical portion of the furca has very much the shape of an ax-head being expanded and more or less blade-like.

The Metathorax.

Metanotum.—As in the case of the other segments, the

metanotum is divided into two areas of which the posterior is a flange or reduplication associated with the metepimeron.

Metapleuron.—A pleural suture dividing the metapleuron into an epimeral and an episternal region is nearly always present. In the genera *Corypsylla* (Fig. 2, ps_3) and *Corypsylloides* (Fig. 8) the pleural suture is vague and incompleet. As in the case of the mesepimeron, the posterior region of the metepimeron (Fig. 4, pem_3) is much thinner than the anterior region, but there is no apodeme between the two areas. The metepimeron is closely associated with the metanotum and in *Rectofrontia* (Fig. 7) is fused with it. The outline of the posterior margin of the metepimeron differs among the different genera, but because of its thinness and the ease with which it is injured in preparation, its use in taxonomy is limited.

The episternum of the metathorax is in most cases divided into a supraepisternum and an infraepisternum (Fig. 4, ses, ies). The supraepisternum varies in size and prominence being conspicuous in some cases (*Rectofrontia*, Fig. 7, ses) or vague and reduced in others (*Corypsylla*, Fig. 2, ses). In some instances, as in *Micropsylla* (Fig. 3, ses), the supraepisternum is fused with the metanotum, while in other instances, as in *Hoplopsyllus*, it shows the beginning of fusion with the infraepisternum.

Metasternum.—The portion of the metasternum remaining ventral is much reduced, its vestiges varying in size and shape. This region may be appropriately designated the metasternite (Figs. 2, 3, etc. ms_3). The furcal arms are much shorter than is the case in the pro- and mesosterna and together are somewhat in the shape of the letter "H."

Summary.

1. The pro-, meso-, and metanota each is not regarded as being divided into a scutum and scutellum. However, two areas are discernible and of these the posterior is considered to be a flange or reduplication. In most cases, only the pronotum is provided with a comb of spines.

2. A pleural suture dividing the pleuron into episternal and epimeral regions is nearly always present on all the pleura. The ventral portion of the propleuron has moved anteriorly so that the pleural suture is oblique or horizontal. The proepisternum is greatly reduced and the proepimeron makes up most of the propleuron. The metepisternum is divided into a supra-, and infraepisternum, and the latter structure varies in size and shape.

3. The prosternum is well developed and consists of the fused basisternum and sternellum. The meso-, and metasterna are vestigial and the sclerites remaining may be designated the mesosternite and the metasternite.

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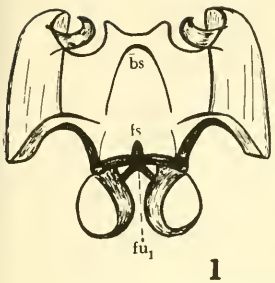
Abbreviations.

The subscript 1, 2, or 3, denotes that the structure belongs to the pro-, meso-, or metathorax.

ap	apodeme
bs	basisternum
cx	coxa
em	epimeron
es	episternum
fs	sternellum
fu	furca
ies	infraepisternum
ls	laterosternite
ms	mesosternite
n	notum
pc	pronotal comb
pem	posterior region of the epimeron
pr	pleural ridge
ps	pleural suture
ses	supraepisternum

Explanation of Plate.

Fig. 1. *Stenoponia americana* (Baker), prosternum, ventral view.
Fig. 2. *Corypsylla ornata* (C. Fox), female, thorax.
Fig. 3. *Micropsylla sectilis* (Jordan and Rothschild), thorax.
Fig. 4. *Stenoponia americana* (Baker), thorax.
Fig. 5. *Idem*, prosternum, posterior view.
Fig. 6. *Idem*, mesosternum, ventral view.
Fig. 7. *Rectofrontia fraterna* (Baker), thorax.
Fig. 8. *Corypsylloides kohlsi* (Hub), thorax.
Fig. 9. *Eptescopsylla chapini* (Jordan), thorax.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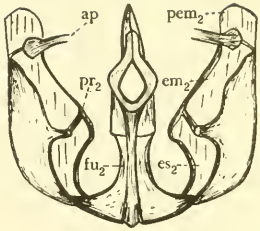
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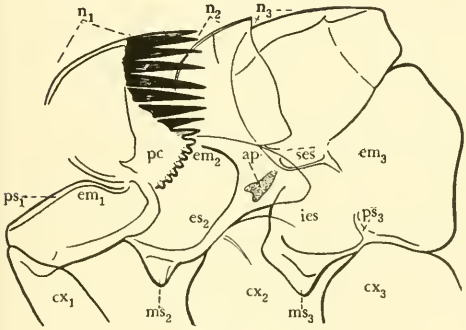
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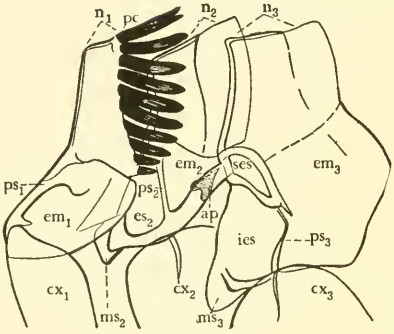
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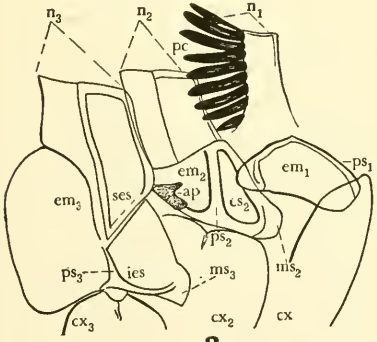
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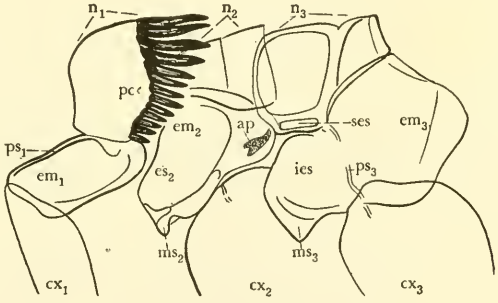
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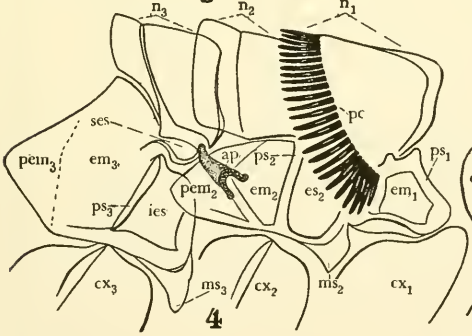
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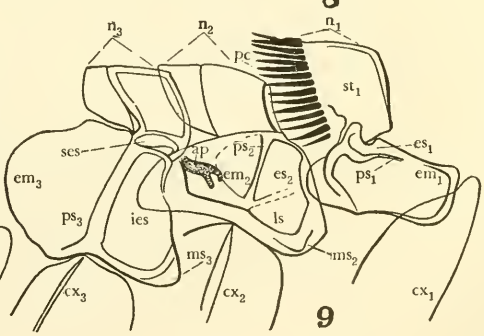
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REPORT OF THE TREASURER FOR THE YEAR 1940.

Receipts.

Cash on hand (Jan. 1, 1940)	$7.64
From members, dues for 1940	503.50
dues in advance	23.83
back dues	106.15
initiation fees	17.00
From subscribers, for subscription to Proceedings	359.34
for entire cost of articles	16.25
From authors, for separate and authors' copies	82.50
for part or entire cost of articles	89.32
for illustrations	11.51
From institutions, for author's separates	19.25
From sale of back numbers of Proceedings	230.85
Total receipts	$1,467.14

Expenditures.

To H. L. & J. B. McQueen, Inc., for printing Proceedings (Nos. 1–8, vol. 42) and separates	$917.66
To H. L. & J. B. McQueen, Inc., for printing programs of meetings (507th to 514th, inclusive)	22.00
To Southern Engraving Company, for engravings	94.32
For stationery	19.05
For stamps	37.20
For shipping charges, including express, second-class postage and packing expenses	14.85
For clerical help, Office Corresponding Secretary	60.00
For clerical help, Office of the Treasurer	24.00
For rental of safe deposit box at City Bank	3.85
For advertising in Journal of Economic Entomology	16.00
Miscellaneous expenses	20.40
	$1,229.33
Stamps on hand received in lieu of cash in 1940	2.25
Cash on hand, Hamilton National Bank	212.93
Cash on hand, undeposited	22.63
	$1,467.14
Outstanding obligations	141.84

Publication Fund.

Schwarz donation (principal $1,000.00) invested with the American Building Association—reported 1939	$1,414.76
Dividend for 1939, credited 1940	62.76
Total in Schwarz donation fund	$1,477.52

Knab bequest, invested with the Columbia Federal Savings and Loan Association reported 1939	$306.94
deposited 1940	300.00
interest (Dec. 31st dividend not included)	11.30
covered by personal non-interest bearing note	800.00
Total in Knab bequest fund	$1,418.24
General publication fund in savings account at the Hamilton National Bank January 1, 1940	370.03
from sale of complete sets	187.20
from sale of No. 1 of Memoirs	74.85
interest from savings account	8.94
Total in general publication fund	$641.02
Total amount of publication fund	$3,536.78

Respectfully submitted,

W. B. Wood,
Treasurer.

The Committee on Audit has examined the Treasurer's financial accounts and found them correct for the year 1940.

Respectfully submitted, January 14, 1941.

P. W. Oman,
Floyd Andre,
Auditing Committee.

REPORT OF THE CORRESPONDING SECRETARY OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON FOR THE YEAR ENDING NOVEMBER 30, 1940.

A Tribute to Mr. Caffrey:

In June the Society suffered a distinct loss by the transfer of Mr. D. J. Caffrey from Washington, D. C., to Twin Falls, Idaho. Many members are somewhat familiar with various detailed duties attached to the office of Corresponding Secretary, but probably few realize how painstakingly and how efficiently Mr. Caffrey performed these duties for three and one-half years. May we give credit to whom much credit is due!

Correspondence:

Approximately 425 letters and other communications have been handled. (These include about 225 advertising letters to prospects in the United States and Canada.)

Reserve Publications:

Statement of the inventory and sales of Proceedings and Reprints:

Proceedings.

1. Copies of Proceedings on hand December, 1939	30,972
2. Copies of Proceedings acquired Dec. 1939—Nov. 1940, incl.	409
3. Copies of Proceedings available (total of 1 and 2)	31,381
4. Copies of Proceedings sold during the year	1,343
5. Copies of Proceedings on hand	30,038

Reprints.

1. Reprinted articles on hand December, 1940	471
2. Total copies reprints reported on hand December, 1939	13,810
3. Copies of reprints sold during the year	20
4. Copies of reprints on hand	13,790

Sales of Proceedings and Reserve Reprints.

1. Total number of sales	34
2. Total number of complete sets sold	3
3. Additional orders exceeding $20.00 net value	2
4. Total net value of sales	$503.15

Report on Memoir No. 1.

1. Total copies of Memoir No. 1 printed	300
2. Total copies of Memoir No. 1 disposed of in 1939	66
3. Total copies of Memoir No. 1 sold in 1940	20
4. Total copies of Memoir No. 1 on hand	214

Members and Subscribers:

					Compared to preceding year		
	1937	*1938*	*1939*	*1940*	*Loss*	*Gain*	*Net loss or gain*
Members	210	240	242	247[1]	16[2]	21	plus 5
Subscribers	120	124	128	134[3]		6	plus 6

Respectfully submitted,

F. W. Poos,
Corresponding Secretary.

[1] Includes 16 members, in arrears for dues, to whom the Society's periodical is not being sent in accordance with Article VI of the By-laws.

[2] Three deaths; 11 resignations; two individuals listed as members were subscribers.

[3] Includes subscribers in nine foreign countries, whose copies are being held on account of war conditions.

BOOK REVIEWS.

Plant Galls and Gall Makers, by Ephraim Porter Felt, D. Sc., pp. 364, text figs. 344, plates 41, Comstock Publishing Company, Ithaca, N. Y., 1940, octavo, cloth, $4.00.

The chief function of this book is to furnish a means of identification for most of the numerous kinds of plant galls found in North America. An account is given of the relations existing between the gall producers and their plant hosts. This work is an extended revision, with much additional matter, of the author's "Key to American Insect Galls," published as New York State Bulletin No. 200, in 1917. It contains many more illustrations, however, as well as keys to the groups discussed.

Part 1 consists of an Introduction comprising a discussion of Galls and Gall Types, The Principal Gall Producers, Injurious Gall Insects, Certain Galls Have Value, Honey Producing Galls, How Galls Are Produced, Biology or Lfe Habits of Gall Producers, Alternation of Generations, etc.

Part 2 consists of "A Key to the Galls of Various Plant Families," some 300 pages being devoted to this purpose. A Bibliography and Index occupy the remaining 25 pages. The format is excellent and the volume is substantially bound in blue buckram.

This work should prove especially valuable to all those interested in the identification of American insect galls. —W. R. Walton.

Fleas of The Eastern United States, by Irving Fox, pp. text 127, plates 31, The Iowa State College Press, 1940, octavo, cloth, $3.00 postpaid.

This authoritative monograph on the Fleas of the Eastern United States is the first separate publication of its kind since the appearance of C. F. Baker's Revision of the Siphonaptera in 1904. Since that time, many new species of fleas have been described and in this book the author has assembled and coordinated the information regarding these, that was formerly scattered throughout the literature of the order.

In addition to the results of his own research, Mr. Fox has made good use of the collections deposited in the United States National Museum to which he has had access for more than 3 years past. The product of his labors is a volume which should enable entomological and medical workers to identify readily and quickly any species of fleas now known to occur in the Eastern United States.

The work contains descriptions of 55 species, in 33 genera belonging to 5 families of the Siphonaptera. A total of 166 figures, averages 3 for each species of flea treated. The known distribution and hosts, and locality of occurrence are also given for each species.

Keys are furnished to the suborders of the Siphonaptera; to the families *Integricipitia* and *Fracticipita* and to the genera of the 5 families included. Convenient features are host and synonymic indices and a selected bibliography.

There are also included brief chapters on the collection and preservation of fleas and the life history and control thereof.

Since these insects are known to transmit both bubonic plague and endemic typhus fever and are also suspected of being implicated in the spread of other diseases of man, it should prove especially timely and useful. In view of the present miiltary activities and concentration of soldiers in many cantonments throughout the country, this work with its synopses and abundant illustrative material doubtless will prove especially valuable to the army medical personnel and sanitary officers. —W. R. Walton.

MINUTES OF THE 514TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON DECEMBER 5, 1940.

The 514th meeting of the Society was held December 5, 1940, in Room 43 of the National Museum. President Muesebeck called the meeting to order at 8 P. M., and 36 members and 12 visitors were present. The minutes of the November meeting were read and approved.

The Corresponding Secretary, F. W. Poos, submitted a report, to November 30, 1940. A preliminary report was given by the Treasurer, W. B. Wood, and both reports were accepted.

The President remarked upon the financial condition of the Society, calling attention to the considerable funds owed to the Society which need to be paid in order to insure the prompt publication of the Proceedings.

The Nominating Committee, comprised of Carl Heinrich, B. A. Porter and J. A. Hyslop, submitted the following nominations for 1941:

President	H. E. Ewing
First Vice-President	E. N. Cory
Second Vice-President	R. W. Harned
Recording Secretary	Ashley B. Gurney
Corresponding Secretary	F. W. Poos
Treasurer	W. B. Wood
Editor	W. R. Walton
Executive Committee	C. F. W. Muesebeck
To represent the Society as Vice-President of the Washington Academy of Sciences	Austin H. Clark

At the motion of R. A. Cushman, seconded by R. E. Snodgrass, the nominees were unanimously elected.

R. A. Cushman presented a memorial statement, prepared by Louise M. Russell and himself, respecting a late member of the Society, Grace A. Sandhouse (See Proceedings, December, 1940).

Under Notes and Exhibition of Specimens, W. A. Hoffman, a non-resident member from Puerto Rico, briefly discussed an hermaproditic ceratopogonid fly, *Culicoides crepuscularis* Mall., which he had collected in Montana. R. E. Snodgrass noted that recent study of the mouth parts of the honey bee had shown that the structures of this well-known insect are not fully understood. Mr. Muesebeck gave a short account of his visit to Urbana, Ill., to attend the dedication, November 15, of the new Natural Resources Building on the campus of the University of Illinois.

There were two talks on the regular program, by members of the Bureau of Entomology and Plant Quarantine:

1. Notes on parasitic beetles. H. S. Barber.
2. Resistance of honey bees to disease. J. I. Hambleton.

Discussion followed by Annand and Hoffman.

Mr. Muesebeck commented upon the progress of the Society in 1940, and expressed his appreciation to the members for enabling him to enjoy his duties as President during the year now drawing to a close.

Adjournment at 10.05 P. M.

Ashley B. Gurney,
Recording Secretary.

Actual date of publication, January 29, 1941.

ANNOUNCEMENT

Prices for back volumes and single numbers of the Proceedings of the Entomological Society of Washington are as follows until further notice:

Vols. 1–19,	per volume	$2.00
	per number	.50
Vols. 20–41	per volume	4.00
	per number	.50

Complete sets, Vols. 1–41 (1884–1939) Inclusive $117.00
Double numbers: ..... (per double no.) .50

These include Nos. 2–3 of Vol. 7; Nos. 1–2 and 3–4 of Vol. 8; Nos. 1–2 and 3–4 of Vol. 10; Nos. 7–8 of Vol. 24; Nos. 5–6 and 7–8 of Vol. 25 and Nos. 8–9 of Vol. 36.

Note: Nos. 1–4 of Vol. 9 and Nos. 1–4 of Vol. 19 (each of which were issued under one cover) are available only as complete volumes. Per volume 2.00

A classified list of available separates of articles which have appeared in the Proceedings will be furnished upon request.

A 20 PERCENT DISCOUNT WILL BE MADE TO MEMBERS AND SUBSCRIBERS ON ORDERS OF $10.00 OR OVER.

Domestic shipments prepaid, foreign shipments f. o. b. Washington.

A new book "The North American Bees of the Genus Osmia" by Grace A. Sandhouse, issued as Memoir Number 1 of the Society, is now available.

Postpaid to non-members and institutions $3.00
To members of the Society $2.50

This is a revisionary study of the genus Osmia with keys for identification descriptions and distribution records for known N. American species.

(*Make checks, drafts, etc. payable to the Entomological Society of Washington.*)

F. W. POOS,
Corresponding Secretary,
Address: Bureau of Entomology and Plant Quarantine, Washington, D. C.

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VOL. 43 February, 1941 No. 2

PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON



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Published Monthly Except July, August and September

BY THE

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U. S. NATIONAL MUSEUM

WASHINGTON, D. C.

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THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

ORGANIZED MARCH 12, 1884.

The regular meetings of the Society are held in the National Museum on the first Thursday of each month, from October to June, inclusive, at 8 P. M.

Annual dues for members are $3.00; initiation fee $1.00. Members are entitled to the Proceedings and any manuscript submitted by them is given precedence over any submitted by non-members.

OFFICERS FOR THE YEAR 1941.

Honorary President . . . . . L. O. HOWARD
President . . . . . H. E. EWING
First Vice-President . . . . . E. N. CORY
Second Vice-President . . . . . R. W. HARNED
Recording Secretary . . . . . ASHLEY B. GURNEY
Corresponding Secretary . . . . . F. W. POOS
Treasurer . . . . . W. B. WOOD
Editor . . . . . W. R. WALTON
Executive Committee . C. F. W. MUESEBECK, R. E. SNODGRASS, E. A. BACK
Nominated to represent the Society as Vice-President of the Washington Academy of Sciences . . . . . AUSTIN H. CLARK

PROCEEDINGS ENTOMOLOGICAL SOCIETY OF WASHINGTON.

Published monthly, except July, August and September, by the Society at Washington, D. C. Terms of subscription: Domestic, $4.00 per annum; foreign, $4.25 per annum; recent single numbers, 50 cents, foreign postage extra. All subscriptions are payable in advance. Remittances should be made payable to the Entomological Society of Washington.

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 43 FEBRUARY, 1941 No. 2

AEDES (HOWARDINA) ALLOTECNON, A NEW SPECIES OF AEDES FROM COSTA RICA, AND A DESCRIPTION OF THE LARVA, ADULT, AND MALE TERMINALIA OF AEDES QUADRIVITTATUS COQ.[1]

By HENRY W. KUMM AND W. H. W. KOMP.

During the course of a mosquito survey of Costa Rica, the senior author collected *Aedes* larvae from bromeliads in several localities at high altitudes. Adults were obtained from these larvae, and it was noted that although the imagos were nearly identical, the larvae from which they were reared were of two quite different kinds. Further search in similar locations resulted in obtaining a good series of both kinds of larvae, and of adults reared from them. Because of the very distinct larval differences, undoubtedly two species are present, the larvae of which may occur in the same bromeliad. The adults resemble each other closely, conforming to the description by Coquillett (1) and that given by Howard, Dyar, and Knab (2) for *Aedes* (*Howardina*) *quadrivittatus*. Slight differences in the mesonotal pattern of golden-scaled lines are present in the adults of the two species, but insufficient material is in hand to permit a statement as to the range of variation in this pattern.

The junior author examined the material in his collection from Panama, and found that he had collected from a bromeliad on the slopes of Chiriqui volcano in northern Panama a perfect larva of the type also obtained from bromeliads in Costa Rica, which has all the head-hairs in multiple tufts. He also had two males, and a number of females, all in poor condition and with the mesonotum badly rubbed. In addition he had one male and six females taken by Mr. Graham Fairchild at Finca Lerida, near Boquete, Panama, on the other side of the Chiriqui volcano from the locality in which he took his material. Unfortunately, the mesonotum is denuded in every specimen taken by Mr. Fairchild, so it is impossible to make out the markings.

[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 United States Public Health Service, and the Gorgas Memorial Laboratory.

MAR 4 19

The male terminalia of all the male specimens of the two species were dissected and mounted, and very few differences were noted in them. One of the males from Chiriqui Volcano had two long setae from the claspette, while all the other specimens, whether from Panama or Costa Rica, had but one seta in this position.

Slight but apparently inconstant differences in the mesosome of the male terminalia of the two species were noted. In males obtained from the larvae from Costa Rica, with single posterior head-hairs, the apex of the mesosome curved forward in the form of two slightly projecting horns. In one of the males of the other species with all the head-hairs multiple, the apex of the mesosome did not have these forward-projecting horns. There were no constant differences in the length of the terminal spine of the clasper, or in the arrangement of the setae on the lobes of the ninth tergites, in either species.

Coquillett described *Aedes quadrivittatus* from females taken at Chaculá, Guatemala. Neither males nor associated larvae were obtained. As it is apparently impossible to distinguish with absolute certainty the two sorts of female adults obtained from very different kinds of larvae by the senior author, the question arises as to which species is the true *quadrivittatus* of Coquillett. It is doubted whether collecting in the type locality would settle the problem, as both species have been found as larvae in the same bromeliad in Costa Rica. By the principle of the first reviser, we propose to restrict the name *quadrivittatus* Coquillett to the species in which the larva has multiple head-hairs, and other larval characters as described under that name in the present paper. The other species will be described as new, under the name *Aedes* (*Howardina*) *allotecnon*, new species. In this the larval head-hairs are not in multiple tufts.

Aedes (Howardina) allotecnon, new species.

Adult Female.

Proboscis moderate, uniform, black. Palpi about one-sixth the length of the proboscis, black, with white tips. Clypeus brown, nude. Occiput with narrow median pale-golden line; on each side a narrow black line, a wider white line, and a black line; cheeks whitish.

Mesonotum with integument dark, clothed with narrow curved brown scales; four narrow, uniform, golden lines on dorsum, extending from anterior margin to scutellum; a small golden spot beneath anterior promontory. Lateral margins of mesonotum golden-scaled, giving appearance of six golden lines on mesonotum. Scutellum with golden scales on middle lobe, long brown setae on outer lobes. Pleura brownish, with patches of white scales on prothoracic lobes; paratergites (just posterior to spiracle); proepisternum; lower margin on anterior pronotum; lower and upper margins of sternopleuron; just anterior to prealar

setae; diagonally across middle of mesepimeron; and before upper mesepimeral setae.

Abdomen: Clothed with flat black scales; lateral basal segmental silvery-white spots on segments, apices with long brown setae.

Legs: Fore-legs dark brown, a very small basal white spot on 1st tarsal segment. Mid-legs dark brown; mid-femur with a white spot on outer two-thirds; extreme apex white. Mid-tibia dark brown.

Mid-tarsi black, with narrow white rings on bases of 1st and 2d segments; 3d and 4th segments black. Sometimes the ring on 2d segment is obsolete.

Hind-femur basally half white, remainder dark brown; a small white spot on outer three-fourths; apex narrowly white. Hind tibia dark brown.

Hind tarsi black, with narrow white rings at bases of 1st, 2d and 3d segments, widest on third; 4th and 5th segments black. Claws on all feet simple.

Wings narrow, hyaline, with narrow brown scales.

Male palpi: About as long as proboscis, slender, nearly uniform, pointed; dark brown, with white rings on under side of base of terminal segment, on under side of base of penultimate segment, and a few white scales at junction of 2d and 3d segments.

Description of Male Terminalia of *Aedes allotecnon*, n. sp.

Side-pieces (coxite) long, tapering, conical, without apical or basal lobe. Claspette a triangular area clothed with a few fine hairs and some larger setae, and having a single (sometimes two) long, slender, tapering spine arising from the apex, and extending to the apical third of the side-piece. Outer aspect of side-piece clothed with dense truncate scales and long, projecting setae.

Clasper long, tapering, abruptly curved inward just before tip; one long seta inserted on outer aspect of clasper just before curve; terminal spine long, slender, curved, slightly tapering.

Mesosome short, somewhat cylindrical, the anterior face deeply excavate from apex and from base, forming a relatively narrow anterior bridge. Posterior face deeply excavate from apex almost to base, forming a very narrow lower bridge. Tips of mesosome produced anteriorly to form short forward-projecting horns.

Ninth tergites large, quadrate, somewhat rugose, the eminences from which the setae arise close together, chitinized; five or six long setae from apical margin, sometimes one or two lateral setae arising from membrane, which is covered with small microtrichia in irregular rows.

Tenth sternites moderate, with thickened apex forming a curved tooth.

Tenth tergites membranous, with three or four small setae from small tubercles below apex.

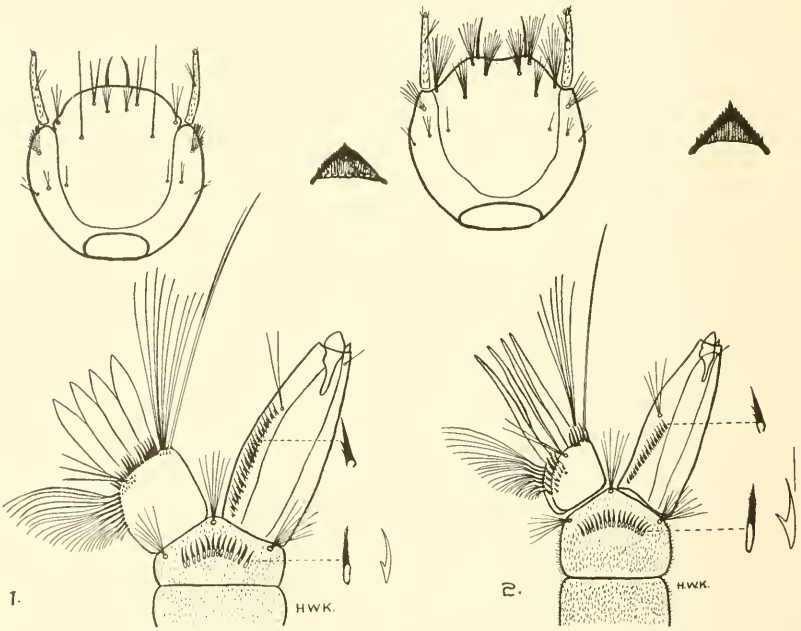
Description of Larva of **Aedes (Howardina) allotecnon**, n. sp.

Head: Subglobose, the dorsum highly arched, dome-shaped. Preclypeal spines very long, strong, heavily infuscated. Anterior head-hairs long, strong, double; middle head-hairs nearly as long as anterior hairs, fine, in tufts of 4 or 5. Posterior head-hairs single, finer than the anterior hairs, and nearly twice as long. Anteantennal hairs fine, double or triple, and longer than the antennae.

Inner occipital hairs long, fine, simple. Outer occipital hairs set somewhat posterior to inner hairs, long, fine, double or triple. Dorsal eye-hairs long, simple. Subantennal (or possibly the postmandibular) hairs multiple, consisting of a tuft of about 12 long, stiff, blunt-pointed hairs.

Antenna moderate, tapering, the shaft sparsely spined. Antennal tuft 2- or 3-haired, on dorso-internal aspect, inserted slightly beyond middle, the tips of the hairs scarcely exceeding apex of antenna.

Thorax: integument glabrous, clothed with numerous short, multiple, stellate hair-tufts.



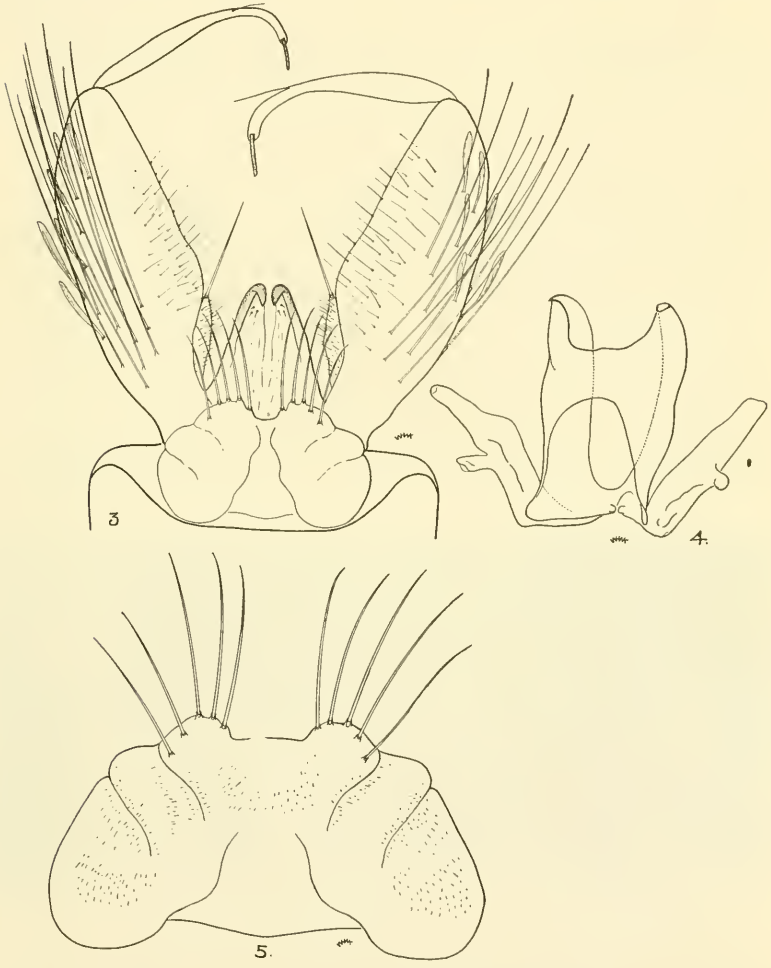
Abdomen: Integument glabrous, except for short, fine pilosity on seventh and eighth segments, sometimes present also on sixth segment. Lateral hairs on segment 2 triple, double on segments 3 to 6. Comb of eighth segment of about 15 long, slender scales, set close together in a slightly curved row. Each scale elongate, thorn-shaped, sharp-pointed, the sides very finely fringed almost to the tip.

Siphon moderate, tapering, slightly less than 4 times as long as width at base. Pecten a row of about 17 to 20 closely-spaced teeth, extending beyond middle of siphon. Each tooth long, usually with one or two short lateral barbs basally. Teeth progressively larger toward apex of siphon. Siphon-tuft beyond pecten, double or triple, long, the tips of the hairs extending to the apex of the siphon.

Anal segment not ringed by the plate. Posterior lateral and dorsal margins fringed with long, curved spines. Lateral hair of the plate long, double or triple,

sometimes quadruple. Inner caudal hair long, exceeding the length of the outer caudal hairs, usually double, sometimes split nearly from base, sometimes split beyond middle. Outer caudal hair a tuft of long hairs. Anal gills long, pointed.

Type locality.—Poas Volcano, Costa Rica. Altitude about 9,000 ft.



Type material.—3 males, bred from larvae found in epiphytic bromeliads. The male terminalia of each mounted in balsam on modified Cobb slide. Nos. 156, 156–A, 156–C.
H. W. Kumm, collector, April 14, 1938.

The skins of the larvae from which the types were reared are preserved with the type specimens.

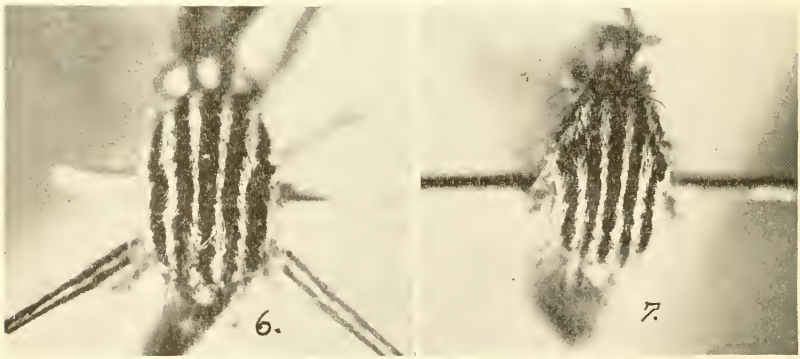
Types deposited in the collection of the U. S. National Museum, Washington, D. C.

Aedes (Howardina) quadrivittatus Coquillett. Adult Female.

Proboscis moderate, uniform, black. Palpi about one-sixth the length of the proboscis, black, with white tips. Clypeus brown, nude. Occiput with narrow median pale-golden line; on each side a narrow black line, a wider whitish-golden line, and a black line. Cheeks whitish.

Mesonotum with integument dark, clothed with narrow curved brown scales. A small golden spot below anterior promontory. Two narrow uniform median golden lines on dorsum, extending from anterior margin to scutellum; two narrow subdorsal golden lines extend from anterior margin to scutellum; lateral margins of mesonotum golden-scaled, forming a sinuous line which divides and incurves posterior to the lateral fossae, one branch joining the subdorsal golden lines, and the other extending forward over the anterior pronotum, enclosing a small S-shaped nude brown area. Sometimes the subdorsal golden lines are continuous, and sometimes they are broken posterior to their junction with the lateral margins of the mesonotum. Sometimes the lateral fossae may be shaded over with golden scales extending from the subdorsal lines.

Scutellum with middle lobe clothed centrally with flat golden scales, flat brown ones on each side; outer lobes with long brown setae and fine curved golden scales.



Abdomen black with large lateral basal segmental silvery-white spots on all segments, and long apical yellow-brown setae.

Legs: Fore-legs dark brown; a narrow basal white ring on 1st tarsal segment, and a small basal white spot on 2d tarsal segment; 3d, 4th and 5th segments dark brown.

Mid-legs with femur black on outer aspect, without white spot, but with apical white ring; basally half white, apically half black on inner aspect. Mid-

tibia black. Mid-tarsi black, with basal white rings on 1st and 2d segments; segments 3, 4 and 5 black. Hind-legs with femur basally half white, apically half black on both inner and outer aspects. No white spot on outer two-thirds, but a broad white apical ring. Hind tibia black. Hind tarsi black, with broad white basal rings on 1st, 2d and 3d segments, broadest on 3d, sometimes extending over basal three-fourths of segment; 4th and 5th segments all black. Claws on all feet simple.

Male palpi: About as long as proboscis, slender, nearly uniform, pointed; dark brown, with white rings on under side of base of terminal segment, on under side of base of penultimate segment, and a few white scales at junction of 2d and 3d segments; many long dark hairs on last two segments.

Male Terminalia.

Sidepiece moderate, slightly conical, rounded at apex, without basal or apical lobe, clothed outwardly with long slender setae and narrow striate round-tipped scales. Inner flap with sparse mesially-directed fine setae, outer flap with longer setae. Claspette a small triangular area at inner angle of sidepiece, bearing a single long slender seta (sometimes two) from a prominent tubercle at apex, extending well beyond middle of sidepiece; basally with a few weak setae from small tubercles. Clasper one-half as long as sidepiece, curved, tapering to tip, a seta on outer aspect slightly before tip; with a long, slender, curved, tapering terminal spine, about one-third length of clasper.

Mesosome: About 1 3/5 longer than wide, somewhat cylindrical, the anterior face shallowly, roundedly excavate from apex; a curved, hornlike forward projection from each side of apex; base somewhat flared, excavate about one-third from base anteriorly; posterior face deeply excavate nearly to base; lateral arms short, strong.

9th tergites broad, slightly rugose, quadrate; connected by a narrow apical bridge, covered with short microtrichia arranged in irregular rows; the apices sclerotized and rounded, bearing three or four long, strong, curved setae from large tubercles, and one or two smaller setae from tubercles below apex laterally.

10th sternites moderate, with outer margin thickened, the tips recurved, sclerotized and pointed.

10th tergites membranous, with three or four small setae from small tubercles below apex.

Description of Larva of **Aedes (Howardina) quadrivittatus** Coq.

Head: Subglobose, the dorsum highly arched, dome-shaped. Preclypeal spines very long, strong, infuscated. Anterior head-hairs similar to the other two pairs of dorsal head-hairs; consisting of from 6 to 9 long hairs forming a tuft. Middle head-hairs somewhat shorter and forming a denser tuft. Posterior head-hairs fewer, and forming a longer tuft. Anteantennal hairs also forming a tuft of about 6 long hairs. Inner occipital hairs very long, slender. Outer occipital hairs set somewhat posterior to inner hairs, long tufts of about 6 hairs each Dorsal eye-hairs long, single. Subantennal (or possibly the postmandibular) hairs multiple, consisting of a tuft of about 15 slender, pointed hairs, not so thick and short or so heavily infuscated as in *A. allotecnon*, n. sp.

Antenna long, slender, tapering, the shaft sparsely spined. Antennal tuft

usually 2-haired, on dorso-internal aspect, inserted somewhat beyond middle, the tips of the hairs scarcely reaching apex of antenna.

Thorax: Integument densely long-pilose, clothed with dense stellate hair-tufts.

Abdomen: Integument densely long-pilose, the pilosity longer on the more posterior segments. Lateral hairs on segment 2 quadruple, single on segments 3 to 6. Comb of eighth segment of about 17 (varying from 13 to 18 in 10 larvae examined) very long, slender scales, set very close together in a nearly straight row. Each scale elongate, thorn-shaped, sharp-pointed, the sides fringed to within a short distance of tip. The scales in *quadrivittatus* are longer and narrower than in *allotecnon* n. sp., and the base to which they are attached is longer and more curved. Siphon slender, tapering, about 4 times as long as wide. Pecten a row of about 15 teeth (varying from 11 to 18 in 10 larvae examined), very closely spaced, extending beyond middle of siphon. Each tooth long, usually with one or two short lateral barbs basally. Teeth progressively longer toward apex of siphon. Siphon-tuft beyond pecten, usually triple, occasionally quadruple, long, the tips of the hairs extending to the apex of the siphon.

Anal segment not ringed by the saddle. Posterior lateral and dorsal margins fringed with long, curved spines. Lateral hair of the saddle long, double. Inner caudal hair long, exceeding the length of the outer caudal hairs, single. Outer caudal hair a tuft of long hairs. Anal gills long, pointed.

TABLE SHOWING MAIN POINTS OF DIFFERENCE BETWEEN THE LARVAE OF *allotecnon* AND *quadrivittatus*.

	Aedes allotecnon n. sp.	*Aedes quadrivittatus* Coq.
Anterior head hairs	Long, double.	Long, multiple tufts of 6 to 9 hairs.
Intermediate head hairs	Long, fine, in tufts of 4 or 5.	Long, multiple, dense tuft.
Posterior head hairs	Long, fine, single.	Long, multiple tuft.
Subantennal hair	More slender elements, and longer than in *quadrivittatus*.	Short, coarse, blunt elements, forming a dense tuft.
Thorax	Integument glabrous, the stellate tufts finer.	Integument long-pilose, the stellate tufts short and strong.
Abdomen	Integument glabrous on first four or five segments, short-pilose on remainder.	Integument long-pilose throughout.
	Comb of eighth segment of 15 scales, long, fringed nearly to tip.	Comb of eighth segment of 17 scales in straight row, elongate, fringed to short distance from tip.

Lateral abdominal hairs on segment 2 triple; on segments 3 to 6 double.	Lateral abdominal hairs on segment 2 triple; on segments 3 to 6 single.
Siphonwithabout 15 teeth. Siphon-hair double or triple.	Siphon with about 17 to 20 teeth. Siphon-hair triple.
Outer caudal hair double.	Outer caudal hair single.

Discussion.

The two species, *quadrivittatus* and *allotecnon* n. sp., are so similar that perfect specimens are required to separate the adult females. The chief differences seem to lie in the different mesonotal markings, and in the markings of the mid and hind femora. In *allotecnon* n. sp. the four golden lines of the mesonotum and the lateral margins are narrow and uniform, giving the appearance of six parallel golden lines on the dorsum. In *quadrivittatus* Coq. the two median lines are parallel, narrow, and uniform, but the golden lines forming the lateral margins of the mesonotum are sinuous, curving outward and surrounding the lateral fossae, and merging with the two parallel subdorsal golden lines anteriorly. The two subdorsal golden lines are sometimes broken before the lateral fossae. Often the lateral fossae are shaded over with golden scales from the subdorsal lines.

The mid and hind femora of our specimens of *allotecnon* n. sp. have a small white spot on the outer two-thirds; those of *quadrivittatus* are without this spot, but are white basally to one-half of their length. Our material of *allotecnon* n. sp. is insufficient to determine whether this femoral white spot is a constant character, but we believe that it is subject to variation, and that specimens will be found in which the femoral white spot merges with the basal white on the femora.

References.

1. Coquillett, D. W., *Canadian Entomologist*, 34, p. 293, 1902.
2. Howard, L. O., Dyar, H. G., and Knab, F., *The Mosquitoes of North and Central America and the West Indies*, 4, p. 852, 1917.

Explanation of Figures.

Fig. 1. Larval details of *Aedes allotecnon*, n. sp.
Fig. 2. Larval details of *Aedes quadrivittatus* Coq.
Fig. 3. Male terminalia of *Aedes allotecnon*, n. sp.
Fig. 4. Mesosome of *Aedes allotecnon* n. sp.
Fig. 5. Ninth tergites of *Aedes allotecnon* n. sp.
Fig. 6. Mesonotum of *Aedes allotecnon* n. sp.
Fig. 7. Mesonotum of *Aedes quadrivittatus* Coq.

A NEW SPINNING MITE ATTACKING STRAWBERRY ON THE MID-ATLANTIC COAST.

By E. A. McGregor,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

Tetranychus atlanticus, new species.

Female.—Body setae fairly conspicuous, not arising from tubercles, 26 in number. Mandibular plate rounded anteriorly at maturity. A single perfect eye cornea on each side. "Thumb" of palpus barely longer than greatest thickness, bearing terminally a nonclavate "finger" which is rotundate terminally, fully two-thirds again as long as thick, and is more than one-half as thick as "thumb" at tip; the unusually thick dorsal sensilla is nearly as long as the terminal "finger"; the other five hairs and setae of the "thumb" about as usual. Legs of moderate length, foreleg about two-thirds the length of the body. Relative lengths of the joints of foreleg as follows: Coxa, 28; trochanter, 11; femur, 28; patella, 17; tibia, 19; tarsus, 27. Tip of tarsus (female) bearing a claw which is sharply bent and is cleft into three pairs of subequal, needlelike spurs, the inner pair being the thickest at base. The usual four tenent hairs arise from the onychium, a pair on each side of the claw base. The collar trachea is of the conventional *Tetranychus* type, in the shape of a ∪ with one long and one short arm.

Male.—Body somewhat wedge-shaped, much shorter and narrower than that of female; legs proportionately longer. Penis with inner lobe rodlike; basilar lobe reduced to an abtuse prominence; shaft about three-fourths again as long as its basal thickness, bent abruptly upward nearly 90° from axis of main shaft, expanding terminally to form the prominent barb whose axial length slightly exceeds the length of the "hook" of the shaft and is fully one-third the length of the shaft proper; posterior portion of barb produced into an acuminate point; anterior portion of barb produced into an equally prominent rounded boss; axis of barb directed somewhat upward posteriorly. Tarsal claw of foreleg differing from those of other three pairs of legs and from those of female, as is usual with red spider males; distal portion (corresponding to the main claw) straight and relatively weak, the proximal portion (analagous to the deflexed spurs in certain genera) much thicker at base and appearing to be 3-pointed terminally.

Type slide.—U. S. National Museum No. 1380.

The type material is from Chadbourn, N. C., September 25, 1939, from strawberry, collected by Floyd F. Smith and W. A. Thomas. To date this mite has been collected from eight localities in four States as follows: Pocomoke, Md., Chadbourn, N. C., Norfolk, Va., Accomac County, Va., Diamond Spr., Va., Princess Anne Court House, Va., Northampton County (Va.?), and Parma, Idaho. The eastern collections were all from strawberry, while the Idaho collection was from red clover. Mr. R. W. Haegele, who sent the material from Idaho, stated that on several occasions strawberry plants have been shipped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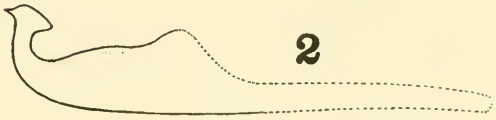
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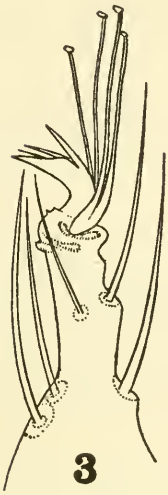
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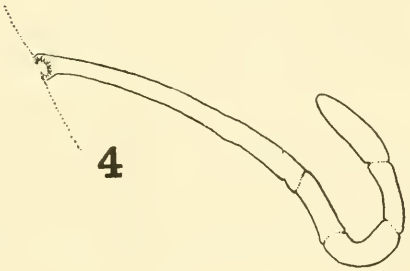
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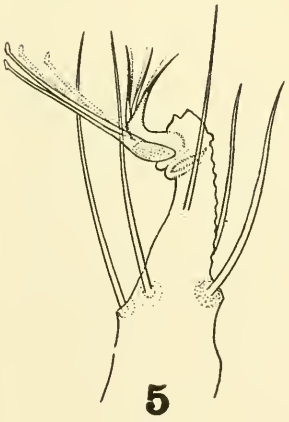
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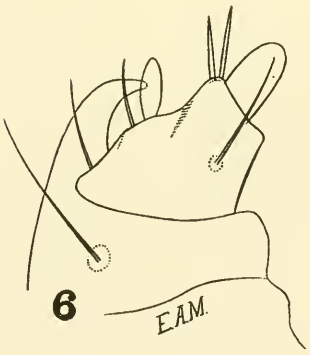
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into Idaho from a nursery in Maryland. This might account for the occurrence in Idaho of this Atlantic Coast mite. The records show that the strawberry *Tetranychus* was first collected by W. A. Thomas at Pocomoke City, Md., May 22, 1939. Others who have since collected this mite are R. W. Haegele, H. G. Walker, F. F. Smith, and Carl Anderson.

The present species is perhaps closest to *T. althaeae* v. Hanst. The two species may be distinguished as follows:

Tetranychus althaeae.

Palpus of female with terminal "finger" slightly clavate, obscurely angular at tip, one-fourth longer than thick, less than one-half as thick as terminal aspect of "thumb." Axial length of barb of penis less than one-fourth that of shaft; as viewed laterally, the anterior and posterior projections of barb of penis each in the form of an acute point; axis of barb not directed upward posteriorly.

Tetranychus atlanticus.

Palpus of female with terminal "finger" non-clavate, rotundate terminally, fully two-thirds again as long as thick, but more than one-half as thick as terminal aspect of "thumb." Axial length of barb of penis fully one-third that of shaft; as viewed laterally, the posterior projection of penis barb in form of an acute point, the anterior process of barb in the form of a rounded boss; axis of barb directed somewhat upward posteriorly.

Explanation of Plate.

Tetranychus atlanticus.

Figs. 1 and 2. Lateral view of penis (Fig. 1 from material from red clover, Parma, Idaho; Fig. 2 from material from strawberry, Pocomoke City, Md.).

Fig. 3. Tip of tarsus of leg I of male, viewed laterally.

Fig. 4. Collar trachea, viewed laterally.

Fig. 5. Tip of tarsus of leg I of female, viewed laterally.

Fig. 6. Terminal portion of palpus (♀) with appendages, viewed laterally.

A NEW SPECIES OF SMICRONYX FROM SASKATCHEWAN, AND SYNONYMICAL NOTES (COLEOPTERA : CURCULIONIDAE).

By L. L. Buchanan.

The species here described is the subject of a forthcoming biological paper.

Smicronyx utilis, new species.

Length 1.8–2.7 mm., width 0.8–1.2 mm. Elongate, sides of elytra subparallel; derm black or nearly so on mature specimens, the legs, antennae, and rostrum reddish to piceous; scales above contiguous to moderately overlapping, elliptical to ovate in general, but some much more slender (sublinear), the vestiture covering, at least in part, the elytral striae; vestiture above white, gray, or light brown, the color occasionally uniform, but on elytra often feebly mottled with brown, sometimes in such a way as to give the effect of faint, irregular, wavy bars; rostrum arcuate, without ventral notch at base, slender and subcylindrical in female, stouter and more thickened basally in male; antennal socket a little distad of middle in female, at about apical three-sevenths in male. Last tarsal segment long, one-half to three-fourths as long as rest of tarsus; claws large, connate basally (but not to middle). No prosternal sulcus.

Rostrum a little longer than head and prothorax together, dorsal transverse impression at base feeble, basal half or less shagreened (strongly so in male), and with setae and slender scales, which are prostrate or subprostrate except for the erect tuft on each side of middle at base; basal half of male rostrum with a lateral carina and, on dorsum, either a carina each side of middle (the median line itself sometimes appearing carinate) or only a feeble median carina, the apical portion more or less shiny, punctate, and with or without carinae; female rostrum longer, smoother, shinier, more finely punctate, basal portion sometimes with traces of carinae. First funicular segment stouter and longer than second, third and remaining segments each at least as long as wide; club elongate, sutures faint. Eyes separated beneath by about three-fourths length of second funicular segment. Head shagreened, dorsum with sparse to fairly dense, slender scales which are usually more or less iridescent. Prothorax nearly as long as wide, much narrower than elytra (in the proportion of about 3 to 5), sides moderately rounded, apical constriction rather long; pronotum feebly convex, normally almost covered by scales but, as seen on abraded specimens, densely punctate, the punctures denser mediobasally, where they usually coalesce here and there to form short, transverse grooves or rugosities. Elytral intervals subplanate, each with two or three irregular rows of broader scales and also a sparse median row of sublinear scales, the latter broadly arched in profile, and often appearing prostrate in dorsal view. Under side densely clothed with white scales, those on sides of thorax broader than either the dorsal scales or the scales on the abdomen; femora and tibiae with elliptical to sublinear scales and inclined setae; lower edges of tibiae with sparse, setiform spines which are darker and a little coarser on fore and middle legs; middle of metasternum, in posterior half, and middle of first and second abdominal sternites flattened or lightly concave, more concave in male; abdominal sternite 5 usually nearly flat. Median lobe of male genitalia

thinner than in many species of *Smicronyx* (fig. 9); internal sac contained within the median lobe, and with minute granules or asperities on portion next to median orifice and spines farther back (figs. 5 and 10).

Type locality.—Regina, Saskatchewan, Canada, June 15, 1939.

Type.—Male, and paratypes, male and female, No. 54279, U. S. National Museum. Paratypes in Canadian National Collection, California Academy of Sciences, and Museum of Comparative Zoology; and in collection J. G. Rempel.

Described from 30 specimens received from Prof. J. G. Rempel, with the statement that the species attacks the noxious poverty weed, *Iva axillaris* Pursh.

There is often a noticeable, though not conspicuous, unevenness in the sizes, shapes and colors of the elytral scales, the larger and broader ones being paler, on the average, and tending to form clusters or short lines here and there. There is considerable variation in the shape of the prothorax, the pronotal sculpture, and the sculpture of the rostrum.

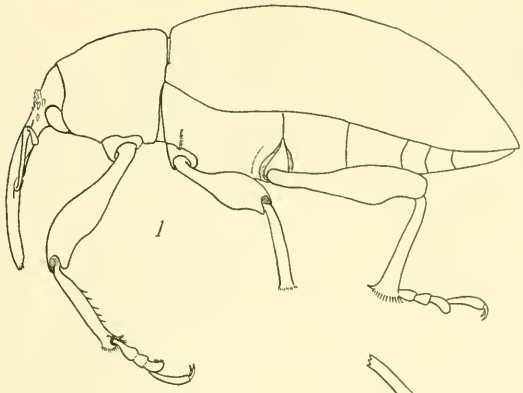
The sexes are not strongly differentiated externally, though when both are present they are rather easy to separate by the difference in the position of the antennal socket in conjunction with the other rostral differences—especially the stouter form, coarser sculpture, and more abundant vestiture of the male rostrum.

The following new synonymy can be recorded:

(*Smicronyx caseyi* Blatchley 1916) = *Smicronyx commixtus* Dietz. 1894.
(*Smicronyx connivens* Casey 1892) and (*Smicronyx spurcus* Casey 1892) = *Smicronyx vestitus* Leconte 1876.

I have seen the types or type sets of all these species excepting *caseyi* Blatch., and the identity of the last named seems beyond doubt.

S. commixtus Dtz. is recorded in literature and named in collections as either *vestitus* Lec. (a misidentification) or *caseyi* Blatch. *S. commixtus* Dtz. and *S. utilis*, n. sp., form a group characterized by the long tarsi and large tarsal claws, the latter not connate so far as middle (figs. 6, 7, and 8), the slender, curved rostrum (figs. 1 and 2), the absence of a notch on under surface of rostrum at base, the absence of a prosternal sulcus, and the relatively thin median lobe of the male genitalia (fig. 9). These characters, most of which are figured on the accompanying plate, seem not to occur in this combination in any other species. In male genital structure *commixtus* and *utilis* appear inseperable. They differ externally as follows: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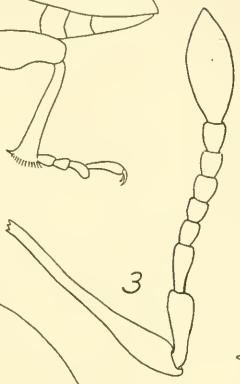
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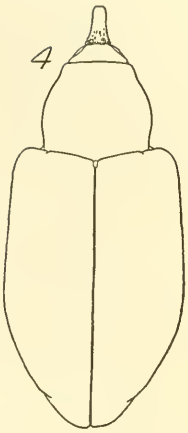
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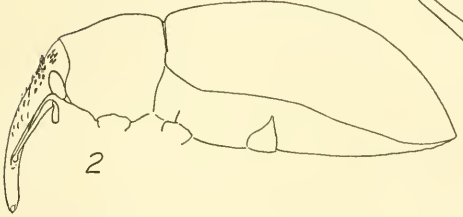
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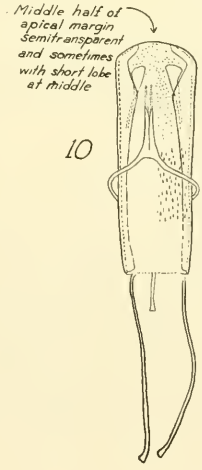
Middle half of apical margin semitransparent and sometimes with short lobe at middle
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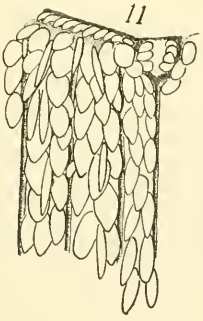
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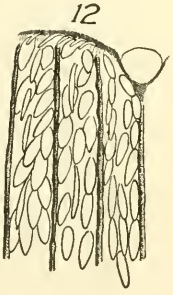
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Elytra, rostrum, and legs red, the elytra frequently with a common sutural line and a vague scutellar area fuscous; dorsal scales narrower and apparently sparser (fig. 12) so that parts of the derm are plainly visible and some of the striae are traceable for the greater part of their length; tarsal claws larger (fig. 6); pronotal punctures not quite so dense. Kansas and Colorado to Montana and Idaho.....
commixtus Dietz.

Elytra black, the rostrum and legs reddish to piceous; dorsal scales denser, usually concealing most of the derm and obscuring at least in part (sometimes almost throughout) the striae (fig. 11); tarsal claws smaller (fig. 8); pronotal punctures denser, those mediobasally often coalescent to form short, transverse rugae. Saskatchewan.....
utilis, n. sp.

In addition the rostrum of *commixtus* is apparently slightly more slender and more finely sculptured. In certain specimens the vestiture is nearly or quite as abundant as in occasional examples of *utilis*, but the average difference in this respect, as brought out in the key and figures, is obvious in series.

Explanation of Plate.

Fig. 1. *Smicronyx utilis*, n. sp. Lateral outline of female.
Fig. 2. *Smicronyx utilis*, n. sp. Same of male.
Fig. 3. *Smicronyx utilis*, n. sp. Antenna of male.
Fig. 4. *Smicronyx utilis*, n. sp. Dorsal outline of male.
Fig. 5. *Smicronyx utilis*, n. sp. Spines of internal sac (greatly enlarged).
Fig. 6. *Smicronyx commixtus* Dietz. Fore tarsus.
Fig. 7. *Smicronyx utilis*, n. sp. Fore tarsus in dorsal view.
Fig. 8. *Smicronyx utilis*, n. sp. Fore tarsus in lateral view.
Fig. 9. *Smicronyx utilis*, n. sp. Male median lobe, lateral view.
Fig. 10. *Smicronyx utilis*, n. sp. Male median lobe, dorsal view.
Fig. 11. *Smicronyx utilis*, n. sp. Scutellar section of left elytron.
Fig. 12. *Smicronyx commixtus* Dietz. Scutellar section of left elytron.

NEW POLYDESMOID DIPLOPODS INTERCEPTED AT QUARANTINE.

By Ralph V. Chamberlin,
University of Utah.

The types of the new millipeds described in the present paper form part of miscellaneous diplopod material submitted to me for identification by Mr. Muesebeck of the U. S. Bureau of Entomology and Plant Quarantine. The specimens representing the four new forms were intercepted by inspectors at Honolulu, H. I., and Washington, D. C., on plants imported from Japan, Philippine Is., Ceylon and Jamaica, respectively. The types are in the author's collection at the University of Utah.

Dominicodesmus expatriatus, new species.

A larger form than *granulofrons* and *panamicus*. The collum of the same general form as in those species; the indentation between the last two lobes on each side shallower than in *granulofrons* but deeper than in *panamicus*.

Diastema between anterior and poriferous lobe on 9th and 10th segments acute as in *granulofrons;* a small lobe adjacent to poriferous process on posterior side more distinctly set off, and the lobe next caudad extending farther laterad, etc.

Length 6 mm.

Locality.—From Japan, taken at quarantine at Honolulu, April 11, 1938, in packing material of *Vanda teres grandiflora*. One adult female of 20 segments, one immature of 17 segments, and one of 19 segments.

Orthomorpha hodites, new species.

Dorsum, upper part of sides, and antennae chocolate brown, lower part of sides paler; keels and legs yellow.

Body stout, constricted over first four segments as usual. Dorsum smooth, not tubercular or longitudinally furrowed; a slight transverse depression or furrow across the metazonites from fifth to eighteenth. Keels very narrow but distinct, ending a little in front of caudal margin of metazonite where ending in the usual projecting angle.

Furrow between prozonite and metazonite minutely "pearled" across dorsum, the nodules more obscure laterally.

Plural keels present on segments from second to seventeenth or eighteenth.

Sternites smooth, without special processes at bases of legs.

Anal tergite truncate, not presenting two cones or divisions, simply setose, the process straight.

Gonopods as shown in the figure.

Length about 20 mm.; width, 2.3 mm.

Locality.—Philippine Is. One male taken by quarantine inspector at Honolulu, April 26, 1938, on root of *Phalaenopsis stuartiana*.

Resembles in general appearance and structure *O. coarctata* but readily distinguished by details of the gonopods which, however, are of the same general type.

Euphyodesmus (Ceylonesmus) vector, new subgenus and species.

It seems desirable to separate the two other species of *Euphyodesmus* from *gracilis* Attems, known from Borneo, as a distinct subgenus *Ceylonesmus* with *vector* as its type, characterized especially by the series of peculiar stout cones across the caudal border of the metazonites.

In comparison with *greeni* the present species differs in color which when full

varies from chocolate to black; keels pale yellow; legs from light brown to colorless.

Antennae long as in *greeni*. Head differing, according to Attems' description, in being setose over the vertex.

Collum with keels acutely produced caudad; across posterior border a series of four tubercles smaller than the cones of ordinary tergites; at middle a transverse series of setae and another series along anterior border.

Keels of typical segments acutely produced caudad and with apices higher than middle of dorsum; four setigerous cones across caudal border essentially as in *greeni*, those at the ends much longer than the submedian two. Metazonites with a deep transverse sulcus in front of which is a series of four cones, each bearing a long, stout seta.

Process of fifth sternite in the male expanded above base over which it projects forward and especially caudad, a transverse depression across the distal end.

The gonopods of the male have the general structure of those of *greeni* but differ in details, such as in having the tibio-tarsus more curved distally and especially in having the terminal seminiferous finger straight and erect instead of strongly curved. See figure.

Width, up to 2.1 mm.

Locality.—Nine specimens taken at Honolulu Feb. 24, 1938, in soil about plants from Ceylon.

Genus **DASOMUS**, new.

A chelodesmid genus characterized by its densely granular metazonites, the granules occurring both over entire dorsum and on sides below keels as well. Several transverse series of setae. Keels of all segments except first acutely and strongly produced caudad; with a stout tooth at anterolateral corner; pores on segments 5, 7, 9, 10, 12, 13, 15–18. Gonopods of male with telopodite more or less segmented near middle and at that level bearing a smaller transverse curved spur and an irregularly sigmoidally curved principal lamina.

Genotype.—Dasomus bicolor, new species.

Dasomus bicolor, new species.

Dorsum when in full color black or nearly so, with the keels yellow excepting anterior portion. Legs yellow, antennae brown.

Head with granules numerous but less well developed; setae numerous over entire surface.

Collum with anterior margin continuous with lateral margins in an evenly convex curve. Caudal margin subarcuate; the posterior corners a little bent caudad. Surface densely granular; with three transverse series of larger setigerous tubercles of which the first runs close to anterior margin, and the third in front of caudal border.

On succeeding metazonites also three transverse series of setae of which one lies near anterior border, one immediately back of the transverse dorsal sulcus and one at caudal margin.

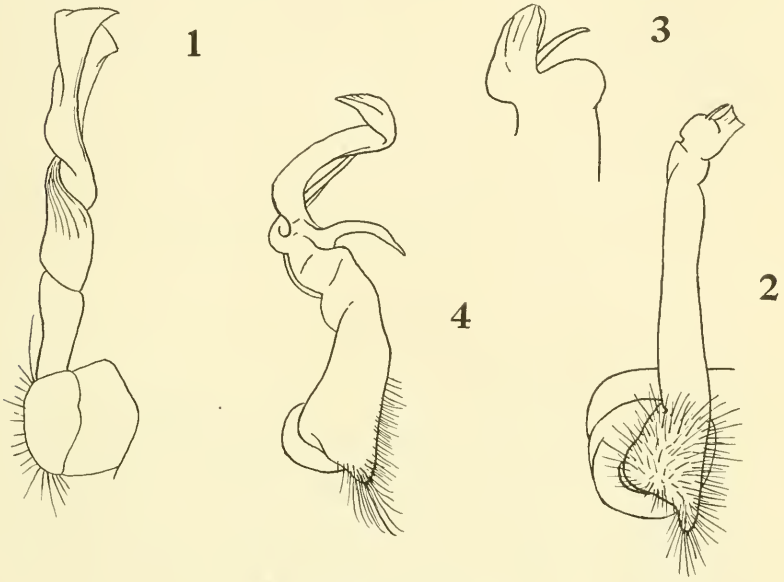
Anal tergite acute, produced well beyond the valves.

In the male the sternite between the third legs produced as a wide plate the free distal (ventral) margin of which is obtusely excised from end to end.

Gonopods of male as illustrated.

Length to about 20 mm.

Locality.—Jamaica. Eight specimens were taken in an express shipment of orchids at the Inspection House in Washington, D. C., on Feb. 17, 1938.



EXPLANATION OF FIGURES.

1. *Orthomorpha hodites*, sp. nov. Left gonopod of male, ectal view. 2. *Euphyodesmus* (*Ceylonesmus*) *vector*, sp. nov. Right gonopod, ventral view. 3. Tip of left gonopod, ventromesal view. 4. *Dasomus bicolor*, sp. nov. Right gonopod, ventral view.

MINUTES OF THE 515TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON JANUARY 2, 1941.

The 515th meeting of the Society was held at 8 P. M., January 2, 1941, in Room 43 of the National Museum. President Ewing presided and 35 members and 11 visitors attended. The report of the December meeting was accepted as read.

The President announced the appointment of the following standing committees for 1941:

Auditing—Paul Oman, Chairman; Floyd Andre.

Program—W. H. Anderson, Chairman; Floyd F. Smith; F. W. Wadley.

Membership—E. H. Siegler, Chairman; H. W. Capps; Louise M. Russell.

Under Notes and Exhibition of Specimens, Austin H. Clark called attention to *Papilio notatus* described in 1803 by Johann Karl Megerle from six specimens from Georgia which undoubtedly is the same as the *Colias philodice* of Godart, 1819. He also noted that the names *calanus*, *gema* (=*gemma*), *gorgonia* (=*gorgone*), *macropus*, and *niphon* attributed to Ziegler were published by Megerle in 1804. All these names except *macropus* were subsequently adopted by Hübner. (Author's abstract.)

The first part of the regular program included reports, as follows, of meetings recently held at Philadelphia in conjunction with the American Association for the Advancement of Science.

1. American Association of Economic Entomologists. P. N. Annand.
2. Entomological Society of America. A. B. Gurney.
3. American Society of Parasitologists. F. C. Bishopp.
4. Annual Address of the Entomological Society of America. R. E. Snodgrass.
5. Taxonomists' Conference on Nomenclature, of the Entomological Society of America. Alan Stone.
6. Group of symposia on human malaria held by American Society of Parasitologists, American Society of Tropical Medicine, and National Malaria Committee. M. V. King.

Dr. Bishopp remarked briefly on malarial problems.

Dr. Annand announced a meeting of the American Association of Economic Entomologists at Durham, N. H., at which a sumposium on chemical control will be included, to be held in connection with the 1941 summer meeting of the A.A.A.S.

The following visitors were introduced: Theodore L. Bissell; Reginald H. Painter; Warren H. Wagner, Jr.; H. Rodney Dodge.

Dr. Poos discussed the recent meetings of plant pathologists in Philadelphia.

The remaining part of the program consisted of an illustrated talk, "Some studies on leafhoppers of forage crops," by F. W. Poos. Dr. Poos gave a discussion of problems centered about the effect of the potato leafhopper on peanuts and alfalfa. The illustrations shown included many interesting views of different phases of peanut culture.

Adjournment at 9.55 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

Actual date of publication, February 28, 1941.

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PROCEEDINGS OF THE

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FIELD STUDIES OF THE ANOPHELINE MOSQUITOES OF ALBANIA.[1]

By MARSTON BATES,

Member of Staff of International Health Division, Rockefeller Foundation.

I. INTRODUCTION.

The present paper summarizes various field observations which were made in connection with the program of the laboratory for mosquito research in Tirana, between 1936 and 1939. The main emphasis of the laboratory work was on the study of the differential characters of the mosquitoes of the *Anopheles maculipennis* group, and the field work was almost entirely confined to these mosquitoes. A few observations on other anophelines are, however, included in this paper. A history and description of the laboratory will be found in a paper by Hackett and Bates (1939), and field work during the years 1934 and 1935 is covered in a paper by Lewis (1939).

The malaria situation in Albania seems to be essentially similar to that found in Greek Macedonia, which has been described in a series of papers by Barber, Rice, Balfour, and others. In Albania, as in Macedonia, the areas of most intense malaria are associated with *Anopheles sacharovi* (*elutus*). In Albania, however, malaria is often found in regions where *sacharovi* does not occur, and in most of these cases *Anopheles superpictus* seems to be the vector (the towns of Elbasan and Berat may be taken as examples). A third type of mosquito-malaria association is found in a very few places, notably in villages on the shores of Lake Malik, a large, shallow, marshy lake in the mountains near the Yugoslav frontier at an elevation of 800 meters (Lewis, 1939, pl. 1, fig. 1). In this area neither *sacharovi* nor *superpictus* is found, and the only common mosquitoes are three species of the *maculipennis* group (*maculipennis*, *messeae* and *subalpinus*), which are generally supposed not to be malaria vectors because of their non-anthropophilous food habits. The mosquitoes breed in immense numbers in the lake, and the villages are in close proximity to the breeding

[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.

MAR 26 1941

places. The resulting situation seems to be rather similar to that found in parts of Hungary (Lörincz, 1937), where malaria is also found associated with *Anopheles maculipennis* and *messeae*.

II. List of Species.

Ten species of *Anopheles* were found in Albania. The nomenclature of the following list is that of Edwards (1932), except in the case of the *maculipennis* group.

Subgenus **ANOPHELES** Meigen.

Anopheles algeriensis Theobald.

Adults of this species were found occasionally in stables (Bates, 1937), but never more than two or three at a time. Larvae were sometimes very numerous in Lake Terbuf; but although large numbers of mosquitoes were collected in stables near the lake shore, no *algeriensis* were ever found. Hence stable collections can not be taken as an index of the abundance or distribution of this species.

Anopheles claviger Meigen.

The seasonal distribution of this species in 1937 and 1938 was similar to that found in the four previous years (Bates, 1937): a large peak in November, and a smaller peak in April or May. Except at these times, adults were rarely found in stables. The species probably occurs in all parts of Albania.

Anopheles hyrcanus Pallas.

Albanian specimens would presumably be identical with Italian ones, and thus belong to the subspecies *pseudopictus* Grassi. The chief distinguishing character of this form, however, is said to be the white color of the fourth tarsal segment of the hind leg, and the coloration of this segment is variable in Albanian specimens. The species was quite common in the marshy border of Lake Terbuf, and larvae were occasionally found in other parts of the coastal plain. During the four years in Albania, we never found a single specimen resting during the day in either a stable or house. Barber and Rice (1935) found occasional specimens in stables and houses in Macedonia.

Anopheles maculipennis Meigen.

We use this name in the restricted sense, for the species called "*typicus*" in previous papers (Bates and Hackett, 1939). It is the commonest and most generally distributed of the Albanian anophelines: it was represented in every collection of adults made from stables.

Anopheles marteri Senevet and Prunelle.

Hadjinicolaou (1938) recently found this species in Greece, breeding in pools in heavily shaded mountain streams. We found it in the same situations in Albania, in streams in the Shkumbini Valley, at elevations between 500 and 600 meters; the larvae were common in July and August, and even more abundant in September.

Anopheles melanoon subalpinus Hackett and Lewis.

This species seems to be found in all parts of Albania, but it is common only in the vicinity of large marshes and lakes, which form the principal habitat of the larvae.

Anopheles messeae Falleroni.

In Albania this species was found only in the vicinity of the highland lakes of Malik, Ochrida and Presba (700–800 m. elevation). This seems to be the southernmost point of its range in the Balkans, the species called by this name in Greece (Rice and Barber, 1937) being *subalpinus*.

Anopheles plumbeus Stephens.

During 1936 we found this species quite commonly in one of the stables near Tirana (Bates, 1937); but although we continued to collect in this stable during the following years, no more *plumbeus* were found, so that its appearance in 1936 must have been due to some exceptional circumstance. Larvae were found in tree holes in various parts of Albania, and the species is probably generally distributed in the country.

Anopheles sacharovi Favr.

This species seems to be limited to the coastal plain in Albania, and we found it nowhere more than 40 kilometers from the coast, or at an elevation of more than 200 meters. We previously thought that the inland extension of the species was a purely summer phenomenon (Bates, 1937), but in 1938 we found hibernating adults in Tirana (24 km. from the coast in a straight line).

Subgenus **MYZOMYIA** Blanchard.

Anopheles superpictus Grassi.

This species is characteristic of the great river valleys, and it seems to be especially abundant in the region where these valleys enter the coastal plain. We attempted to establish its inward extension up the valley of the Shkumbini River in July, and failed to find any larvae at elevations above 500 meters. In

September, however, we found a few adults at Lubonik, in the Korça region, at an elevation of 800 meters.

III. Identification of Eggs.

The egg characters of the *maculipennis* group were discussed at some length in a paper by Bates and Hackett (1939), and the chief distinguishing characters of the Albanian populations are outlined in the key below. The eggs of all of the other Albanian anophelines have been included in this key, not so much with the idea that it would serve for the identification of the eggs—since in most cases this is more easily achieved by an examination of the adult mosquito—as in order to show the type of characters that seem to distinguish these various species. We did not examine the eggs of *Anopheles marteri*, and the species is included in the key on the basis of the description and figure published by Hadjinicolaou (1938).

We have found the field study of eggs to be the most useful way of defining the breeding places of the various species of the *maculipennis* group. We followed the method described by Barber (1935), except that we found it more convenient to use as a sieve, instead of the mitten, a piece of muslin stretched taut over an embroidery hoop (Fig. 2). By marking the cloth off into squares, the eggs can be counted without difficulty. *Sacharovi* eggs are easily recognized by the absence of floats and the uniform grey color; *maculipennis* by the two prominent black bars; and *subalpinus* and *messeae* by the general mottling of the egg surface. We have not been able to distinguish between *subalpinus* and *messeae* in the field, but this does not seriously interfere with the utility of the method, since *messeae* has a very limited distribution in Albania. Of the other species, *superpictus* and *claviger* can quite readily be recognized in the field, and it would probably also be comparatively easy to distinguish *hyrcanus* and *algeriensis* with a little patience.

Key to Eggs.

1. Eggs without floats or floats rudimentary 2
– Eggs with well developed floats 4
2. Egg diamond-shaped ..... *plumbeus*
– Egg elongate 3
3. Ground color of upper side dark (black) ..... *superpictus*
– Upper side light, silver grey (early spring eggs with rudimentary floats) ..... *sacharovi*
4. Upper side of egg with a pattern of light and dark spots 5
– Upper side of egg uniformly dark 7
5. Intercostal membranes of floats smooth ..... *subalpinus*
– Intercostal membranes rough (finely corrugated) 6

6. Pattern of two transverse black bars at ends of floats, sharply contrasted with the light ground color ..... *maculipennis*
– Transverse bars part of a diffuse dark pattern ..... *messeae*
7. Floats very large; viewed from above the two floats are wider than the dorsal surface of the egg exposed between them 8
– Floats smaller, the combined width less than the width of the dorsal surface of the egg between them 9
8. Intercostal membrane of float smooth ..... *claviger*
– Intercostal membrane moderately rough ..... *marteri*
9. Float membrane extending on to the dorsal surface of the egg at the ends of the floats, making four membranous patches on this surface ..... *algeriensis*
– Membrane not extending on to surface in four distinct patches, but visible on the dorsal surface along the entire float length ..... *hyrcanus*

IV. Identification of Fourth Stage Larvae.

In a previous paper (Bates, 1939–b) we published statistics on the variation in the antepalmate hairs of larvae in the *maculipennis* group, showing that the larvae could in many cases be distinguished by the branching of these hairs. The results have been incorporated in the following key. We have found no means of distinguishing between the larvae of *maculipennis* and *messeae*, and the distinction between *sacharovi* and *subalpinus* is not absolute, although by making hair counts it should be possible to determine the relative abundance of these two species in any particular breeding place. The key is in all cases based on Albanian larvae; it is possible that widely distributed and little known species like *marteri* and *algeriensis* will be found to show geographical variation in larval characters.

Key to Larvae.

1. A row of six large plumose hairs across middle of head 2
– These hairs vestigial, simple ..... *plumbeus*
2. Antepalmate hair of segments IV and V simple, or long stalked, with a terminal bifurcation 3
– These hairs with three or more branches, the branches arising near the base of the hair, not from a long stalk 5
3. Antepalmate hairs of segments IV, V and VI always simple; hair of antennal shaft simple ..... *superpictus*
– Some of the antepalmate hairs on IV, V and VI bifurcate at tip, or double: hair of VI especially apt to be double; hair of antennal shaft bifurcate 4
4. Branches of palmate hair of segment II well developed, sharply divided into a broad basal portion and a narrow terminal portion ..... *marteri*
– Branches of palmate hair of segment II lanceolate, narrowing gradually toward tip ..... *algeriensis*
5. Outer clypeal hair simple ..... *claviger*
– Outer clypeal hair branched, dendriform 6

6. Hair of antennal shaft prominent, long, many branched (longer than width of shaft)..... *hyrcanus*
– Hair of antennal shaft small, inconspicuous, with two or three branches (shorter than width of shaft)..... 7
7. Antepalmate hairs of segments IV and V normally with three branches, the total count of the branches of the four hairs varying between 11 and 17..... *maculipennis*, *messeae*
– These hairs always with more than three branches, the total count being more than 17..... 8
8. Count of antepalmate hairs of segments IV and V usually 26 or less; antepalmate hair of segment I usually larger than the palmate hair, and with 5 or more branches..... *subalpinus*
– Count of antepalmate hairs of segments IV and V usually more than 26; antepalmate hair of segment I minute, usually smaller than palmate hair, and with 3 or 4 branches..... *sacharovi*

V. Larvae of the Maculipennis Group.

The distribution of the antepalmate hair count of larvae from three Albanian breeding places is given in Table 1, to show the application of this method of identification to field material. The straight lines on the table indicate the range of variation of each species, as determined by a study of bred material (Bates, 1939–b).

Lakes Malik and Presba are located in the southeastern corner of the country, at an elevation of about 800 meters. *Maculipennis*, *messeae*, and *subalpinus* eggs were found in marshy areas along the lake margin (Fig. 3). *Sacharovi* did not occur in this region, hence larvae with high counts must in all cases be *subalpinus;* the modes at 12 and 15 in the hair count distribution may represent *maculipennis* and *messeae* respectively. In Vorra Pond (a marshy area between Tirana and Durazzo) we found eggs of *maculipennis*, *subalpinus* and *sacharovi*. The hair count of *maculipennis* larvae is distinctive, but it is more difficult to be sure of the separation of *subalpinus* and *sacharovi;* from an examination of other characters it seemed that only the two larvae with counts of 30 and 33 were *sacharovi*. In Yrshek Pond (Fig. 6) we found only *maculipennis* eggs, and the larval hair count is typical for this species.

VI. Larval Habitats.

In studying the factors limiting the habitats of anopheline larvae, it is interesting to reverse the usual procedure, and list the types of habitat in which larvae of a particular species are not found. Extended field work in Albania was confined to the species of the *maculipennis* group; and of these, *subalpinus* seemed to have the most sharply limited habitat (marshes and ponds). If any natural accumulation of water is regarded as a

TABLE 1.

Counts of the branches of the antepalmate hairs of the fourth and fifth abdominal segments of larvae from three types of habitat in Albania.

	Eggs present	Total hair counts																						
		11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
maculipennis		———	———	———	———	———	———																	
messeae			———	———	———	———	———	———	———	———														
subalpinus									———	———	———	———	———	———	———	———	———	———	———	———	———	———		
sacharovi															———	———	———	———	———	———	———	———	———	———
Lakes Malik and Presba (69 larvae)	*maculipennis messeae subalpinus*	2	15	6	3	12	4	3	1	2	3	4	2	1	3	3	1	2	–	1	1	–	–	–
Vorra Pond (41 larvae)	*maculipennis subalpinus sacharovi*	4	10	3	2	1	2	–	–	1	1	2	6	1	3	1	1	1	–	–	1	–	–	1
Yrshek Pond (25 larvae)	*maculipennis*	2	13	4	4	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

potential anopheline breeding place, the larvae of *subalpinus* were not found in:

1. Heavily shaded situations (forest pools).
2. Habitats with a small surface area (pools, ditches).
3. Water without vegetation.
4. Water subject to strong surface movements (waves, current).
5. Water with a high nitrate content.
6. Water with an appreciable salinity (more than 0.001 NaCl).

From the point of view of the ovipositing mosquito, the first two of these factors might be called "visual" (landscape), the second two "physical," and the third two "chemical." If this list of restrictions is applied to the other species of the *maculipennis* group, we find the following differences:

The limitations of *Anopheles messeae* seem to be identical, except that in addition the geographical range of the species is very restricted in Albania (effect of maximum summer temperature on adult?).

Anopheles sacharovi seems not to be subject to the second (area) and sixth (salt) limitations: although typically a marsh breeder, it was occasionally found in pools and ditches; larvae were sometimes found in water with a sodium chloride content of slightly above 20 parts per thousand. The geographical range of *sacharovi* was also limited, again perhaps because of factors affecting the adult (minimum winter temperature?).

Anopheles maculipennis was found in all parts of Albania, and in a remarkably wide range of habitats. In general, however, the limitations were the same as those for *subalpinus*, except for the second (area). The contrast at this point is striking. *Subalpinus* and *maculipennis* are often found in the same locality, and adults may be present in a particular stable in almost equal numbers. Egg dips in nearby breeding places, however, will disclose only *maculipennis* in the ditches, streams and small pools, and both *maculipennis* and *subalpinus* in the marshes. This difference is brought out clearly in the figures published by Lewis (1939, Table 3). The wide range of *maculipennis* habitats is illustrated in Figures 3 to 7. In Yrshek and Ipja Ponds (Figs. 6 and 7) only *maculipennis* was found in the middle of the summer. The spring-fed pool illustrated in Figure 4 is the sort of place where one would normally expect to find only *maculipennis*, but at the time the photograph was taken (September 2d), *sacharovi* and *superpictus* eggs were also found. The habitat illustrated in Figure 5 is most unusual for *maculipennis*, since normally only *superpictus* is found in this sort of situation; this habitat forms an exception to the third limitation (vegetation), since only a sparse algal growth was



Fig. 2. Sieve made of cheese cloth spread over an embroidery hoop for the field study of anopheline eggs.

Fig. 3. Method of fencing off part of a larval habitat with a bottomless gasoline tin for making measurements of the larval population. The habitat illustrated is the marginal zone of Lake Presba (800 m.), where *Anopheles maculipennis*, *messeae* and *subalpinus* were found.

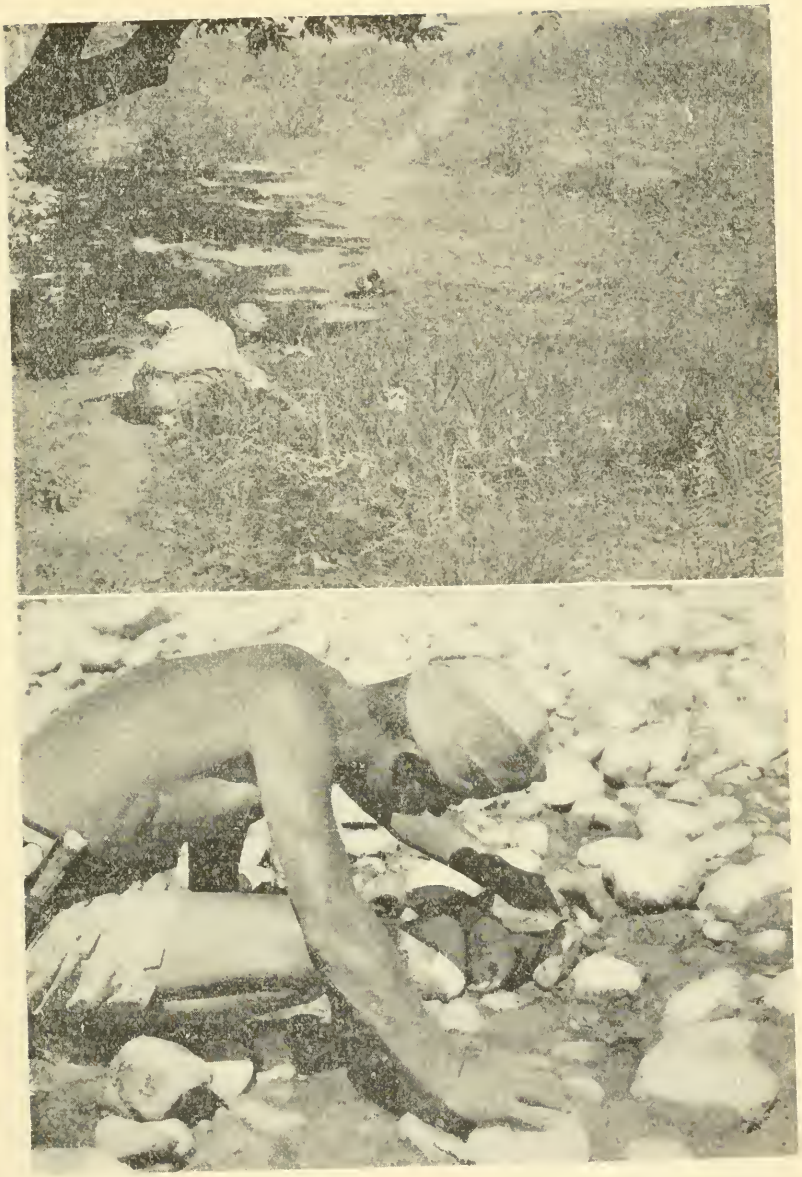

Fig. 4. Spring-fed pool in the coastal plain of Albania: eggs of *Anopheles maculipennis*, *sacharovi* and *superpictus* were found here in September.

Fig. 5. Detail of the bed of the River Dhrino in southern Albania. Eggs and larvae of *Anopheles maculipennis* were found in this particular place, although such locations are normally the habitat of only *Anopheles superpictus*.



Fig. 6. Yrshek Pond, near Tirana: made by damming a small stream: only *Anopheles maculipennis* eggs and larvae were found here, although *A. subalpinus* adults were also common in a nearby stable.

Fig. 7. Ipja Pond, near Tirana, formed where a small stream spread over a mud flat. Only *Anopheles maculipennis* was found here.

present; and to the fourth (current). *Maculipennis* larvae were, however, frequently found in protected spots in ditches and streams, where there was a slight current.

Anopheles superpictus, as is well known, breeds typically in the small pools in gravelly river beds (Figure 5), and is thus not subject to the third and fourth of the *subalpinus* limitations. The current in the pools where *superpictus* breeds is usually slight, but the larvae are nevertheless exposed to a steady change of water. Late in the season, when the adult population of *superpictus* has reached its peak, the eggs may sometimes be found in all sorts of habitats, including small pools (Fig. 4) and rice fields.

Hyrcanus and *algeriensis* were found most abundantly in the great marsh at Lake Terbuf (Lewis, 1939, Pl. 2). Five species of anophelines (*maculipennis*, *subalpinus*, *sacharovi*, *hyrcanus* and *algeriensis*) were, at one time or another, found breeding in this marsh. We found *plumbeus* larvae only in tree holes. *Claviger*, in the summer, was found only in shaded spring-fed pools, but in the winter and early spring the larvae could be found in many types of habitat, so that it looks as though low temperature were the important factor. The breeding places of *marteri* (pools in mountain streams) were characterized by heavy shade, low temperature, and clear fresh water.

In general, we have found a close correlation between the species of eggs and of larvae found in a given habitat, and we are convinced that the ecological distribution of anophelines depends on selection of oviposition site by the adult mosquito. In the laboratory, it is possible to demonstrate selection by ovipositing adults for both chemical and visual factors (Bates, 1940), and from the list of limitations that seem to affect the selection of breeding places in nature, it looks as though both types of sensory perception might be operative. It is particularly difficult to explain the marked "landscape" differences in anopheline habitats, except by the operation of a visual factor in the oviposition reaction.

VII. Seasonal Distribution of Anopheles Maculipennis.

In a previous paper (Bates, 1937) we published a summary of data collected during four years on seasonal variation in the number of adult mosquitoes collected in stables in the vicinity of Tirana. We found that in the case of *Anopheles maculipennis* the population seemed to build up to a peak somewhere about the first of July, and then to fall off fairly rapidly although maintaining a moderately high level, and sometimes increasing again, in August. We thought that it might be interesting to try to compare this distribution of adults with the distribution of larvae. The breeding places in the vicinity of Tirana vary considerably in extent during the summer, many ponds and

marshy areas drying up during July and August, and our first impulse was to attribute the summer decline in *maculipennis* to this drying up of breeding places. If this were true, it seemed likely that the larval population in a breeding place that could be maintained at a constant level through the summer might not show a decline corresponding to the decline in adult population.

There was a small permanent stream about 200 meters from the stable at Yrshek where we collected adult mosquitoes, and in the spring of 1937 we built a dam across this stream, making a small shallow pond that could be kept at a permanent level all through the summer (Fig. 6). The dam was built in May, and observations on larvae were begun five weeks later, when conditions in the pond seemed fairly stable. To get data on the larval population, we used a method that we had developed during the previous summer, and which we referred to as the "gasoline tin technique." The idea was to fence off a sample unit of the breeding area, and make a complete count of the larvae found in that area. We find that a convenient method of doing this is to remove the top and bottom from a gasoline tin, leaving a frame which can be thrust quickly over the spot to be

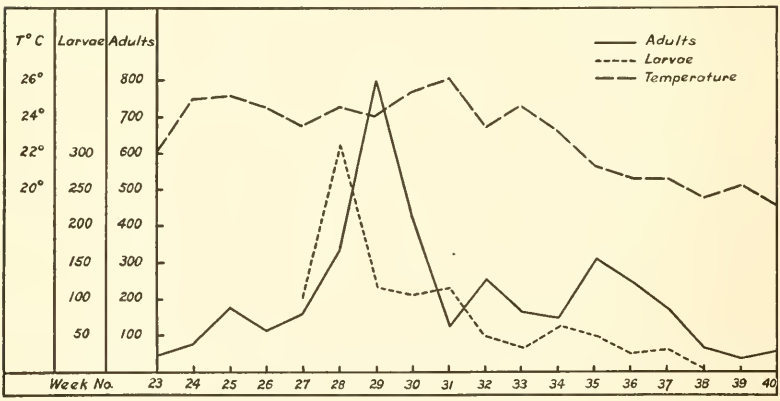

Fig. 1. Relationship between adult *Anopheles maculipennis* population (no. of mosquitoes in stable), larval population (total no. of *A. maculipennis* larvae per 500 cm² of surface in Yrshek Pond) and temperature (mean stable temperature), near Tirana, Albania.

tested, and pushed into the bottom so that it is firmly placed. The larvae are then collected from the enclosed area by dipping, and counted one by one as they are picked out of the dipper with a pipette. If the man doing the counting has had training in the laboratory with larvae of different stages, he can estimate the stage of a particular larva quickly and accurately by

noting the relative size and shape of the head. This method of counting larvae is somewhat tedious; it requires two men, one to count the larvae and the other to note down the results as they are called to him, and a single trial may take half an hour, if it is carefully made. Gasoline tins are approximately 23 cm. on a side, so that in a single trial about 500 square centimeters of surface are enclosed; to cover a square meter, twenty trials would be necessary. We made up a series of frames of different height, for use in different depths of water, as counting is greatly facilitated if the surface of the water is only slightly below the edge of the tin. Fig. 3 shows the method of operation. Cambournac (1939) has obtained interesting results by applying this method to the estimation of larval populations in rice fields in Portugal.

TABLE 2.

Seasonal distribution of *Anopheles maculipennis* at Yrshek station near Tirana: number of adults in stable and number of larvae per 500 cm² in Yrshek Pond.

Week	Month	Stable temp.	Adults	Larvae per trial	Stage (percent)			
					I	II	III	IV
20	May	18.8	18	—	—	—	—	—
21	May	21.4	15	—	—	—	—	—
22	May	19.8	115	—	—	—	—	—
23	June	22.1	50	—	—	—	—	—
24	June	25.1	81	—	34	32	23	11
25	June	25.2	180	—	—	—	—	—
26	June	24.6	118	—	37	21	16	26
27	July	23.6	163	100	22	47	23	8
28	July	24.6	335	311	50	35	7	8
29	July	24.1	798	119	36	29	22	13
30	July	25.4	426	104	28	43	20	9
31	July	26.1	123	115	38	37	19	7
32	Aug.	23.4	251	48	6	29	28	37
33	Aug.	24.6	167	31	26	30	12	32
34	Aug.	23.1	149	61	33	28	19	20
35	Aug.	21.6	306	49	47	29	14	10
36	Sept.	20.6	244	24	31	41	16	12
37	Sept.	20.6	171	29	43	32	16	9
38	Sept.	19.8	62	1	0	0	69	31
39	Sept.	20.2	34	0	—	—	—	—
40	Sept.	19.1	50	—	—	—	—	—

The results of the 1937 study at Yrshek Pond are given in Table 2, and the figures for larval population, adult population and temperature are plotted in graph form in Fig. 1. The mean stable temperature (calculated from thermograph records) corresponds quite well with the mean outside temperature;

the temperature range was, however, very much less. It was unfortunately impossible to continue these observations in the following year, so the results of this single year of work can not be taken as more than suggestive of the utility of this line of attack. From these results, and from various other observations, it seems to us that the midsummer drop in *maculipennis* population is quite possibly in large part due to a high mortality in the adult population—probably the result of high temperature and low humidity. It is interesting that in each of the four years from 1933 to 1936, the peak of *maculipennis* preceded the peak in mean temperature (Bates, 1937, Figs. 2 and 10), as it did in 1937 (Fig. 1). The peak in larval population preceded the peak in adult population, and there was no great increase in the population of first stage larvae following the peak in adults, as one would expect if the adults lived and started laying eggs.

VIII. Larval Stage Ratios.

We started collecting data on the relative numbers of larvae in different stages of growth in various breeding places, on the theory that the ratio between stages might turn out to be fairly constant during the period of continuous breeding, and that variation in the ratio might throw light on seasonal population changes. We found that in fact the larval stage ratio varied considerably from one breeding place to another, and from the data collected in Albania it looks as though this ratio might be even more useful as an index of differences between breeding places than as a tool for the study of seasonal variation.

The larval stages are of unequal duration. From data collected in rearing experiments (Bates, 1939, Table 1) it looks as though in *Anopheles atroparvus*, at a constant temperature of 27°, stage I lasted 2 days; stage II, 2.5 days; stage III, 3 days; and stage IV, 5 days; making a total of 12.5 days. The length of stage IV varies greatly, but five days seems to be about the average at this temperature in favorable media. The period of growth in unfavorable media is greatly prolonged, and in some experiments we have had larvae of *Anopheles atroparvus* remain in stage II, for instance, for as much as seven days (at 27°). The figures quoted above for the various stages are based on experiments in "Medium S" (Bates, 1939), which was the most favorable of our artificial media. As a check, we tried growing larvae in bolting-cloth enclosures in the open, at Yrshek Pond. The experiment was carried out in July, and the mean water temperature (calculated from thermograph records) during the experimental period was 26.7°, so the field and laboratory results should be comparable. The first pupa was formed in 11 days, and half of the larvae had pupated on the 13th day, which would seem to indicate that the laboratory results with "Medium S" were reliable.

Martini (1923, p. 155) gives the following lengths for the larval stages of *Anopheles maculipennis* at temperatures between 24° and 27°: I, 2 days; II, 1¼ days; III, 2½ days; IV, 4¼ days; making a total of 10 days. Hadjinicolaou (1938) gives the following figures for *Anopheles marteri* (at temperatures between 19° and 24°): I, 3; II, 5½; III, 3½; IV, 6. The discrepancy between the relative lengths of the larval stages is curious: it may be that this is a specific characteristic, but that would hardly explain the differences between Martini's figures and ours. Our figures are estimates based on counts of fifty larvae grown together; much more accurate figures could be obtained by following the development of a number of individual larvae, which may be the system that Martini used. The need for accurate figures on this point for the interpretation of field larval ratios did not occur to us until after the Albanian work had been stopped.

On the basis of our figures for the relative length of larval stages, the larval stage ratios in an area of continuous breeding where there was no mortality should be: I, 16 percent; II, 20 percent; III, 24 percent; and IV, 40 percent. In actual breeding places, these ratios are practically always reversed—there are more Ist stage than IInd stage, and so forth. The weekly ratios for the summer of 1937 in Yrshek Pond are given in Table 2, and ratios for various breeding places in Table 3. Of the breeding places listed in Table 3, Yrshek Pond, Ipja Pond, and Shën Vllash had only *maculipennis;* Lakes Presba and Mali had a mixture of *maculipennis*, *messeae* and *subalpinus* (cf. Table 1); while the Portuguese rice fields had only *atroparvus* (Cambournac, 1939).

TABLE 3.

Larval stage ratios in different habitats in Albania.

Place	No. larvae	Stages (per cent)			
		I	II	III	IV
Theoretical ratio, no mortality	—	16	20	24	40
Yrshek Pond, 1937, 14 weeks in summer	4,464	37	33	16	14
Ipja Pond, 1937, 9 weeks in summer	1,565	57	28	12	3
Lake Presba (June)	106	47	29	17	7
(September)	402	53	30	12	5
Lake Malik (June)	110	33	31	24	12
Shën Vllash, 19 May, 1937	39	18	20	26	36
8 June, 1937	107	74	17	6	3
Portugal, rice field (Cambournac, 1939)					
June	73,130	66	15	9	10
July	19,320	32	31	30	7
August	11,400	49	26	13	12

Our figures are too incomplete to warrant any very detailed analysis or discussion, and they are given here principally because they suggest what may prove to be a very interesting line of attack on some of the problems of larval ecology. In the figures for Yrshek Pond (Table 2) it is interesting that the proportion of Ist stage larvae tends to be higher at the beginning and end of the summer: it falls fairly steadily between weeks 29 and 32, between the peak of adult population and its lowest point, during the period of highest summer temperatures. This is what one would expect if the adults during this period should die before eggs are matured. The increase in the percentage of IVth stage larvae in the latter part of the summer may be due to the lower larval population density at this time, which might result in an increased survival rate. Figures of this sort would gain greatly in value if they could be compared with statistics on other variable factors in the pond, such as variations in the density of the predator population and variations in the physical and chemical environment.

The figures for the collection of May 19th at Shën Vllash (Table 3) are interesting, since they probably represent the first spring generation of mosquitoes: larvae from eggs laid by hibernating females have reached IVth stage, and the overlapping of generations which results in a general preponderance of Ist stage larvae for the rest of the summer has not yet started.

The differences for the summer period between Yrshek Pond and Ipja Pond, two *Anopheles maculipennis* habitats in the vicinity of Tirana, are striking. Apparently Yrshek Pond was a much more favorable breeding place than Ipja Pond, a fact that we did not realize until we started to analyze the larval data, after we had left Albania. The two ponds (Figs. 6 and 7) both seemed excellent breeding places and supported approximately the same larval population per unit of area.

IX. Summary.

Ten species of *Anopheles* were found in Albania: *algeriensis*, *claviger*, *hyrcanus*, *maculipennis*, *marteri*, *messeae*, *plumbeus*, *sacharovi*, *subalpinus* and *superpictus*. Keys for the identification of the eggs and larvae of these species are given. Larvae of the *maculipennis* group can in most cases be identified by means of the variation of the antepalmate hair. Larval habitats were studied in detail only in the case of the four species of the *maculipennis* group; of these *messeae* and *sacharovi* were limited geographically, while *maculipennis* (s.s.) and *subalpinus* were found in all parts of the country. The chief distinction between the habitats of the latter two seemed to be of landscape nature: *subalpinus* was found only in large accumulations of water (marshes, ponds), while *maculipennis* was found in a wide range of habitats, including small as well as large water bodies (ditches,

pools, slow streams). The habitats could be accurately defined by means of the field study of eggs, which seems to show that the oviposition habits of the adult mosquito must be the controlling factor in determining specific differences in larval distribution.

From a study of the seasonal variation in adult and larval populations of *Anopheles maculipennis* in a locality near Tirana, it seems likely that the midsummer drop in population is due in large part to factors affecting the adults rather than the larvae: the peak of larval population preceded the peak of adult population, and there was no great increase in the population of first stage larvae following the peak in adults. Figures on the relative proportions of larvae in different stages of growth were collected for various breeding places and seasons, and it was found that the larval stage ratio was characteristic not only of the season, but of the breeding place. The collection of data on this point may serve as a useful index in determining the relative importance of different types of breeding place.

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THOMAS H. JONES

THOMAS H. JONES.

Obituary Notice.

Thomas Henry Jones, senior entomologist of the Division of Forest Insect Investigations, Bureau of Entomology and Plant Quarantine, died suddenly in Morristown, N. J., on Saturday morning, February 22. Mr. Jones was the son of Robert P. Jones and Bertha A. (Tiepke) Jones. He was born at Pawtucket, R. I., on September 25, 1885, attended the Easton, Mass., public schools, and graduated from the Massachusetts State College in 1908 with the degree of Bachelor of Science. In 1929 he married Katherine H. Alyward.

Mr. Jones was a quiet man but when he did talk usually had something to say. He had an ideal balance of scientific and manly qualities, and was a conservative, careful investigator, and an excellent cooperator who was universally liked by all who knew him, and was particularly encouraging to his younger co-workers. He had a broad basic knowledge of entomology, and having been raised on a truck farm had a keen sense of the applicability of his work. His contributions to the economic entomology of truck crops in the southern United States, based as they were on his youthful training and tropical experience, were accurate and sound.

He was appointed to the Bureau of Entomology on May 26, 1909, with the Division of Truck Crops and Stored Products Insect Investigations. In 1911 he resigned from the Bureau to accept a position with the Puerto Rico Sugar Planters' Association and during the next 4 years he published seven important papers. In 1914 he was reappointed to the Division of Truck Crop Insect Investigations and assigned to work in Louisiana. In 1920 he again resigned from the Bureau, this time to accept the position of entomologist for the Louisiana Agricultural Experiment Station at Baton Rouge. After 4 years in this capacity he returned to the Bureau in January, 1924, to carry on investigational work on introduced parasites of the gypsy moth at Melrose Highlands, Mass. He continued in this capacity until 1935, when he was assigned to research work on the beetle vectors of Dutch elm disease. At the time of his death he was assistant to the entomologist in charge of the research laboratory carrying on these investigations.

Mr. Jones was a member of the Phi Kappa Phi honorary society, and the American Association of Economic Entomologists.

Mr. Jones is survived by his wife, his mother, and a brother.

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James A. Hyslop and John E. Graf.

A NEW ISONEUROTHRIPS FROM NEW ZEALAND (THYSANOPTERA, THRIPIDAE).

By J. C. Crawford,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

A name is needed for this species, since it is reported to be doing considerable damage to the flowers of grapes in a restricted area in the Aukland district of New Zealand.

Isoneurothrips obscuratus, new species.

Female.—Length (distended) 1.45 mm. Dark brown, head and thorax more or less reddish brown; antenna entirely dark brown, except for a narrow whitish ring just beyond pedicel of segment III and base of IV beyond pedicel somewhat lightened; femora concolorous with body, tibiae distinctly lighter than femora and lightened apically, tarsi yellowish; forewing dark, with an almost hyaline band beyond scale. Antennal segments III, IV, and VI subequal in length; fore vein with a complete and continuous row of bristles which number distinctly more than those on hind vein; comb on abdominal tergum VIII complete but the spines sparse, mostly in groups of two, each spine on an enlarged base; sterna III–VII each with from three to five pairs of accessory bristles.

Head distinctly wider than long, constricted just behind eyes so that the eyes appear somewhat bulging; with very distinct transverse anastomosing lines; occipital carina much darker brown than rest of head; ocelli large, in an equilateral triangle, with brownish-red crescents, posterior ocelli well separated from eyes; facets of eyes large, two or three ventro-caudal ones larger than the rest; eyes strongly but sparsely pilose; interocellar bristles about on a line tangent to the posterior margin of anterior ocellus and just outside of a line tangent to the outer margins of the anterior and posterior ocelli; postocular row of bristles with one bristle back of ocelli, the one next outwardly and one almost at lateral margin of head longest, subequal.

Pronotum with sculpture similar to that of head, but closer and more delicate; mesonotum with similar but still closer and stronger sculpture; pronotum with strong discal bristles, of which only a pair situated near lateral margins at about one-third the length of pronotum from posterior margin are distinctly longer and stronger than the rest; posterior margin of pronotum with 3 pairs of bristles between the postangulars; fore vein of anterior wings with 18 to 20 bristles, those distad only slightly farther apart than those basad; hind vein with 13 to 15 bristles.

Abdomen normal, basal subcostal lines of terga almost black; tergum X not contracted medially at sides, split open above almost to base.

Measurements (in microns): Head, length 114, length from front of eye to occipital carina 104, width across eyes 152, greatest width across cheeks 156; interocellar bristles circa 22 to 24; longest postoculars about 30. Prothorax, length 144, width 208; long anteriorly directed bristle at anterior angle 26; postangulars, outer 88, inner 92; middle pair of postmarginals 24, inner postmarginals 38; long pair of bristles on lateral margins 44; wing 860. Bristles on tergum IX, outer 124, middle 112, inner 72; on tergum X, both pairs 102.

Antennae:	1	2	3	4	5	6	7
Length	36	44	60	60	42	60	20
Width	30	24	21	22	20	20	9

Described from eight females with the record, "Henderson, Auckland [New Zealand], Dec. 20, 1940, ex grape flowers, W. Lindeman coll."

Type Catalogue No. 55193, U. S. National Museum.

In most of the paratypes the tarsi are distinctly brownish and in the lighter-colored specimens there is less contrast in color between the femora and the tibiae and less apical fading on the tibiae.

Five of the specimens have both antennae with seven segments; one has the left antenna seven-segmented and the right with the distal segments missing; one has the left style missing and the right antenna eight-segmented; and one has the left antenna seven- and the right eight-segmented.

The described species of the genus which have a complete comb differ, in part, as follows: *Isoneurothrips antennatus* Mlt. has antenna III (60 μ) much longer than VI (48 μ); *debautiae* Mlt. has antenna I–IV whitish, and wing and body bristles transparent, except for brown postangulars and bristles at apex of abdomen; *fullowayi* Mlt. has antenna III (45 μ) much longer than VI (36 μ); *pallipes* Mlt. has antenna III (39 μ) distinctly shorter than VI (48 μ); *sumatrensis* Pr. has antenna III entirely, and IV and V at base, clear yellow, and the bristles on fore vein outwardly are spread apart so that there appear to be a basal series of 11–13 followed by a distal series of 4 or 3 with a total of 15 or 16, hind vein with 14–16; *sumatrensis* var. *cinchonae* Pr. (to which *obscuratus* runs in Priesner's key[1]) is said to have the prothorax longer than wide (!), antenna III yellow and distinctly longer than VI, postangulars shorter (62 μ), and the wing bristles as in the typical form; *williamsi* Mlt. has antenna III (51 μ) longer than VI (45 μ), antenna I whitish, II and basal one-third of III brownish yellow, concolorous with head, general body color brownish yellow.

The species for which the status of the comb on tergum VIII is not stated in the descriptions differ in part as follows: *australis* Bagn. is a yellow species; *orientalis* Bagn. has antenna III yellow white and, according to Priesner (*l. c., ante*), the comb incomplete; *multispinus* Bagn. has the interocellars as long as the postoculars, the spines on the fore and hind veins equal in number, and the fore tibiae yellow; *setifer* Ky. has the head longer than wide.

[1] Natuurk. Tijdschr. Ned.-Ind., vol. 94, pp. 284 et seq., 1934.

SOME FLEABEETLES INJURIOUS TO BEANS IN TROPICAL AMERICA (GENUS DIPHAULACA, FAMILY CHRYSOMELIDAE).

By H. S. Barber,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

A few fleabeetles found in cabins of passenger planes arriving at Brownsville, Tex., from the south and submitted for identification represent a species which seriously injures Mexican "frijole" culture but is not yet known in our country. Attacks by this species in the delta of the Rio Grande may be expected. It has long been known under the name *Diphaulaca aulica* (Oliv.) and is externally similar to that species. The two differ, however, in the shape of the aedeagi and must be regarded as distinct. The generic name is to be maintained for them, but most of the species which have been placed in *Diphaulaca* are not congeneric. Nomenclatorial and taxonomic details appear to be as follows:

Diphaulaca Chevrolat 1837 (*in* Dejean, Catalogue de Coléoptères, 3d ed., p. 412) was proposed to include 16 tropical American species, of which 3, *Altica aulica* Oliv. 1808, *Haltica striata* Klug 1829, and *Altica janthinipennis* Latr. 1832, had already received valid names. The first of these, *aulica*, became the genotype through designation by Chevrolat 1845 (*in* d'Orbigny, Dict. Univ. d'Hist. Nat., vol. 5, p. 46). Clark 1865 cited the two prior contributions and gave a formal description for the genus but did not mention *aulica* by name. He credited the generic name to Chevrolat and added descriptions of 9 new species. Six more new species were named by Harold 1875, and several more by Jacoby 1883 and 1902. Few of the species can here be considered, but these require proposal of 2 new generic and 3 new specific names. All material here discussed is in the United States National Museum.

Jacoby's concept of *Diphaulaca aulica* agrees closely with the limits of the genus *Diphaulaca* as here defined. He mentions variability in more than a hundred specimens from Mexico to Guiana, concluding, "I prefer to look upon them as varieties." A different view now seems necessary.

About 50 dissections of male genitalia have been made from among 300 specimens, representing a number of localities from Mexico to Cayenne. These indicate 5 species as below distinguished and probably others not now so clearly indicated. The habitat of this group from Texas to Uruguay should be more adequately sampled and dissections prepared. The internal sac remains unknown, but the cleared aedeagus shows no recognizable armature other than that on the inflexed apex of the orificial plate, which seems to be distinctive in the new species

from Panama. Throughout their habitats these species seem to attack cultivated and wild legumes.

Several specific names have been given to forms similar to, or perhaps conspecific with, *Diphaulaca aulica*. Three of them are mentioned below but are not placed in the following key.

1. Elytra punctate-striate; prothorax red.....2
   Elytra without striae of punctures in series, surface smooth, shining, finely, sparsely, irregularly punctulate; a transverse impressed area at basal fourth delimiting a large, subquadrate, gibbous area near scutellum, separated from humeral callus by a feeble longitudinal impression; form robust, ovate; color black and metallic blue or green; aedeagus subcylindrical, moderately curved, widened and flattened in apical third, rounded at apex, under surface with a very strong, median, lamellate carina in apical half, separating a pair of deep sulci. Mexico to Costa Rica. (*Diphaulaca nitida* Jac. 1883, type of new genus).....*Diphaltica*, new genus.
2. Elytra black with strial punctures becoming irregular, confused, and obsolescent toward apex; base of elytra evenly convex, only the humerus gibbous; form subglobular ovate; aedeagus straight, four times as long as wide, convex and sclerotized above, nearly flat below with side margins subparallel, strongly sclerotized and with median three-fifths membranous from basal third to near apex; eastern part of United States. (*Diphaulaca bicolorata* Horn 1889, type of new genus).....*Hornaltica*, new genus.
   Elytra blue or green, the punctures regular, forming fine striae almost to apex, the humeral and discobasal gibbosities distinct; form more elongate and depressed; aedeagus simple, slightly depressed, curved; Neotropical. (*Diphaulaca* Chev. restricted).....3
3. Antennae, legs, abdomen, and usually the metasternum black or fuscous, elytra dark blue; head and prothorax red; aedeagus rather slender with acute apex; Guatemala....*Diphaulaca wagneri* Harold 1875.
   Body and appendages red, tarsi and intermediate antennal joints usually somewhat infuscate, elytra bright blue or green.....4
4. Aedeagus relatively broader, its width at basal fourth (sub-basal constriction) almost one-fourth its length, its apex right-angled ogival. Cayenne.....*Diphaulaca aulica* (Oliv. 1808).
   Aedeagus relatively narrower, its strong subbasal constriction about one-seventh as broad as its length.....5
5. Apex of aedeagus ogival, usually acutely angulate, dorsal plate closing the orifice broad, smooth, shining, concave. Cordoba, V. C., Mexico.....*Diphaulaca cordobae*, new species.
   Apex of aedeagus broadly and evenly arcuate or obsoletely angulate.....6
6. Apex of aedeagus subangulately elliptical and slightly elevated, its upper surface broadly concave, with a small, short, median, subapical carina or tubercle; the orificial plate nearly plane with two feeble submedian longitudinal costae. Summit, C. Z., Panama.....*Diphaulaca panamae*, new species.

Apex of aedeagus broadly rounded and feebly bituberculate at middle of upper margin, the broad shining orificial plate narrowly concave near its apex. Merida, Venezuela.....
Diphaulaca meridae, new species.

Diphaltica nitida (Jac. 1883, Biol. Centr.-Amer., Coleop., vol. 6, pt. 1, p. 265). Of this genotype we have two paratypes received from the Godman-Salvin collection and with these are associated a series from Cordoba, Mexico (Knab, 1907–8), and others from Costa Rica (Schild, Bergdorf, Ballou, Valerio, Nevermann), some of them labeled as on *Cestrum aurantiacum*. Numerous representatives of similar species are not specifically assigned. Jacoby suggests that *nitida* may be a synonym of *Haltica sallei* Harold 1876.

Hornaltica bicolorata (Horn 1889). The excellent description by Horn (Trans. Amer. Ent. Soc., vol. 16, p. 234) and the above-mentioned characters show this little-known species to be unrelated to *Diphaulaca*. *Orestioides* Hatch 1935 (Ent. News, vol. 46, p. 276), genotype *Crepidodera robusta* Lec., is closely related but differs in its arcuate aedeagus, regular elytral punctures, and sharply defined pronotal sulcus. The habits of *bicolorata* are unknown, but its habitat appears to be extensive. One of Horn's cotypes bearing his original label is from Bayou Sara, La.; and another from Detroit, Mich., also in the Hubbard and Schwarz collection, is probably the one from which he recorded that State. Several other specimens are from Fort Monroe, Va., and Coleta and Mobile, Ala.

Diphaulaca wagneri Harold 1875, Coleopt. Heft. 14, p. 5. Type locality, Guatemala. The black legs and abdomen, supposed to distinguish this species, appear in samples from Oaxaca to the Volcano of Chiriqui.

Diphaulaca aulica (Oliv. 1808, Ent. vol. 6, p. 678) is believed to be represented by only one male from its type locality, Cayenne, French Guiana.

Diphaulaca cordobae, new species. Type and 30 paratypes from Cordoba, V. C., Mexico, May 16, 1906, F. Knab; 4 paratypes, Rodriguez Clara, V. C., Mexico, June 20, 1929, on frijoles, A. Dampf; 6 paratypes, St. Lucrecia, V. C., June 21, 1905, F. Knab. Other samples, probably of this species, are labeled Tuxtepec, Oax., Almoloya, Oax., Rincon Antonio, Oax., and Acapulco, in Mexico, but 2 males received from the Godman-Salvin collection, labeled "Atoyac, Vera Cruz, April, H. H. S.," may be mislabeled since they agree with the species below described from Venezuela.

Diphaulaca panamae, new species. Type and 11 paratypes collected on pole beans at Summit, C. Z., Panama, October 30, 1918, H. F. Dietz; 8 paratypes, Toboga Island, Panama, June 12, 1919, Dietz and Zetek; 3 paratypes, Ancon, C. Z., Panama, 1919, Molino and Zetek; 2 paratypes from leaves of red kidney bean, SW. Antioquia, Colombia, F. L. Galego M.

Diphaulaca meridae, new species. Type and 32 paratypes, Merida, Venezuela, S. Briceno; 11 paratypes, Merida, Venezuela (from duplicates of Bowditch collection); 10 paratypes, Trinidad, West Indies, June, 1905, August Busck; 4 paratypes, Aripo savana, Trinidad, October 26, 1918, H. Morrison; 1 paratype, Port of Spain, Trinidad, November 23, 1918, H. Morrison. Some other specimens from the type locality, also from Montserrat, Trinidad, June, 1905, Busck,

and from Caracas, Venezuela, Bro. Anthonius, and A. J. C. Rojas, are not suitable for definite study.

Diphaulaca volkameriae (F. 1792, Ent. Syst., vol. 1, pt. 2, p. 28), long cataloged as from Brazil, was originally described as living on *Volkamera aculeata* (now *Clerodendron*), a West Indian plant on which Wolcott 1936 (Jour. Agr. Univ. Puerto Rico, vol. 20, p. 275) records the similarly blue and red *Oedionychis bicolor* (L.) in Puerto Rico. Pflug, who collected the Fabrician type, was at St. Croix, where he died in 1785, but he had collected on other islands and perhaps on the Caribbean mainland. The Brazilian form recorded under this name as a pest of beans by Monte 1933 (abstract in Rev. Appl. Ent., A, vol. 22, p. 664) may be *striata* Klug. No West Indian sample agreeing with the Fabrician description is known to me.

Diphaulaca striata (Klug 1829, Preis-Verz. Ins.-doubl., Berlin, p. 9) of southern Brazil is represented by only two doubtfully identified females.

Diaphaulaca janthinipennis (Latr. 1832, Voy. Humbold., vol. 2, p. 24) has no recorded type locality. Its home may have been anywhere on the route which Humboldt traveled from the Guianas to Guayaquil and both coasts of Mexico, but its description does not conform as to sculpture and ventral coloration with species before me unless a few samples from Salvador, which are neither of the two new species listed from Central America, may represent this species.

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NEW NORTH AMERICAN GENERA AND SPECIES OF APTERYGOTAN INSECTS OF THE FAMILY JAPYGIDAE.

By H. E. Ewing,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

In recent years but little work has been done on the North American members of the Apterygotan family Japygidae. Nearly all the papers that have been published dealing with the North American species have been by the Italian entomologist, F. Silvestri, who has described a small number, chiefly from the Neotropical part of the continent. Under these circumstances the reporting in this paper of two new genera and three new species from North America should be of special interest.

The japygids described as new in this communication were all collected by W. F. Turner, of the Division of Fruit Insect Investigations, Bureau of Entomology and Plant Quarantine. They were obtained as soil inhabitants in a survey of the arthropods infesting the soils of peach orchards.

Order ENDOTROPHI.

Family Japygidae.

HEMIJAPYX, new genus.

Body sparsely clothed with short setae; no long tactile setae on abdomen.

Head with sides subparallel. Labium without palpi. Outer lamina of inner lobe of maxilla simple, long, setiform. Antenna with 18 segments; sense setae absent.

Thorax with a pair of straight, lateral, submarginal, tactile setae, considerably longer than the body setae, on each notum. Only the anterior ventral pair of thoracic spiracles present. Middle tarsal claw minute, sharply pointed.

Abdomen with segments VIII and IX of the usual shape. First abdominal sternum without median glandular organ. Subcoxal organ without microsetae, but with a row of five or six setae. Abdominal segments II and III each with a pair of large vesicles. Styli each with basal spur. Spiracles on segment VII circular, slightly enlarged. Tergum VI subequal to VII; tergum VII with outwardly rounded lateral margins and rounded posterolateral corners; tergum VIII about as long as VII, with posterolateral corners rounded. Forceps with similar arms, each of which has but a single articulating acetabulum, a single tooth and no denticles.

Type species.—*Hemijapyx unidentatus*, new species.

Remarks.—Only the type species is included in this new genus, which is unusual in that the arms of the forceps each has but a single tooth and no denticles and each is provided with but a single articulating acetabulum. Each of these arms is more of less fanglike, or resembles probably more closely the sting of a scorpion. They are excellently adapted for piercing the body walls of small arthropod victims upon which the species doubtless feeds.

This genus should have a position among the more primitive of the family, because of the following characters: The small number of segments in the antennae; the absence of sense setae from the same; and the absence of the median glandular organ.

Hemijapyx unidentatus, new species.

Plate 8, Figures 1, 2, 3.

Head subquadrangular, slightly longer than broad. Segment I of antenna as broad as long; segment II as long as I but not so broad; segments III and IV each with a single whorl of setae; segment XVI with two whorls of setae, XVII with three very irregular whorls and XVIII studded with setae, forming, however, only one distinct whorl, which is at the base. Mandible with proximal lobe formed into a bladelike projection; between it and distal clawlike tooth are two large teeth and five smaller ones as shown in figure 1. All but outer lamina of inner lobe of maxilla pectinate as usual, but outer lamina similar to a long, stout, curved seta, and extending almost to tip of strong maxillary claw.

Pronotum about as broad as long, with anterior transverse row of six setae including the two submarginal tactile setae and posterior transverse row of four similar but somewhat shorter setae, in addition to two small, short, lateral, marginal setae on each side. Mesonotum divided by a transverse suture, in front of which is situated a single pair of submedian setae. Metanotum larger than mesonotum, transverse suture very distinct. In front of transverse suture of metathorax are situated four rather small, submedian setae arranged in a transverse row and four submarginal microsetae (two on each side) situated near transverse suture not far from lateral margins of body. Legs equal; tarsal claws of a single pair equal.

Abdomen with first seven segments of about equal width and similar in shape; segment VIII quadrangular, slightly longer than broad; IX almost twice as broad as long but not so broad as VIII; X about one and a half times as long as broad and well sclerotized and pigmented. Each stylus with an inner, subbasal, curved seta in addition to outer basal spur. Each subcoxal organ occupying about one-fourth of posterior margin of sternum I and bearing five or six subequal, curved setae arranged in a transverse row. A pair of vesicles on abdominal segments I, II and III; those on II and III large and conspicuous. Abdominal segments I to VII each with a small pair of spiracles, those on VII being somewhat larger than the others. Forceps almost as long as segment X; each arm with a single articulating acetabulum which is entirely lateral; arms subequal, each with subbasal tooth very sharply pointed, setae of varying lengths as shown in figure 3.

Length of body including forceps, 2.90 mm.; width (that of abdominal segments III and IV), 0.25 mm.

Type locality.—Escambia County, Alabama.
Type (holotype).—U. S. N. M. No. 54394.
Remarks.—Description based upon two adult specimens taken in peach orchard soil July 10, 1936, by W. F. Turner (T–322). These adults are probably females, since the genitalia are very simple and there are no secondary sexual characters such as median foveae.

MIOJAPYX, new genus.

Body sparsely clothed with short, straight setae, but longer tactile setae also present.

Head with straight lateral margins which slightly diverge posteriorly. Labium without palpi. Outer lamina of inner lobe of maxilla simple, long, setiform. Antenna with 20 or 21 segments; sense setae absent.

Thorax with two pairs of straight, lateral, submarginal, tactile setae on each notum. Anteroventral pair of thoracic spiracles present; other thoracic spiracles absent. Middle tarsal claw of all legs minute to vestigial.

Abdomen with segments VIII and IX of the usual shape. First abdominal sternum without median glandular organ. Subcoxal organ with one row of setae and one row of microsetae. Abdominal segments II and III, as well as all following segments, without vesicles. Styli without basal spur. Spiracles on segment VII circular, slightly, if at all, enlarged. Tergum VI subequal to VII; tergum VII with outwardly rounded lateral margins and non-acute posterolateral corners; tergum VIII about as long and as wide as VII but with parallel lateral margins. Forceps with similar arms, each having an almost straight inner margin provided with medium-sized, irregularly-shaped, sharp teeth.

Type species.—*Miojapyx americanus*, new species.
Remarks.—Only the type species is included in this new genus, which is most nearly related to *Parajapyx* Silvestri. It differs from *Parajapyx* in that the styli are without the basal spur and abdominal segments II and III are without vesicles.

Miojapyx americanus, new species.

PLATE 8, FIGURES 4, 5, 6.

Head about as broad as long; lateral genal margins broadly rounded. Antenna with 21 segments; segment I fully as broad as long; segment II longer than I but not so broad; segments III to V each with several setae which are not arranged in a whorl; segment VI and several segments immediately distal to it, each with setae arranged in a whorl; end segment and several segments proximal to it each studded with setae which do not form as much as one whorl. Mandible with inconspicuous proximal lobe which is not formed into a tooth or blade; distal tooth long, curved, clawlike, considerably exceeding the others. All but

outer lamina of inner lobe of maxilla strongly curved and pectinate; but outer lamina long, curved, and setalike.

Pronotum but slightly longer than broad, with anterior curved row of six setae, including the four longer tactile ones, and a single posterior pair of discal setae. Mesonotum divided near its anterior end by a slightly curved transverse suture, in front of which is situated a single pair of straight, submedian setae. Metanotum similar to mesonotum and with similar arrangement of setae. Legs equal or about so; tarsal claws of each pair not quite equal.

Abdomen with first seven terga subequal, each divided by a transverse groove or line near its anterior end, in front of which is situated a single pair of submedian setae. Each of first seven sterna divided by a similar transverse groove, but the groove is situated farther caudad and in front of it is a transverse row of several setae. Segment I with two subcoxal organs occupying about two-thirds distance between the styli, each with four or five setae in the transverse row. Styli each with an inner subbasal, curved seta. Segment IX of abdomen about one-half as long as VIII; segment X with dorsum quadrangular and distinctly longer than broad. Arms of forceps shorter than segment X, but broad at base; each armed with about ten unequal, slightly curved, sharp teeth. Setae on each arm of forceps varying much in size and length, about six of the smaller ones arranged in a submarginal row near bases of teeth.

Length of body including forceps, 2.70 mm.; width (that of abdominal segments III and IV), 0.24 mm.

Type locality.—Saluda County, South Carolina.

Type (holotype).—U. S. N. M. No. 54395.

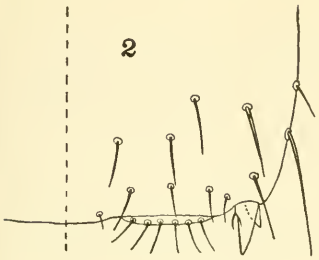
Remarks.—Description based on a single adult, in perfect condition, taken in peach orchard soil, August 6, 1936, by W. F. Turner (T–552).

Japyx turneri, new species.

Plate 8, Figure 7.

Female.—Head about as long as broad, with sides slightly rounded outwardly. Antenna with 33 or 34 segments; segment I broader than long; II not so broad as I but longer; IV with two dorsal and one ventral sensory setae; V and VI each with two dorsal, one lateral and one ventral sensory setae. Antennal segments I to VI with setae irregularly placed; segments VII to XIV each with setae arranged in a single whorl; segments beyond XIV, except for the last two, with two whorls each, the more distal of which may be incomplete; last two segments well studded with setae not arranged in definite whorls. Mandible with five simple teeth; base of mandible slightly more forward than base of maxilla. All laminae of inner lobe of maxilla pectinate, but distal one more slender and with teeth set at an acute angle.

Pronotum with five pairs of long setae, four being submarginal, and four pairs of very small setae, one pair being very near lateral margins. Mesonotum with distinct, movable prescutum, which is provided with posterolateral, condylic plates, articulating with thickened front margin of scutum; prescutum with a pair of small, submedian setae and several very short and very sharply pointed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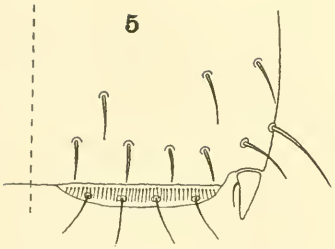
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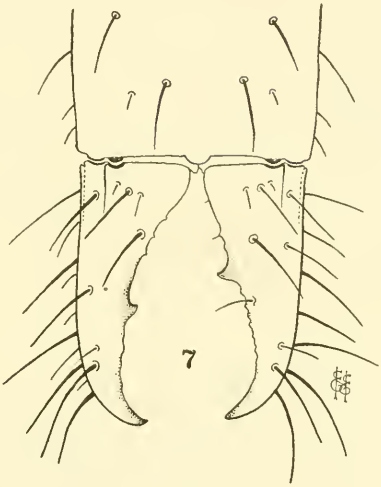
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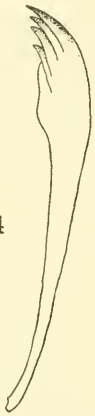
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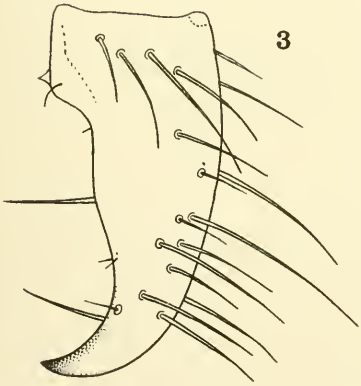
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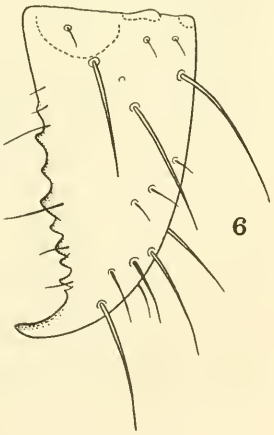
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microsetae on each condylic plate; scutum of mesonotum with a pair of internal, posteriorly convergent, apodemal ridges. Metanotum similar to mesonotum but slightly larger. Mesothorax and metathorax each with a dorsal and a ventral pair of spiracles in their usual positions. Legs increasing slightly in size from the first pair backward; tarsal claws of each pair unequal; middle tarsal claw much reduced on front tarsi only.

Abdomen with first seven terga subequal, each divided by a transverse groove near the front margin and by a median suture. Each of first seven sterna divided by a similar transverse groove, but groove is situated farther caudad and there is no median suture. Segment I with rather small median glandular organ which contains about eight subequal, contiguous disculi. Subcoxal organs of segment I each occupying about one-fifth the distance between the styli and each bearing a row of six curved setae and a row of microsetae. Styli each with a subbasal, curved seta and usually with a small to vestigial basal spur. Segment IX of abdomen about one-half as long as VIII; segment X with tergum subquadrangular, the straight sides converging slightly posteriorly, and provided with a median, posterior, semicircular process as shown in figure 7. Arms of forceps very slightly dissimilar but to be regarded as of the "similar" type and almost as long as segment X of abdomen; dorsal articulating acetabulum of each arm heavily sclerotized, inner in position to ventral acetabulum but similar to the latter; setae and teeth of forceps as shown in figure 7.

Length of body including forceps, 5.26 mm.; width (that of abdominal segments III and IV), 0.65 mm.

Male.—Unknown.

Type locality.—Upson County, Georgia.

Types.—U. S. N. M. No. 54396.

Remarks.—Description based on two females, one of which was taken in peach orchard soil at the type locality, July 6, 1936, by W. F. Turner (T-244) and the other in a similar situation by the same collector, in Saluda County, South Carolina, August 5, 1936 (T–534). An immature individual, not considered in the description of the species, was taken at the type locality by Turner.

This species is similar to *J. intercalatus* Silvestri but has 33 or 34 segments in each antenna while Silvestri's species has only 28. Also there are fewer disculi in the median glandular organ in *turneri* than in *intercalatus*.

Explanation of Plate.

(All drawings of equal magnification except no. 7, which is less magnified than the others.)

Fig. 1. *Hemijapyx unidentatus*, new genus and species; dorsal view of mandible.

Fig. 2. *Hemijapyx unidentatus*, new genus and species; ventral view of posterolateral aspect of abdominal sternum I.

Fig. 3. *Hemijapyx unidentatus*, new genus and species; dorsal view of right arm of forceps.

Fig. 4. *Miojapyx americanus*, new genus and species; dorsal view of right mandible.

Fig. 5. *Miojapyx americanus*, new genus and species; ventral view of posterolateral aspect of abdominal sternum I.

Fig. 6. *Miojapyx americanus*, new genus and species; dorsal view of right arm of forceps.

Fig. 7. *Japyx turneri*, new species; dorsal view of posterior part of tenth abdominal segment and the forceps.

THE GENUS ECTECEPHALA IN NORTH AMERICA (DIPTERA, CHLOROPIDAE).[1]

By Curtis W. Sabrosky,[2]
Michigan State College.

The genus *Ectecephala* Macquart, originally founded for the North American species *Ectecephala albistylum* Macquart, appears to represent a Neotropical element or derivative in the fauna of the Eastern United States. Approximately 25 specific names are available in the genus, of which seven names are Nearctic and fall within the scope of the present paper. If we follow Malloch's implication (1938, Proc. Linn. Soc. N.S. Wales, LXIII, p. 337) and limit the genus to those species possessing hairs on the posterior portion of the mesopleura, the genus *Ectecephala s. str.* in North America will contain *albistylum* Macq., *laticornis* Coq., *sulcifrons* Coq., and *sulcata* Sabrosky, new species.

The North American species referred to in the literature as *Ectecephala capillata* (Coq.) (See Becker, 1912, Ann. Mus. Nat. Hung., X, p. 71; Sabrosky, 1935, Trans. Amer. Ent. Soc., LXI, p. 235; and Brimley, 1938, Insects of North Carolina, p. 387) was found to be *Chlorops unicolor* Loew. The type of Coquillett's species is from Nicaragua, and I propose to restrict the use of *capillata* to that form; the paratypes from Georgia and North Carolina should be referred to *C. unicolor*. From the type in the Naturhistorisches Museum at Vienna I find that *Ectecephala similis* Becker is also a synonym of *unicolor*. In both *unicolor* and *capillata* Coq. *s. str.*, as well as in several Neotropical forms described as *Ectecephala*, the mesopleura is glabrous, entirely lacking the fine hairs possessed by the geno-

[1] Journal Article No. 425 (n.s.) from the Michigan Agricultural Experiment Station.

[2] The writer is greatly indebted to a large number of institutions and collectors for the loan of material for study, and particularly to Mr. David G. Hall of the U. S. National Museum for his kindness in making available for study the long series of specimens accumulated by Dr. J. M. Aldrich. He also wishes to thank Mr. Nathan Banks for rechecking specimens with the type of *Chlorops unicolor* Loew. Study of other types involved was aided by Grant No. 352 from the Bache Fund of the National Academy of Sciences and by a Grant-in-Aid from the Permanent Science Fund of the American Academy of Arts and Sciences.

type and its related species. Decision as to whether these deserve separate generic or subgeneric recognition will best be held in abeyance until a complete generic revision of the Chloropinae can be completed, and until the Neotropical species can be thoroughly studied. For the sake of reference, the synonymy and distribution of *unicolor* is as follows:

Chlorops unicolor Loew. 1863. Berl. Ent. Zeit., VII, p. 51. (Cent. III, No. 93). (Miss.)

= *Chlorops capillata* Coquillett, in part. 1904. Proc. Ent. Soc. Wash., VI, p. 98. (Paratypes, Ga. and N. C.)

= *Ectecephala capillata* Coquillett of authors (North American records).

= *Ectecephala similis* Becker. 1912. Ann. Mus. Nat. Hung., X, p. 72. (North America). New synonym.

Distribution: *Alabama:* Prattsville (Kans. Univ.). *Arkansas:* Fayetteville (Ark. Univ.) and Polk Co. (Kans. Univ.). *Florida:* Gainesville (Univ. Mich. Mus. Zool.) and "Florida" (Purdue Univ.). *Georgia:* Spring Creek in Decatur Co. (Cornell Univ.). *Illinois:* Ashley, DuBois, Havana, Meredosia (Ill. Nat. Hist. Surv.). *Indiana:* Crawford Co. (Purdue Univ.) and Daviess Co. (U. S. Nat. Mus.). *Kansas:* Manhattan (Kans. State Coll., and Sabrosky Colln.) and Stafford Co. (Sabrosky Colln.). *Louisiana:* Lake Charles (Sabrosky Colln.), Opelousas (Hough Colln., Field Museum), Red River Parish (Kans. Univ.) and Winnfield (Univ. Mich. Mus. Zool.). *New York:* Long Island (Mus. Roy. Hist. Nat. Belgique). *North Carolina:* Raleigh (N. C. Dept. Agr.). *Oklahoma:* Broken Bow (Oklah. A & M Coll.) and Le Flore Co. (Kans. Univ.). *Texas:* Cameron Co. (Kans. Univ.) and Houston (Sabrosky Colln.).

Key to the North American Species of Ectecephala s. str.

(mesopleura with hairs.)

1. Frontal triangle with a distinct, deep median sulcus, extending from the median ocellus nearly to the apex of the triangle 2
– Triangle not sulcate 3
2. Large species (4–5 mm.); darker species, with black mesonotal stripes and several black spots on the pleura; clypeus shining black ..... *sulcifrons* Coq.

Smaller species (3¼–3½ mm.); paler species, with yellow ground color and deep yellow to reddish mesonotal stripes, a broad reddish stripe extending from the humerus across the upper half of each pleuron and along the venter of the abdomen; clypeus reddish yellow ..... *sulcata* Sabrosky, new species.

3. Palpi yellow; third antennal segment elongate and narrowed apically, about twice as long as its greatest breadth ..... *albistylum* Macq.
– Palpi black; third antennal segment shorter, not narrowed apically, about 1½ times as long as broad ..... *laticornis* Coq.

Ectecephala albistylum Macq.

Ectecephala albistylum Macquart. 1850. Dipt. Exot., Suppl., IV, (2), p. 280. (North America.)

Ectecephala laevifrons Becker. 1912. Ann. Mus. Nat. Hung., X, p. 153. New synonym, in part (North America).

Becker described *E. laevifrons* in his monograph of Neotropical Chloropidae, from Paraguay and Argentina, with a mention of specimens from Kansas and Texas. The North American specimens appear to be only dark examples of typical *albistylum*, but the name *laevifrons* may still be retained for the South American form.

Albistylum is the genotype of *Ectecephala* Macquart (monobasic).

DISTRIBUTION: eastern United States, New Jersey to Colorado, Texas and Florida. *Arkansas:* Fayetteville (Ark. Univ.) and Washington Co. (Kans. State Coll.). *Colorado:* Crowley (M. T. James). *District of Columbia:* Washington (U. S. Nat. Mus.). *Florida:* Hilliard (Kans. Univ.) and Orlando (U. S. Nat. Mus.). *Illinois:* Algonquin and Danville (U. S. Nat. Mus.), Champaign Co. (Canad. Nat. Colln.), Chicago (A. L. Melander Colln.), Urbana (Amer. Mus. Nat. Hist.); Alto Pass, Dongola, DuBois, Havana, and Meredosia (Ill. Nat. Hist. Surv.). *Indiana:* East Chicago (Field Museum), and Lafayette (U. S. Nat. Mus., and Canad. Nat. Colln.). *Iowa:* Sioux City (Univ. Minn.), and Des Moines, Makaska, and Muscatine Counties (Iowa Wesleyan Coll.). *Kansas:* Published records of nearly 100 specimens from eleven counties (Sabrosky, 1936, Trans. Amer. Ent. Soc., LXI, p. 236), also Baldwin and Lawrence (U. S. Nat. Mus.). *Maryland:* Plummer's Island (U. S. Nat. Mus.). *Michigan:* South Haven and Shelby (Sabrosky Colln.). Cass Lake (Geo. Steyskal), East Lansing (H. E. Milliron). *Minnesota:* Anoka and Scott Counties, and North Branch (Univ. Minn.). *Mississippi:* Shuqualak (Kans. Univ.). *Missouri:* Atherton (Purdue Univ.), Atherton and Kansas City (Ark. Univ.). *Nebraska:* Cambridge (Mus. Comp. Zool., Harvard), Fremont (Cornell Univ.), and "Neb." (U. S. Nat. Mus.). *New Jersey:* Trenton (Acad. Nat. Sci. Phila.). *North Carolina:* Raleigh and Blantyre (N. C. Dept. Agr.). *Pennsylvania:* "Pa." (U. S. Nat. Mus.) and Harrisburg (Mus. Comp. Zool. Harvard; also a published record by Walton, 1911, Ent. News, XXII, p. 321). *South Dakota:* Elk Point, bred from *Cenchrus* sp. (U. S. Nat. Mus.); Elk Point, Springfield, and Yankton (S. Dak. State Coll.). *Tennessee:* Knoxville (U. S. Nat. Mus.). *Texas:* College Station (Texas A & M Coll.); Eastland, Jackson, Jim Wells, and Victoria Counties (Kans. Univ.); Cibolo River at Sutherland Springs (Sabrosky Colln.); Victoria, Cuero, and Dallas (U. S. Nat. Mus.). *Virginia:* Falls Church and Great Falls (Mus. Comp. Zool., Harvard); Veitch, Mathias Point, and Difficult Run (U. S. Nat. Mus.).

Ectecephala laticornis Coq.

Ectecephala laticornis Coquillett. 1910. Canad. Ent. XLII, p. 46. (Colo., Ga., N. C.)

A well-marked species, of whose identity there has been no question.

DISTRIBUTION: Eastern United States, New York to Colorado and Georgia. *Colorado:* Ft. Collins (Colo. State College, and U. S. Nat. Mus.). *Georgia:* paratype (U. S. Nat. Mus.). *Kansas:* Published records from eleven counties (Sabrosky, 1936, op. cit., p. 235). *New York:* Babylon (F. S. Blanton). *North Carolina:* paratype (record repeated by Brimley, 1938, "Insects of North Carolina"). *South Dakota:* Canton, Springfield, Waubay, and Winner (S. Dak. State Coll.).

Ectecephala sulcifrons Coq.

Ectecephala sulcifrons Coquillett. 1910. Canad. Ent., XLII, p. 46. (Kansas.)

Other than the type series (two specimens, Arkansas City and Kinsley, Kansas), no specimens have been seen which could positively be associated with *sulcifrons*. Specimens from Turkey Creek and the Santa Rita Mts., Arizona (Kans. Univ.) are very close and probably represent the species.

Ectecephala sulcata Sabrosky, new species.

Yellow species with reddish triangle, mesonotum, and dorsum of abdomen.

♂, ♀. Head pale yellow, face and cheeks whitish, front deep yellow, browned laterally near the bases of the antennae, ocellar tubercle black, frontal triangle with a broad red stripe on each side extending forward from the base nearly to the apex, the stripes merging on the lower 2/5 or more of the triangle, leaving only the apex and a small triangular area surrounding the ocelli yellow. Two narrow red lines extend ventrad on the occiput from the basal angles of the triangle and join a broad red transverse band which reaches from eye to eye midway on the occiput. Apical 2/5 to half of the third antennal segment black, the antennae otherwise yellow, basal segments slightly darkened and the arista white. Palpi pale yellow, clypeus and proboscis deep yellow. Front slightly wider than an eye, and projecting slightly but distinctly beyond the anterior margin of the eyes. Triangle long and moderately narrow, at its base distinctly separated from the eyes, the acute apex reaching the anterior margin of the front; moderately convex above the flatness of the front, a distinct median sulcus extending from the median ocellus about 3/4 the length of the triangle. Eyes apparently bare, but under high magnification with short sparse hairs; longest diameter of eyes slightly oblique. Height of cheeks subequal to the breadth of the third antennal segment and less than 1/3 the height of the eyes. Face receding in profile, the vibrissal angle obtuse and rounded. Oral opening small, palpi weak, proboscis short and fleshy. Antennae porrect, second segment slightly elongate, the third segment nearly 1½ times as long as wide, slightly concave dorsally. The arista appears thick and white because of dense short

hairs, the basal segment enlarged. Bristles black but short and inconspicuous; the usual inner and outer verticals, proclinate divergent ocellars, and strongly proclinate, parallel postverticals. The red lateral stripes of the triangle each with two rows (sometimes as three irregular rows) of black hairs set in fine punctures, leaving the yellow central area smooth and glabrous. The few weak fronto-orbital and frontal hairs are brown and inconspicuous, as are the pale vibrissae and hairs along the lower margin of the cheeks.

Thorax: notum reddish, broadly pollinose on the dorsocentral lines and between the humeri and the wing bases, giving the appearance of three broad shining stripes and two shining supra-alar vittulae, the median stripe abbreviated posteriorly by the pollinose posterior slope of the mesonotum. Scutellum triangular, apically rounded, the disk reddened. Pleura bright yellow, each pleuron with a broad red stripe extending across the lower half of the humerus, upper half of the mesopleura, most of the pteropleura, and except for a slight break at the base of the halteres, continuing as an equally broad red stripe along the ventral margin of the tergites to the apex of the abdomen. Sternopleural spot orange, inconspicuous. Metanotum orange, subshining but thinly covered with bright pollen. Thoracic bristles black, slender: 1 humeral, 1 + 2 notopleural, 1 postalar, 1 posterior dorsocentral, and 1 subapical and 1 apical pairs of scutellars. Notum and disk of scutellum rather thickly beset with short dark hairs, each set in a fine puncture. Mesopleura with a few pale hairs near the upper posterior margin.

Dorsum of the abdomen dark reddish to brown, distal margins of the posterior segments narrowly yellow in some specimens. Sides of the abdomen yellow, appearing as a broad yellow stripe between the dark dorsum and the narrow red stripe along the ventral margins of the tergites. Venter membranous, yellow. The numerous hairs are dark and short.

Legs entirely bright yellow, with black claws.

Wings hyaline, not browned, veins brown and strong except for the ultimate section of the fourth vein. Second costal sector distinctly longer than the third sector (1¼–1½ times), the third longer than the fourth sector. Third and fourth veins divergent from their bases, the third vein practically straight. Fore cross-vein as a rule enters the discal cell slightly but distinctly distad the middle of the cell. Knob of halteres cream-white, the pedicel brown.

Length, 3.25–3.5 mm.

KNOWN DISTRIBUTION: Eastern and east central United States.

Holotype, ♂, Lafayette, Indiana, Aug. 5 (J. M. Aldrich). Allotype, same locality, Sept. 9, 1916 (J. M. Aldrich). Type and allotype in the United States National Museum. 49 paratypes: *Arkansas:* 2 ♀, Fayetteville, July 3 and 5, 1906 (Ark. Univ.). *District of Columbia:* 1 ♀ (?), Bennings, June 14 (J. M. Aldrich) U. S. Nat. Mus.). *Illinois:* 1 ♀, Bluffs, Aug. 19, 1917; 4 ♀, Dubois, Aug. 8 and 9, 1917; 1 ♀, Urbana, June 18, 1915 (on flowers of dogwood) (Ill. Nat. Hist. Surv.). *Indiana:* 7 ♂, 10 ♀, Lafayette, various dates, June 27 to Sept. 9, 1914 to 1918 (J. M. Aldrich) (U. S. Nat. Mus.); 1 ♀, Daviess Co., Aug. 8,

1938 (M. C. Reeves) (U. S. Nat. Mus.); 1 ♂, Crawford Co., Sept. 30, 1934 (Purdue Univ.). *Iowa:* 1 ♂, Muscatine Co., June 14, 1936 (B. Berger) (Iowa Wesleyan Coll.). *Kansas:* 1 ♀, Douglas Co. (F. H. Snow) (Snow Colln., Kansas Univ); 1 ♂, Lawrence, June (E. S. Tucker; at twilight) (Hine Colln., Ohio State Univ.). *Louisiana:* 1 ♀, Opelousas, April, 1897 (Hough Colln., Field Museum); 1 ♂, Tallulah, July 15, 1925 (R. H. Painter). *Michigan*: 1, Detroit, June 19, 1938 (Geo. Steyskal). *Mississippi:* 1 ♀, Lincoln Co., May 27, 1938 (W. F. Turner) (U. S. Nat. Mus.). *Missouri:* 6 ♂, 4 ♀, Atherton, May 21, to June 18, 1922 (C. F. Adams) (Purdue Univ.). *Ohio:* 1 ♂, 2 ♀, Columbus, May 28, June 5, 1925 (R. H. Painter) Painter, Sabrosky Colln). *Tennessee:* 1 ♀, Knoxville, May 21, 1891 (H. E. Summers) (U. S. Nat. Mus.)

Except for the sulcate triangle, the species is superficially similar to *Chlorops unicolor*, but the latter has no hairs on the mesopleura, the antennae are slightly less elongate, and the third and fourth veins are more divergent. The resemblance is sometimes quite marked, because *unicolor* frequently has a median reddish streak on the triangle in the same position as the median sulcus, and with a similar appearance under low magnification. In the structure of the triangle and antennae, presence of mesopleural hairs, and general structure of the body, *sulcata* is most closely related to *E. laticornis* Coq., from which it differs by yellow palpi, lighter body color, and smaller average size.

SOME EARLY BUTTERFLY RECORDS FROM GEORGIA.

By Austin H. Clark and Leila F. Clark.

Mr. Herbert S. Barber has been so kind as to call our attention to photostat copies of the eleven catalogues of public sales of insects published by Johann Karl Megerle [von Mühlfeld] (1765–1840) in Vienna from 1801 to 1805, which were procured for the library of the United States Department of Agriculture by the late Dr. Walter Horn of Berlin-Dahlem.

The first two catalogues include no names of North American butterflies, but beginning with the catalogue for the sale scheduled for November 9, 1802, the names of many southern species are mentioned.

In the few cases in which a definite habitat is given it is "Georg[ia]." Presumably all these specimens came from Georgia, whence they were sent to Herr Megerle by John Abbot, at that time a resident of Jacksonborough, county seat of Scriven (now Screven) County, situated on Beaver Dam creek near its junction with Brier creek. Jacksonborough was

abandoned shortly after 1847 when the public buildings were removed to Sylvania, the present county seat.

Abbot sent many butterflies and colored drawings to Europe and descriptions of his specimens and reproductions of his drawings were published by several authors, chiefly by Sir James Edward Smith (1797), Jacob Hübner (1806–1824), and Dr. J. A. Boisduval and Major John E. LeConte (May 2, 1829–July 24, 1837).

The pages in Megerle's catalogues are not numbered, but there is a number before each of the species listed. The titles of the several catalogues, and the species included in each, are as follows:

CATALOGUS INSECTORUM QUAE VIENNAE AUSTRIAE DIE IX ET SEQUENTIBUS NOVEMBRIS MDCCCII. AUCTIONIS LEGE DISTRAHUNTUR.

Papilio

401 *Archippus* = *Basilarchia archippus*

APPENDIX AD CATALOGUM INSECTORUM, QUAE MENSE NOVEMBRIS MDCCCII. VIENNAE AUSTRIAE AUCTIONIS LEGE VENDITA FUERE.

Papilio

64 *Ajax* = *Papilio marcellus*
96 *Genutia* = *Anthocharis genutia*
115 *Nicippe* = *Eurema nicippe*
128 *Proteus* = *Goniurus proteus*
135 *Troilus* = *Papilio troilus*

CATALOGUS INSECTORUM QUA VIENNAE AUSTRIAE DIE 28. NOVEMBRIS 1803 AUCTIONIS LEGE DISTRAHUNTUR.

Papilio

330 *Ajax* = *Papilio marcellus*
344 *Archippus* = *Basilarchia archippus*
345 *areolatus. Sm.* = *Neonympha areolatus*
360 *Catullus* = *Pholisora catullus*
389 *Genutia* = *Anthocharis genutia*
390 *Glaucus* = *Papilio glaucus*
401 *Ilioneus* = *Papilio troilus* var. *ilioneus*
430 *Monuste* = *Ascia monuste*
434 *Nicippe* = *Eurema nicippe*
436 *notatus. M. ex. Georg. Maj. Hecabe. Alae. antic. nig. fasc. flav. nig. notat. posti. flav. margin. nig. subt. flav. ocell. argent.* 6.[1] = *Colias philodice philodice*
447 *Philenor* = *Papilio philenor*
453 *Plexippus* = *Danaus plexippus*
454 *Polydamas* = *Papilio polydamas*

480 *Thoas* = *Papilio cresphontes*
481 *Troilus* = *Papilio troilus*
483 *Turnus* = *Papilio glaucus*
487 *Vanillae* = *Dione vanillae incarnata*

CATALOGUS INSECTORUM QUAE VIENNAE AUSTRIAE DIE XX. ET SEQUENTIBUS SEPTEMBRIS MDCCCIV. AUCTIONIS LEGE DISTRAHUNTUR.

Papilio

460 *Accius. Sm.* = *Lerema accius*
468 *Ajax* = *Papilio marcellus*
488 *Archippus* = *Basilarchia archippus*
489 *areolatus. Sm.* = *Neonympha areolatus*
512 *Catullus. Sm.* = *Pholisora catullus*
523 *Claudia. C.* = *Euptoieta claudia*
527 *Clyton. H.* = *Asterocampa clyton*
529 *Calanus Zi. Aff. et Magn. Lincei.*[2] = *Strymon falacer*
550 *Eubule* = *Phoebis eubule*
556 *Gema. Zi. ex. Georg. Aff. areolati.* = *Neonympha gemma*
557 *Genutia. C.* = *Anthocharis genutia*
558 *Gorgonia. Zi. ex Georg. Aff. Tharos.* = *Phyciodes phaon*
572 *Huntera. F.* = *Vanessa virginiensis*
583 *Iuvenalis. F.* = *Erynnis juvenalis*
584 *Ladon. C.* = *Lycaenopsis argiolus pseudargiolus*
601 *macropus. Zi. ex Georg. Aff. Iuvenali.*[3] = *Erynnis ? brizo*
606 *melinus. Zi. ex Georg. Aff. W. latino.*[4] = *Strymon melinus*
618 *Nicipe* = *Eurema nicippe*
619 *Niphon. Zi. ex Georg. Magn. Lincei.*[2] = *Incisalia niphon*
634 *Philenor* = *Papilio philenor*
641 *Plexippus* = *Danaus plexippus*
642 *Polydamas. C.* = *Papilio polydamas*
648 *Polyxenes. F.* = *Papilio polyxenes asterius*
654 *Proteus* = *Goniurus proteus*
669 *Syrichtus. F.* = *Pyrgus communis*
674 *Tharos. C.* = *Phyciodes tharos*
676 *Troilus* = *Papilio troilus*
679 *Turnus* = *Papilio glaucus*
685 *Vanillae* = *Dione vanillae incarnata*
687 *Vitellius* = *Atrytone logan*

APPENDIX AD CATALOGUM INSECTORUM QUAE MENSE SEPTEMBRIS MDCCCIV. VIENNAE AUSTRIAE AUCTIONIS LEGE VENDITA FUERE.

Papilio

438 *Illioneus* = *Papilio troilus* var. *ilioneus*

CATALOGUS INSECTORUM QUA VIENNAE AUSTRIAE DIE JUNII MDCCCV. AUCTIONIS LEGE DISTRAHUNTUR.

Papilio

519 *Accius. Sm.* = *Lerema accius*
547 *Archippus* = *Basilarchia archippus*
548 *areolatus. Sm.* = *Neonympha areolatus*
551 *Argiolus. Sm.* = *Lycaenopsis argiolus pseudargiolus*
576 *Catullus. Sm.* = *Pholisora catullus*
585 *Claudia C.* = *Euptoieta claudia*
591 *Clyton, H.* = *Asterocampa clyton*
592 *Calanus. Zi.* = *Strymon falacer*
621 *Eubule* = *Phoebis eubule*
631 *Gema. Zi.* = *Neonympha gemma*
632 *Genutia C.* = *Anthocharis genutia*
635 *Glaucus* = *Papilio glaucus*
654 *Huntera* = *Vanessa virginiensis*
664 *Illioneus* = *Papilio troilus* var. *ilioneus*
668 *Juvenalis* = *Erynnis juvenalis*
669 *Ladon. C.* = *Lycaenopsis argiolus pseudargiolus*
686 *Lycidas. Sm.* = *Achalarus lyciades*
689 *Macropus. Zi.*[3] = *Erynnis ? brizo*
696 *Melinus. Zi.* = *Strymon melinus*
704 *Niphon. Zi.* = *Incisalia niphon*
725 *Philenor* = *Papilio philenor*
733 *Plexippus* = *Danaus plexippus*
734 *Polydamus. C.* = *Papilio polydamas*
739 *Polyxenes* = *Papilio polyxenes asterius*
743 *Proteus* = *Goniurus proteus*
761 *Syrichtus* = *Pyrgus communis*
767 *Tharos* = *Phyciodes tharos*
772 *Turnus. Ant. des.* = *Papilio glaucus*
777 *Vanillae* = *Dione vanillae incarnata*
779 *Vitellius* = *Atrytone logan*

NOTES.

1. *Papilio notatus* Megerle, 1803, appears to cover the same species as *Colias philodice* Godart, 1819. This is the only species occurring in Georgia suggesting *Eurema hecabe* but larger, with a black spot on the fore wing and with a silver ocellus on the under side of the hind wing. The figure 6 presumably refers to the number of specimens at hand.

2. *Lincei; Papilio linceus* Fabricius, a synonym of *Thecla ilicis* (Esper).

3. *Papilio macropus* Zi[egler], related to *juvenalis*, is probably *Erynnis brizo* (Boisduval and LeConte). Boisduval and LeConte named this species *Thanaos brizo* in 1833 on the basis of a colored drawing by John Abbot, which they published, showing the male and female, under side, larva and pupa, and

food plant (*Galactia glabella*). Abbot made drawings of both *juvenalis* and *brizo*, and probably sent specimens of both to Europe. We know of no publication by Ziegler.

4. *W. latinus;* this is *Thecla w-album.*

It is interesting to note that all but one of the species credited to Ziegler in the 1804 list (529 *Calanus*, 556 *Gema*, 558 *Gorgonia*, 606 *melinus*, and 619 *Niphon*), which are followed by non-diagnostic comparisons with European species, were subsequently published by Hübner. Whether Hübner obtained his specimens already named by Ziegler from Megerle can not be determined. Apparently Boisduval and LeConte, when they gave the name *brizo* to one of the species illustrated by Abbot, were unaware of Ziegler's name *macropus*.

Species Listed by Megerle.

Megerle's catalogues from 1802 to 1805 include the names of thirty-five species of butterflies from Georgia. These are the following:

Neonympha gemma (*Hübner*)
Neonympha areolatus (Smith)
Vanessa virginiensis (Drury)
Asterocampa clyton (Boisduval and LeConte)
Basilarchia archippus (Cramer)
Phyciodes tharos (Drury)
Phyciodes phaon (W. H. Edwards)
Euptoieta claudia (Cramer)
Dione vanillae incarnata Riley
Danaus plexippus (Linné)
Lycaenopsis argiolus pseudargiolus (Boisduval and LeConte)
Strymon falacer (Godart)
Strymon melinus (Hübner)
Incisalia niphon (Hübner)
Ascia monuste (Linné)
Anthocharis genutia (Fabricius)
Phoebis eubule (Linné)
Colias philodice philodice Godart
Eurema nicippe (Cramer)
Papilio philenor Linné
Papilio polydamas Cramer
Papilio polyxenes asterius Cramer
Papilio cresphontes Cramer
Papilio glaucus Linné
Papilio troilus Linné
Papilio troilus var. *ilioneus* Smith
Papilio marcellus Cramer
Goniurus proteus (Linné)
Achalarus lyciades (Geyer)

Pyrgus communis (Grote)
Pholisora catullus (Fabricius)
Erynnis ? brizo (Boisduval and LeConte)
Erynnis juvenalis (Fabricius)
Atrytone logan (W. H. Edwards)
Lerema accius (Smith)

THE AVOCADO MITE OF CALIFORNIA, A NEW SPECIES.

By E. A. McGregor,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

A species of spinning mite has been known to attack avocados in southern California for over a decade. A related species has attacked avocados and other trees in Florida for over thirty years. Since these two mites of avocado resemble one another superficially, entomologists and others have been identifying the California species as *Paratetranychus yothersi*, the name assigned to the Florida mite by the writer in 1914.[1]

At the time when *Paratetranychus yothersi* was described, the male genital structure had not been studied and was unknown. Rather recently male specimens were obtained from Florida and studied critically, together with males of the California form. This examination of the male characters revealed (see Figures 1, 2, and 3) that the California avocado mite is a distinct and undescribed species, and its description follows.

Paratetranychus coiti, new species.

Female.—Body outline widely ovate, about a third longer than wide. Dorsal armature consisting of 26 strong, pale bristles, distributed about as usual; not arising from tubercles. Greater portion of cephalothorax pale, rusty pink to pink; a pattern of darker spots and blotches occupies much of the lateral area and at times the median area of the abdomen, these blotches purplish brown to blackish brown; forelegs and palpi rusty pink, the other legs pale. Two carmine eye corneas on each side, just laterad of the subfrontal bristles. A series of measured females averaged 0.397 mm. long (tip of mandibular plate to hind body margin). Mandibular plate tapering gradually forward, and distinctly emarginate anteriorly. Dorsal suture separating cephalothorax and abdomen rather indistinct. "Thumb" of palpus much shortened axially, almost twice as thick as long, bearing at its tip a nonclavate "finger" which is about as thick as long; the dorsal sensilla is unusually slender and is situated unusually near the base of the "thumb"; the customary pair of tacklike digituli arise just dorsad of the terminal "finger"; a weak hair arises near the base of the dorsal sensilla, and a similar seta arises dorsally from the "thumb" at its base; a hair arises near the ventro-distal angle of the "thumb." Legs relatively short; foreleg longest, barely two-thirds length of body proper, four-fifths width of body;

[1] McGregor, E. A. "Four New Tetranychids." Ann. Ent. Soc. Amer., Vol. VII, No. 4, 1914.

well supplied with strong hairs. Relative lengths of the joints of foreleg as follows: Coxa, 18; trochanter, 16; femur, 28; patella, 18; tibia, 17; tarsus, 20. Tarsus I dorsally with 7 strong hairs and 2 weak hairs; tarsus II dorsally with 6 strong hairs and 1 weak hair; tarsi III and IV with only 4 hairs dorsally. Tip of tarsus (♀) bearing a simple claw, which is thick at base, straightish to about midpoint, where it bends downward about 90°; at a point about one-third the length of the claw from its base arise eight gently curving ventral spurs (in pairs) whose tips conspicuously exceed that of the main claw, the proximal pair being stronger; the usual four tenent hairs arise at the base of the main claw. Collar trachea for the most part a straightish tube, ending in a somewhat enlarged elliptical chamber. Egg oblate to lenticular, bearing dorsally a slender axial stalk which somewhat exceeds the axial diameter of the egg.

Male.—Much smaller than female; a measured series averaged 0.297 mm. (tip of mandibular plate to hind body margin). Body narrow, pointed behind. Color paler than that of female. Palpus bearing a spur dorsally on second joint. Tarsus of leg I of male with the main claw somewhat stouter and a little less abruptly bent than in female; at a point about one-fourth the length of the claw from its base arise three weak, straightish spurs which are surpassed by the main claw. Penis with inner lobe rodlike; a very weak basilar lobe dorsally, and a slightly stronger lobe ventrally at outer end of inner lobe. Shaft at point of origin a little thicker than inner lobe; middle portion bent upward about 60° from main axis of penis and very little narrowed; distal extremity bent backward and very abruptly narrowed; the thin tip barely truncated.

Type slide.—Cat. No. 1379, U. S. National Museum.

The type material is from Chula Vista, Calif., February 1, 1940, from avocado leaves, collected by Dean F. Palmer, deputy agricultural commissioner for San Diego County.

A mite was described by Ewing from avocado from Yarrow Experiment Station, Rockville, Md., as *Oligonychus major*, but is distinct from the California avocado mite. In the male genital characters the California species is perhaps closest to *Paratetranychus ununguis* Jac. and *P. ilicis* McG. The California avocado mite may be distinguished from the above three species as follows:

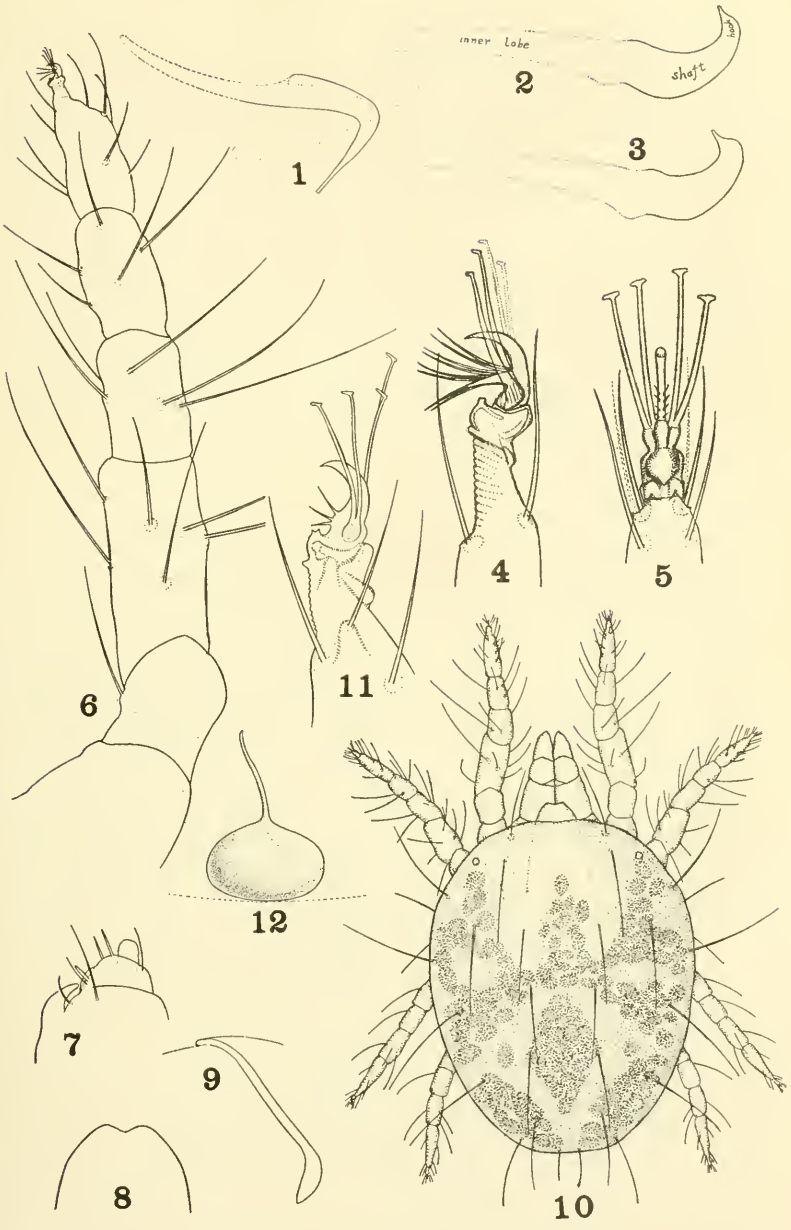
O. Major.

"Thumb" of palpus not surpassing the palpal claw; tarsal claw (♀) with 3 to 5 ventral spurs, these two-thirds as long as main claw; mandibular plate not emarginate.

P. ununguis.

Terminal "finger" of palpus almost twice as long as thick; tarsal claw (♀) with 10 to 12 ventral spurs, these barely equalling the main claw; mandibular plate not emarginate; inner end of collar trachea terminating in a globular chamber; hook of penis narrow-attenuate (Hirst) [2] recurved hardly 90°, about equalling shaft; egg globular.

[2] Widely truncate according to Zacher.


inner lobe
shaft
1
2
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P. ilicis.

"Thumb" of palpus almost as long as thick, exceeding the palpal claw; terminal "finger" noticeably clavate; tarsal claw with 6 ventral spurs, these about equalling the main claw; mandibular plate emarginate anteriorly; dorsal bristles arising from prominent tubercles; collar trachea terminating inwardly in a rectangular chamber; tarsus of leg I (♀) fully one-half again as long as tibia; penis with hook gradually acuminate to a sharp tip.

P. coiti.

"Thumb" of palpus almost twice as thick as long but much exceeding the palpal claw; terminal "finger" about as thick as long; tarsal claw (♀) with 8 ventral spurs, conspicuously exceeding the main claw; mandibular plate distinctly emarginate anteriorly; dorsal bristles not arising from prominent tubercles; hook of penis less than one-half length of shaft, extremely abruptly narrowed to the barely truncate tip, which is deflected slightly more than 90° from the axis of the penis; tarsus of leg I unusually short, barely longer than tibia; inner end of collar trachea terminating in an enlarged elliptical chamber.

This mite was first brought to the writer's attention in 1929, by J. Elliot Coit and P. E. Oliver, both then engaged in agricultural consulting service. Dr. Coit stated that the avocado mite "started around Carlsbad and spread rapidly from there . . . Several hundred acres were showing defoliation." In the last few years the writer has received this mite from seven localities in San Diego County, one locality in Orange County, and one locality in Los Angeles County, the collectors having been J. E. Coit, P. E. Oliver, H. M. Armitage, H. J. Quayle, Dean Palmer, and J. R. Lafollette. It has been commonly reported that the avocado mite is readily controlled by applications of sulfur dust.

At a constant temperature of 77° F., under laboratory conditions, the avocado mite requires 7 days to complete a full generation (egg to egg). At a constant temperature of 91.4° F., individuals of the avocado mite were not able to develop, and mites in all stages, including eggs, died.

EXPLANATION OF PLATE 9.

Paratetranychus coiti, new species, and *P. yothersi* McG.

Fig. 1. Penis of *P. yothersi* McG.
(Remaining figures are all of *P. coiti*, n. sp.)
Fig. 2 and 3. Penis (lateral view).
Fig. 4. Tarsal appendages of female (lateral view).
Fig. 5. Tarsal appendages of female (ventral view).
Fig. 6. Foreleg of female.
Fig. 7. Tip of palpus of female and its appendages (lateral view).
Fig. 8. Anterior half of mandibular plate.
Fig. 9. Collar trachea.
Fig. 10. Adult female (dorsal view).
Fig. 11. Tarsal appendages of foreleg of male (lateral view).
Fig. 12. Egg (lateral view).

MINUTES OF THE 516TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, FEB. 6, 1941.

The Society met for its 516th meeting at 8 P. M., February 6, 1941, in Room 43 of the National Museum. President Ewing presided and 46 members and 19 visitors were present. The minutes of the previous meeting were read and approved.

Sarah Hoke DeBord, Bureau of Entomology and Plant Quarantine, Washington, D. C., and Harry G. Walker, Virginia Truck Crop Experiment Station, Norfolk, Va., were elected to membership. P. D. Sanders, Editorial Office of the Southern Planter, Richmond, Va., was reinstated as a member.

The President announced that the Executive Committee had been considering the advisability of extending certain privileges to members of the Society following their retirement. At a meeting held January 14, 1941, the Executive Committee accepted a proposed Article of the By-laws and recommended that it be considered at a general meeting of the Society as provided for by Article VII of the By-laws. Austin H. Clark, who prepared the proposed Article, read it to the Society, as follows:

Article VII. Retirement Privileges (the present Article VII to be designated as Article VIII)—

> Members of 15 years or more standing not in arrears for dues or otherwise indebted to the Society when reaching the retirement age, or if retired for any cause, on recommendation of the Executive Committee, may be continued as members without further payment of dues; members thus relieved of the payment of dues will not be sent copies of the Proceedings.

There was discussion by Rohwer, Cushman, Poos, McIndoo and Snodgrass. Rohwer moved that the proposed Article be amended by the elimination of the clause, "members thus relieved of the payment of dues will not be sent copies of the Proceedings." Cushman seconded the motion and it was passed. The matter was then set aside for consideration at a later meeting.

Under Notes and Exhibition of Specimens, E. A. Back exhibited samples of hair insulation material which had been infested by 1000 moths per square foot. He said that the beetles, *Mezium americanum* Lap. and *Thylodrias contractus* Mots. were also present.

Austin H. Clark conveyed the greetings of the Honorary President, L. O. Howard, with whom he and Mrs. Clark had spent some time that evening. He also gave a short note on a nomenclatorial matter.

The first item of the regular program was a talk entitled "Biometric methods in entomology," by F. M. Wadley, of the Bureau of Entomology and Plant Quarantine. Discussion followed by Rohwer, Muesebeck, Yeager, Cory and Snodgrass. The Address of the Retiring President, entitled "Insect taxonomy in relation to economic entomology," was given by C. F. W. Muesebeck. A spirited and humorous discussion then took place, participated in by Rohwer, Muesebeck, Wadley, Heinrich, McIndoo, Clark, Sasscer, Cushman and Cory.

Upon invitation from the chair, the following visitors greeted the Society: H. K. Townes, W. W. Chapman, Ralph B. Swain, A. G. Webb.

Adjournment at 9.55 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

MINUTES OF THE 517TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, MARCH 6, 1941

The 517th meeting of the Society was held at 8 P. M., Thursday, March 6, 1941, in Room 43 of the National Museum. Vice-President Cory presided, and 44 members and 10 visitors were present. The report of the February meeting was approved as read.

The first item of business was the consideration of an amendment to the By-Laws, concerning retirement privileges. The Recording Secretary read the proposed article as originally submitted, and also an amendment to it proposed at the February meeting which provided for the sending of the Proceedings to any retired members covered by the proposed article. Following discussion by Wood, Snodgrass and Gurney, the amendment was defeated. There was further discussion by Anderson, Snodgrass, Wood, Clark, Webb and Gurney, and the new Article VII of the By-Laws was adopted, reading as follows:

"Members of 15 years or more standing not in arrears for dues or otherwise indebted to the Society when reaching the retirement age, or if retired for any cause, on recommendation of the Executive Committee, may be continued as members without further payment of dues; members thus relieved of the payment of dues will not be sent copies of the Proceedings."

The following were proposed for membership, and, after discussion by Poos, McIndoo, Clark and Snodgrass, were elected:

Candido Boliver Pieltain, Instituto Enfermedades Tropicales, Colonia Anahuac, Mexico, D. F.

J. D. Maple, Division of Foreign Parasite Introduction, Bureau of Entomology and Plant Quarantine.

John L. Sperry, 3260 Redwood Drive, Riverside, California.

Joseph L. Williams, Lincoln University, Lincoln University, Pa.

The death of T. H. Jones was announced, and James A. Hyslop and John E. Graf were appointed to prepare a biographical sketch. A short obituary notice of Samuel Henshaw, prepared by Dr. Ewing, was read by the Recording Secretary. A committee composed of J. S. Wade and J. A. Hyslop was appointed to write a more extended biography for publication in the Proceedings.

Under Notes and Exhibition of Specimens, J. A. Hyslop discussed *Senotainia trilineata* (V. d. W.) (Diptera, Sarcophagidae), a commensal of *Eumenes fraterna* Say (Hymenoptera, Eumenidae). Early in September, 1940, he received an inquiry from Marguerite Remark, of Sinking Spring, Ohio, with the statement that she had found a peculiar mud formation on the under side of an hibiscus leaf. From the description he believed that the mud formation was the nest of some species of *Eumenes*, but Miss Remark went on to state that on placing this nest in a Mason jar 9 flies emerged from one of the mud nests. Under date of September 13, there were obtained from Miss Remark 5 of these mud nests which proved to be *Eumenes fraternus* Say, determined by R. A. Cushman. With this material were several small Diptera, the flies to which she referred in her letter of September 5. These were badly broken, but were identified by D. G. Hall as *Senotainia trilineata* (V. d. W.) This species has long been known to infest the nests of *Bicyrtes* and *Bembix*, but heretofore has not been recorded as infesting the nests of Eumenidae. The mud nests were found to contain the remains of

lepidopterous larvae, determined by Carl Heinrich as Geometridae. (Author's abstract.)

A few comments were made by Bishopp.

The regular program consisted of the following talks:

1. Lethal effect of heat on *Bacillus larvae*.

C. E. Burnside, Bureau of Entomology and Plant Quarantine.

The degree of resistance to heat of *Bacillus larvae*, the bacterium that causes American foulbrood of honeybees, appears to vary widely among individual spores. The great majority are quickly killed by boiling or autoclaving and more slowly at temperatures below boiling. Hot air is several times less effective than wet heat for destroying spores, while hot beeswax is less effective than hot air at the same temperature. A small percentage of the spores appear to be more resistant to heat than the majority, while occasional spores seem to possess extreme resistance. Growth was obtained in culture from spores exposed as follows: Boiling in water for 7 hours, exposure to flowing steam for 7 hours, boiling in diluted honey for 5 hours, autoclaving in saturated scales also scales in water at 15 pounds for 25 minutes, autoclaving in dry scales (exposed to steam in the autoclave) at 15 pounds for 40 minutes, exposure in beeswax at 100° C. for 5 days, at 75° C. for 42 days, and at 66° C. for 83 days, exposure to hot air at 98° C. for 46 hours, at 75° C. for 13 days, and at 66° C. for 52 days. The limit of resistance in some cases may not have been reached.

Heated spores in culture are extremely variable in incubation, luxuriance of growth, and percentage of positive cultures. In some cultures growth appeared to originate from one or a few of the most resistant spores.

Sixty-two colonies of bees inoculated with spores subjected to sub-lethal heating all remained free from disease. The indications are that virulence of spores is destroyed by heating sooner than is the viability in culture, or else not enough spores survive to cause infection.

Four of 11 colonies given brood foundation with *B. larvae* spores incorporated in the wax developed disease within 1 month. Six of seven colonies that remained healthy received a smaller number of spores in the foundation, while one received the larger number of spores, but the wax was held at about 90° C. for a longer period before the foundation was moulded than in case of the four colonies that became diseased. (Author's abstract.)

Discussion followed by Bishopp, McIndoo and Fracker.

2. The work of the Illinois Insect Survey.

B. D. Burks, Illinois State Natural History Survey.

Dr. Burks briefly traced the development of the Illinois Insect Survey, under both its original and present organizations, and described the methods now being followed in studying the insects of Illinois. He mentioned the various groups of insects which had been treated in a monographic way and discussed the different steps usually followed in selecting problems, doing field and laboratory work, and finally bringing out a revisionary publication. (Secretary's abstract.)

There were comments by Anderson and Muesebeck.

3. Mosquito associations of the Pacific Northwest.

H. H. Stage, Bureau of Entomology and Plant Quarantine.

Dr. Stage outlined the different interests which are affected in an economic way by northwestern mosquitoes and discussed the several distinct associations

of species occurring in Oregon and Washington. The lumber and real estate industries are seriously affected, and agriculture suffers as a result of the attacks on both men and domestic animals by mosquitoes. The impress which these insects have made upon campers, rangers and other outdoor people is exemplified by the frequent occurrence of the word "mosquito" in the names of lakes, creeks and other natural objects, and the torment to fishermen, huckleberry pickers, golfers and others is well understood by any one who has experienced a full fledged attack in our northern woods.

Excellent photographs of representative areas where mosquitoes are important and where control work has been done were shown. Of particular interest were those showing the appearance both before and after brush clearing or other clean-up operations to remove favorable breeding conditions. (Secretary's abstract.)

Discussion by Stone and Cory took place.

Adjournment at 10.10.

Respectfully submitted,

ASHLEY B. GURNEY,
Recording Secretary.

BOOK REVIEW.

Insect Pests of Stored Grain and Grain Products. Identifications, Habits, and Methods of Control, Richart T. Cotton, 242 pp., 93 figs. $3.50, Burgess publishing Co., Minneapolis, Minn., 1941.

This book fills a long felt want and is excellently written by a man who has been engaged for many years in the investigation of the subject treated. It begins with an account of the Insect Pests of Stored Grain and Milled Cereals, with illustrations of the principal insects treated. Each chapter is followed by selected references to the subject. Chapter 2 treats of Controlling Stored Grain Insects on the Farm, a subject of prime interest at present because of the operation of the "Ever Normal Granary" by the U. S. Department of Agriculture. Then the subject of the Control of Insects in Grain Stored in Elevators and Warehouses is taken up and recommendations are made for fumigation with all modern fumigants and the use of heat and low temperature for insect control under the conditions discussed. Chapter 4 discusses the Insect Problem in Flour Mills, telling of the sources of infestation and methods of avoiding or suppressing it.

Practical Control Methods in the Mill is the subject treated in chapter 5, which is one of great importance to the flour trade. This and the following chapter on Protecting Flour After Manufacture, are eloquent of Dr. Cotton's intimate and comprehensive knowledge of these subjects and his appreciation of the difficulties involved in producing insect free flour. Fumigants and Fumigation is the subject of chapter 7 and tells all, from the effect of fumigants on the respiration of insects and how they kill the pests, to the "Behavior of Fumigants in Mills and Warehouses." Then comes an account of the Common Fumigants with their physical characteristics and their effect on the fumigator if he is not careful to adopt the precautions described in the following chapter on Flour Mill and Warehouse Fumigation.

This begins with a discussion of gas masks and first aid treatment and, thence, to a complete exposition of the various methods of fumigation and the application of heat for the destruction of insect pests. An index completes the volume which is printed by the offset process on excellent heavy white book stock. A very commendable feature is the character of the binding which permits the book to lie flat, immediately, when opened at any page. In fact altogether an excellent and practical job. —W. R. WALTON.

Actual date of publication, April 30, 1941.

ANNOUNCEMENT

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F. W. POOS,
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Address: Bureau of Entomology and Plant Quarantine,
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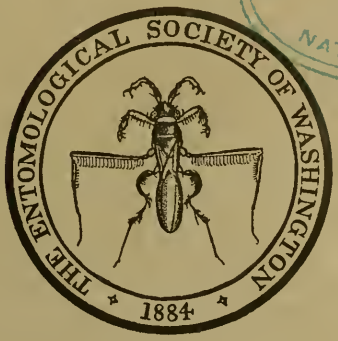

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PROCEEDINGS OF THE

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NEW SPECIES OF PSEUDOCOCCIDAE.[1]

By H. S. McConnell,

University of Maryland, College Park, Md.

During the course of making a study of the coccid fauna of Maryland, and the identification of material sent to the University and occasional collecting trips in South Carolina, a number of forms have come to hand that are apparently undescribed. The five species described below as new belong to the family Pseudococcidae as defined by Morrison.[2] They were collected in Maryland and South Carolina during the past three or four years. The genera represented are: *Pseudantonina*, one species from South Carolina; *Pseudococcus*, two species, one from Maryland and one from South Carolina; and *Trionymus*, two species from Maryland.

The author is grateful to Dr. Harold Morrison of the Bureau of Entomology and Plant Quarantine for the privilege of studying material in the National Collection and for making helpful criticisms of the manuscript.

The clerid mentioned in this paper was identified by Dr. E. A. Chapin of the U. S. National Museum and the chalcids by Mr. A. B. Gahan of the Bureau of Entomology and Plant Quarantine.

Pseudantonina arundinariae, n. sp.

Adult female, in life, occurring between leaf sheaths of host, flattened on account of position, derm pink to reddish (dead specimens dark brown to black), dorsum nearly naked, powdery wax along margins, especially posterior part of abdomen; no definite ovisac formed, eggs pushed out behind and mixed with powdery wax.

Larvae, mounted, 0.7 mm. long and 0.22 mm. wide, sides parallel; antennae 6-segmented, with segment VI about as long as segments II, III, IV, and V, together, otherwise normal in appearance; legs stout, tibiae and tarsi about equal in length; beak rounded, about as long as wide at base, apparently 2-segmented; anal lobes not protruded, apical setae long, stout, one subapical

[1] Paper #540 Scientific Journal Series, Maryland Agricultural Experiment Station.

[2] Annals of the Ent. Soc. of America, Vol. 22, p. 33, 1929.

seta; only trilocular pores present, arranged as follows: a marginal series of 28 to 34, apparently always one on each margin of abdominal segments, those of head and thorax not so definitely arranged, a longitudinal row on sub-median areas of dorsal and ventral surfaces of abdomen, others on head and thoracic surfaces, but not in definite rows; abdominal setae arranged as follows: on dorsum, a marginal series, apparently one seta on each segment, and six other longitudinal rows, each with a seta on each segment except the apical, six similar rows on the venter; two pairs of small cerarian spines on the apical segment with one associated seta and one trilocular pore; anal ring terminal or nearly so with six anal ring setae; apparently only posterior pair of dorsal ostioles present.

Adult female, mounted, from 2.5 to 5.2 mm. long and 1.7 to 2.5 mm. wide, slightly irregular in shape, segmental restrictions distinct, derm slightly sclerotized at margins, sides subparallel, tapering somewhat toward the well-rounded ends of the body; antennae at anterior margin of head, usually 6-segmented, normal in appearance for pseudococcine forms, sometimes teretological, with only 4 or 5 segments, first segment of normal antennae about twice as broad as second, second and third segments subequal in length, fourth usually shortest and narrowest, sixth segment twice as long as fifth, setae few, small; legs small, probably non-functional, but all the segments present; tibiae and tarsi vary considerably in length, tarsal digitules long, slender, hair-like, slightly knobbed at distal end, claw digitules stouter, exceeding claw, claws without denticle; derm about the hind coxae, or the hind coxae themselves expanded into a comma-shaped blister, thickly set with many minute simple pores about twice as deep as wide, leg proper attached near center of mesal margin of blister, leg setae few, small; tentorial structure rounded, longer than wide; beak small, rounded, wider at base than long, apparently 2-segmented; only apical pair of cerarii present, composed of two small short cerarian spines, no grouping of trilocular pores, and no definitely associated body setae; anal lobes, not at all indicated, apical setae small, about 120 microns long, without any definitely associated subapical setae, without a ventral thickening; trilocular pores arranged in broad, loose bands on abdomen, otherwise uniformly distributed, more on dorsal surface than on ventral; multilocular pores numerous, nearly all ventral, arranged in more or less definite patches, except on head, where scattered, and few in number, and on apical segment where numerous and uniformly distributed, extending on to dorsal margins; an anterior and posterior patch on ventral margins of other abdominal segments and indicated on thorax, patches extending on to dorsal margins of penultimate and antepenultimate segments; a median transverse band of patches on penultimate and antepenultimate segments; the number of pores in marginal patches decreasing from posterior toward anterior; tubular ducts apparently lacking, but some deep pores on ventral abdominal segments similar to those on hind coxae; body setae more numerous on ventral surface and longer than on dorsum; abdominal setae in definite loose transverse bands; setae on ventral surface of penultimate and antepenultimate segments anterior to transverse band of multilocular pore patches; setae on ventral margins of abdomen interspersed among anterior patch of multilocular pores, with only an occasional one in posterior patch; ventral setae of apical segment long, slender, uniformly distributed; anal ring

characteristic in shape (see Plate 10, fig. 3), about as broad as long, nearly terminal, not at all invaginated, anal ring setae about as long as apical setae, with usual inner and outer rings of pores; spiracles large, moderately sclerotized with several trilocular pores loosely grouped lateral to the opening; no ventral cicatrix; apparently only posterior pair of ostioles present.

Host.—*Arundinaria*, sp.

Locality.—Anderson, S. C., Aug. 18, 1939; August 25, 1939; March 1, 1940; and July 11, 1940.

Holotype, collected Aug. 18, 1939, deposited in the National Collection. Paratypes collected Aug. 18, 1939; Aug. 25, 1939; March 1, 1940; and July 11, 1940, in National Collection, Maryland Agricultural Experiment Station collection, Clemson College collection, and author's collection.

This species was described from a long series of specimens collected at the type locality. It seems to be definitely related to *Pseudantonina bambusae* Green and *P. giganticoxa* Lobdell, an American species. Judging from the published descriptions and illustrations, it differs from the *P. bambusae* in having the derm about the hind coxae only expanded, and poriferous, the anal ring not invaginated; more multilocular pores on the ventral surface of posterior part of body, and fewer on head; and in having a constant pair of apical cerarii that are not mentioned in Green's description of *P. bambusae*. It differs from *P. giganticoxa* Lobdell in being elongate instead of broad and oval, flattened instead of convex, one pair of dorsal ostioles instead of two pairs, many multilocular pores on dorsum instead of a few; deep, simple pores, instead of many small tubular ducts on body, the hind leg attached at side of poriferous expanded derm instead of at end, and in having a pair of constant apical cerarii.

Despite the fact that this species is well covered by the leaf sheaths of the host, a high percentage are parasitized by a species of *Pseudaphycus*. It is also attacked by the larvae of a small clerid beetle, *Isohydnocera curtipennis* (Newm.).

Pseudococcus diodium, n. sp.

Living adult female small, oval and rather convex when fully mature, covered with powdery wax, derm pink to reddish, unrubbed specimens with short pencils of wax projecting from margins, ovisac formed of powdered wax mixed with long threads.

Adult female, mounted on slide, from 1.6 to 1.9 mm. long and 1.1 to 1.3 mm. wide; segmentation of abdomen fairly well indicated, derm membranous, eyes rather prominent; antennae 6 or 7 segmented, normal in appearance, more specimens 6-segmented than 7-segmented, some showing incomplete fusion of segments III and IV; segments III and IV about equal in length in 7-segmented specimens, terminal segment longest, fifth segment shortest, setae numerous, quite stout; leg normal in appearance, rather stout, claw digitules small, clubbed, only slightly exceeding claw, tarsal digitules small, slender, slightly clubbed,

scarcely reaching tip of claw, some specimens with clear pores on tibia and femur, setae numerous and stout; beak almost as long as tentorial structure, conical, distinctly 2-segmented; 17 pairs of cerarii, first three pairs on head with 3 or 4 cerarian spines, small, acutely pointed; other cerarii with only two cerarian spines, size of cerarian spines increasing in size from anterior to posterior, cerarii with two to four accessory setae, trilocular pores definitely grouped about each cerarius, usually separated by less than their diameter, number about each cerarius, varying from about 30 at the apical pair to 15 at the head cerarii; anal lobes definitely protruded, ventral surface with a large pear-shaped thickening, apical setae slightly shorter than anal ring setae, but stouter, 2 or 3 subapical setae; multilocular pores few, about 20, grouped around genital opening, not occurring elsewhere on the body; trilocular pores numerous, those on abdomen principally in segmental bands, otherwise evenly distributed over body; tubular ducts of a single type occurring only on ventral surface of posterior segments of abdomen, rather large, one-third longer than wide, a group at the margins of each of the four posterior segments, a few along the median portions of these segments; body setae not numerous, rather small, those on abdomen arranged principally in segmental rows, those on head and thorax evenly distributed, ventral setae somewhat stouter and longer than dorsal; two pairs of large, prominent dorsal ostioles with some grouping of trilocular pores; anal ring normal in appearance, with usual inner and outer rings of pores, six anal ring setae somewhat longer than the apical setae; without ventral cicatrix.

Hosts.—*Diodia teres* and false foxglove, *Gerardia* (*Aureolaria*) *laevigata*.

Locality.—Anderson, S. C., August 14, 1939, on roots of *Diodia teres*. This species was found very common on *Diodia teres*, a common annual weed, growing at margins of cultivated fields and on terraces. It was also collected August 28, 1939, on the roots of *Gerardia* (*Aureolaria*) *laevigata* growing in barren woods.

Holotype collected August 14, 1939, at Anderson, S. C., on *Diodia teres* deposited in the National Collection, numerous paratypes collected Augst 14, 1939, and August 28, 1939, on *Gerardia* (*Aureolaria*) *laevigata* in National Collection, Maryland Agricultural Experiment Station collection, Clemson College collection, and the author's collection.

This species is apparently closely related to a form Cockerell described as *Ripersia aurantia*, which really belongs in the genus *Pseudococcus*. It differs from that species principally in being smaller, in having more than two cerarian setae in the three anterior pairs of cerarii, fewer trilocular pores grouped about the cerarii, and the ventral thickening of anal lobes much larger.

Pseudococcus junceus, n. sp.

Living adult female small, lightly covered with powdered wax, derm pinkish, short tassels of wax along posterior abdominal segments on unrubbed specimens, no definite ovisac formed, the eggs deposited beneath posterior tip of abdomen.

Adult female mounted, small, elongate oval, fully matured specimens somewhat convex, posterior end truncate in appearance, length from 1.01 to 1.51 mm., average length of several specimens 1.2 mm., width from 0.63 to 0.99 mm., average width of several specimens 0.77, anal lobes slightly protruded, abdominal segmentation rather distinct with some indication of sclerotization of coriae; eye spots large, tuberculate; spiracles large; antennae usually 7-segmented, occasionally segments III and IV partially or completely fused, rather short, otherwise normal in appearance; beak slightly more than half as long as tentorial structure, definitely 2-segmented, about as wide at base as long; legs normal in appearance, claw digitules small, delicate, slightly exceeding claw, tarsal digitules slender, short, not reaching tip of claw, hind coxae with a varying number of rather large clear pores; only 6 to 8 pairs of cerarii recognizable, cerarian spines gradually decreasing in size and increasing in length and distance apart from the apical pair toward the anterior until they can not be differentiated from body setae, the slight grouping of trilocular pores usually not evident beyond the sixth pair anterior to apical pair, all cerarii with two small, acute cerarian spines, 2 or 3 accessory setae in apical pair, others without; anal lobes slightly indicated, without ventral thickening, apical setae nearly twice as long as anal ring setae, stout; multilocular pores, few, about 40, all on ventral surface, most of them grouped around genital opening, a few on median portion of the two segments anterior to this opening; trilocular pores numerous, those on abdomen in segmental bands, evenly distributed on remainder of body; tubular ducts of one type, large, all on the ventral surface of the posterior 4 or 5 segments of abdomen, a group on each margin and a few on the median section of these segments; body setae not numerous, except on head area, in segmental bands on abdomen, evenly distributed on remainder of body, those of ventral surface slightly longer; two pairs large, prominent dorsal ostioles with some grouping of trilocular pores; anal ring normal in appearance with the usual inner and outer bands of pores and six anal ring setae; without ventral cicatrix.

Host.—Roots of *Juncus tenuis*

Locality.—College Park, Md., June 26, 1938; October 19, 1938; March 17, 1939; and June 26, 1939.

Holotype, collected June 26, 1938, deposited in the National Collection; numerous paratypes, collected on above dates, in National Collection, Maryland Agricultural Experiment Station collection and the author's collection.

This species departs quite widely from the typical pseudococcine form and its relationship to other forms is rather indefinite. It has been collected in one restricted area only, in all cases on *Juncus tenuis*, despite examinations in several areas, and several different species of *Juncus*.

Trionymus caricis, n. sp.

Adult female, in life, long, narrow, egg laying individuals from 2 to 3 mm. in length, between leaf sheaths of host; an ovisac formed, of indefinite character on account of position on host plant, usually long, narrow, flat; body of female pinkish to reddish in color, lightly dusted over with powdered wax.

Adult female mounted, length from 2.3 to 3.2 mm., width 0.7 to 1.2 mm., sides nearly parallel, ends of body well rounded, segmental restrictions scarcely indicated; antennae small, normally 7-segmented, some 6-segmented, and some specimens with segments III and IV partially fused, average length of segments in microns about as follows: I, 32; II, 29; III, 19; IV, 22; V, 22; VI, 23; VII, 64; 6-segmented antennae have segment III about 38 microns long; legs rather small, slender, hind coxae with pores at base, varying from large to small in size; claws slender, curved, claw digitules stout, exceeding claw in length, tarsal digitules slender, exceeding claw, femur and tibia subequal in length, tarsus about one-third shorter than tibia; tentorial structure rounded, somewhat longer than wide; beak definitely 2-segmented, slightly longer than wide at base; only apical pair of cerarii definitely developed, with two small slender acute cerarian spines, a small group of trilocular pores separated from each other by two or three times their diameter, and a group of 4 or 5 accessory setae, anteapical pair of cerarii sometimes indicated by a single cerarian spine-like seta; anal lobes little if at all indicated, without a ventral thickening, apical setae somewhat longer and stouter than anal ring setae, several subapical setae; trilocular pores not numerous, in loose segmentally arranged bands on abdomen, uniformly distributed over remainder of body; multilocular disc pores numerous, nearly all on ventral surface, some on dorsal margins, and dorsum of posterior abdominal segments, ventral pores distributed as follows: uniformly over posterior segment, in loose anterior and posterior segmental bands on the three or four segments anterior to the apical, remainder of abdominal segments usually with only a posterior band; a few scattered over ventral surface of head and thorax; tubular ducts of two kinds, small, and very small, the smaller ones about half the diameter of the larger ones, and somewhat shorter, larger form more numerous, distributed as follows: on abdomen larger ducts principally near margins, some in a transverse row on each segment, smaller ducts few in number, scattered on segments, body types few and scattered on surfaces of head and thorax; body setae not numerous, ventral ones longer and stouter, in segmental bands on abdomen between bands of multilocular disc pores; two pairs of dorsal ostioles; ventral cicatrix circular to transverse oval between third and fourth abdominal segments; anal ring not unusual.

Host.—*Carex tribuloides* Wahl.

Locality.—Bowie, Md., at Priests Bridge, collected Aug 4, 1940.

Holotype, collected Aug. 4, 1940, in the National Collection; paratypes collected same place and date, in National Collection, Maryland Agricultural Experiment Station collection and author's collection.

This species was collected on *C. tribuloides* growing on the banks of the Patuxent River. All specimens observed were beneath the leaf sheaths. Other species of *Carex* and *Cyperus* growing near were examined but no specimens were found. Its relationship to other forms of the genus *Trionymus* is too indefinite to warrant a statement. The double row of multilocular pores on the dorsum of the posterior abdominal segment

is quite striking, as is also the very narrow, elongate form. A few specimens of the chalcid Xanthoencyrtus sp. were reared from this species.

Trionymus cladestinis, n. sp.

Adult female collected while ovipositing deep in the crown of *Panicum* spp., some specimens on roots; large, dense, doughy masses of wax completely covering one or two, or more specimens served as ovisac; derm of female pinkish; elongate.

Adult female mounted, elongate with well-rounded ends, sides parallel; average length 3.5 mm. and average width 1.9 mm.; derm membranous; antennae usually 7-segmented, normal in appearance, occasionally segments III and IV partially fused; segment lengths in microns about as follows: I, 61; II, 50; III, 30; IV, 39; V, 23; VI, 29; VII, 84; thus segment VII is much the longest; legs normal in appearance, long and rather slender, tarsi about 2/5 as long as tibiae; claws stout, curved, claw digitules exceeding claw, tarsal digitules long, slender; hind coxae with clear pores at base, tibiae and tarsi sometimes with small clear pores, two spine-like setae at apex of tibia; with only apical pair of cerarii present, no modification of setae nor grouping of pores to indicate others, the two cerarian spines rather small, sharp, 25 to 30 trilocular pores grouped about cerarian spines, and 3 to 5 apparently associated setae; anal lobes not at all indicated, without ventral thickening, apical setae long and stout, one or two subapical setae; trilocular pores few, some suggestion of loose segmental arrangement on abdomen, evenly scattered on head and thorax, somewhat more numerous on ventral surface; multilocular disc pores numerous, distinct bands on dorsal and ventral surfaces of all of body except head where scattered, more numerous on ventral surface; two kinds of tubular ducts, small and very small, the smaller ones about half the diameter of the larger ones, but only slightly shorter; both kinds on both surfaces, larger ones more numerous, arranged as follows: smaller ducts usually anterior to multilocular disc pore bands, larger ones interspersed among multilocular disc pore bands, more numerous at margins of abdomen, both types distributed on both surfaces of head, more at margins; body setae few, arranged in transverse bands anterior to multilocular disc pore bands on abdomen, ventral setae longer than dorsal, conspicuously so on head; spiracles rather large with a group of trilocular pores about opening, more numerous at posterior pair; anal ring heavily sclerotized, with usual inner and outer bands of pores, six anal ring setae, about 115 microns long; ventral cicatrix small, oval, apparently between third and fourth abdominal segments; two pairs of dorsal ostioles with slight grouping of trilocular pores.

Hosts.—*Panicum cladistinum* and *Panicum* sp.

Locality.—Ashton, Md., October 12, 1939, and College Park, Md., Oct. 14, 1939.

Holotype collected at Ashton, Md., October 12, 1939, in the National Collection; paratypes collected at Ashton, Md., October 12, 1939, and College Park, Md., October 14, 1939, in National Collection, Maryland Agricultural Experiment Station collection, and in the author's collection.

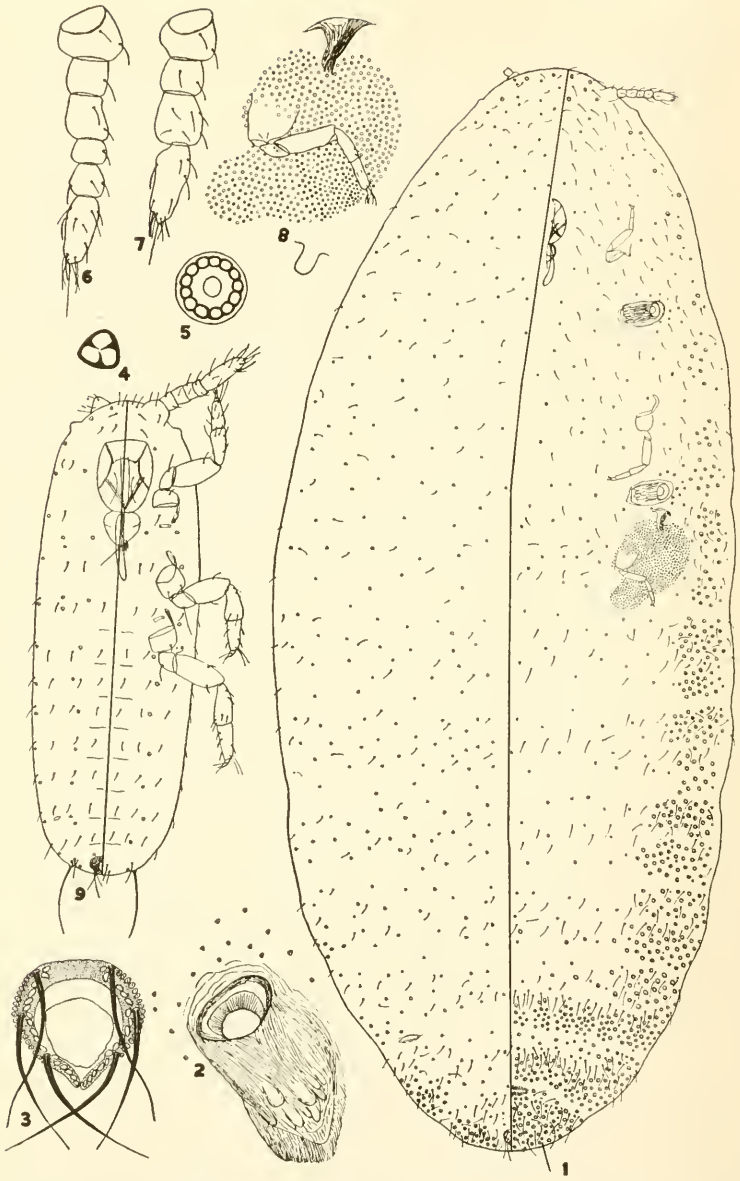

PLATE 10. *Pseudantonina arundinariae*, adult female: 1, details of dorsal and ventral surfaces X 40; 2, posterior spiracle, X 240; 3, anal ring, X 330; 4, trilocular pore, X 1400; 5, multilocular pore, X 1400; 6, 6-segmented antenna, X 100; 7, 4-segmented antenna, X 100; 8, hind leg, X 80; and pore greatly enlarged; larva; 9, X 80.

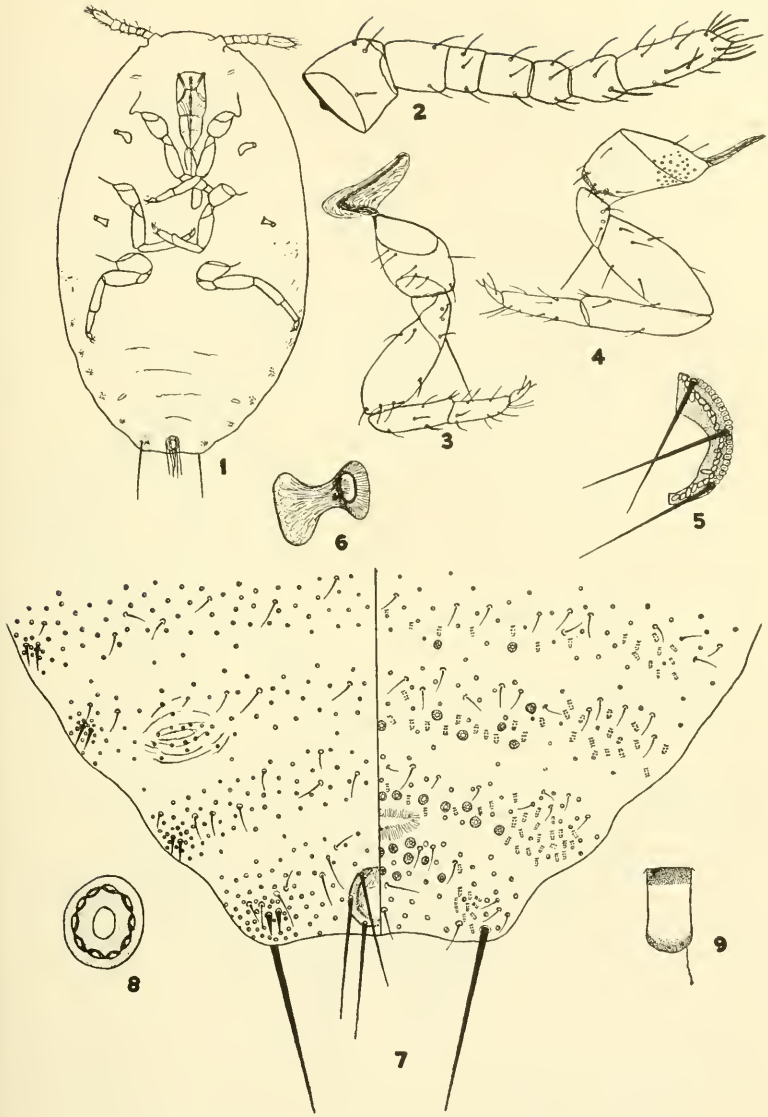

PLATE 11. *Pseudococcus junceus*, adult female: 1, outline of body, X 45; 2, antenna, X 220; 3, mesothoracic leg, X 140; 4, hind leg, X 140; 5, anal ring, X 120; 6, posterior spiracle, X 300; 7, apex of abdomen, X 160; 8, multilocular pore, X 2900.

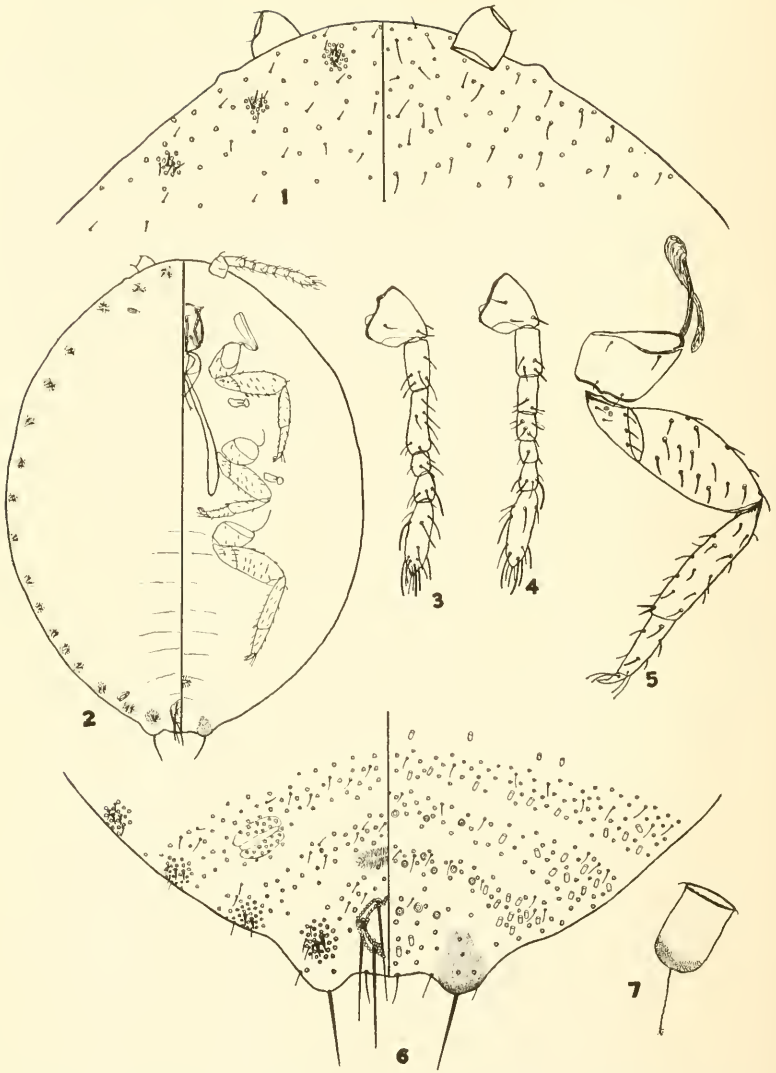

PLATE 12. *Pseudococcus diodium*, adult female: 1, apex of head, X 155; 2, outline of body, X 36; 3, 6-segmented antenna, X 130; 4, 7-segmented antenna, X 130; 5, hind leg, X 130; 6, apex of abdomen X 85; 7, tubular duct, X 1100.



PLATE 13. *Trionymus caricis*, adult female: 1, apex of abdomen, X 77; 2, outline of body, X 37; 3, anal ring, X 220; 4, antenna, X 220; 5, hind leg, X 220; 6, tubular duct, X 2600; 7, tubular duct, X 2600.

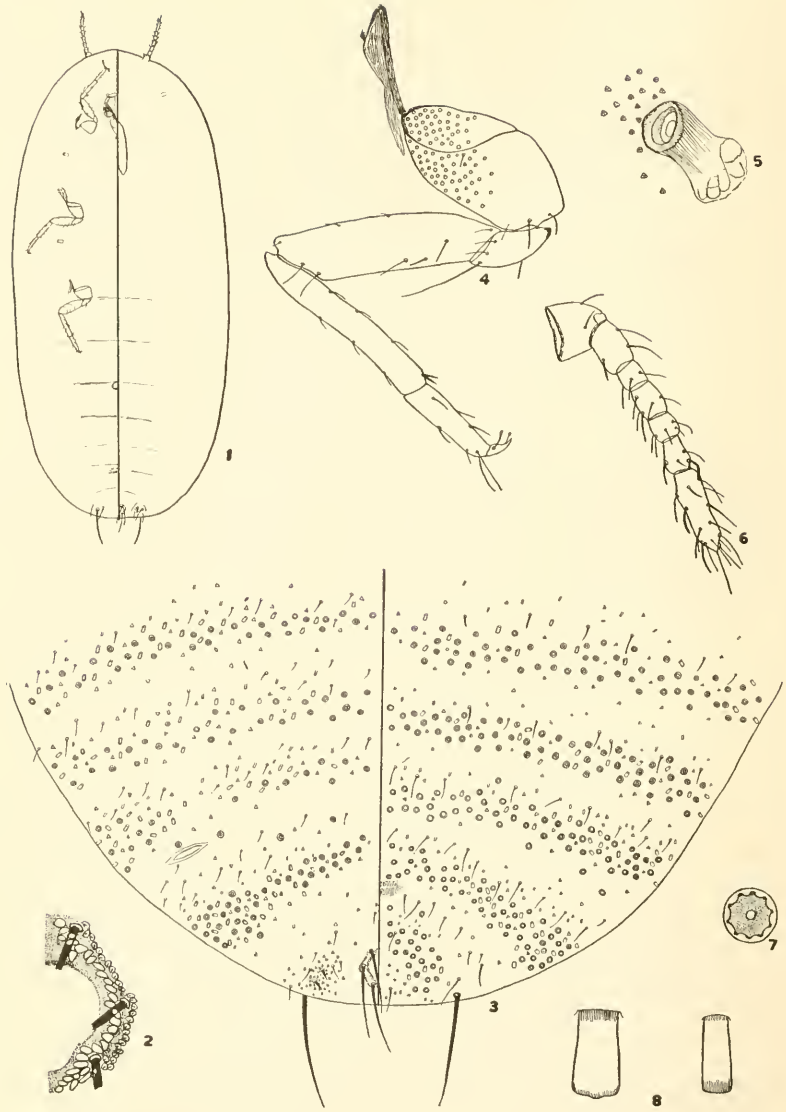

PLATE 14. *Trionymus cladestinis*, adult female: 1, outline of body, X 20; 2, anal ring, X 345; 3, apex of abdomen, X 85; 4, hind leg, X 145; 5, posterior spiracle X 220; 6, antenna, X 145; 7, multilocular disc pore, X 950; tubular ducts, X 1900.

This species seems to be most closely related to *Trionymus insularis* Ehrn., from which it differs principally in the following respects: the legs are longer and more slender, and in the number and arrangement of the tubular ducts on the abdomen. In *T. insularis* they are very numerous and in crowded transverse bands.

THE GENUS ZONOTHRIPS IN NORTH AMERICA (THYSANOPTERA).

By J. C. Crawford,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The genus *Zonothrips* Priesner was established in 1926 [1] for a new species from Java. The discovery of this, the second species of the genus, in the northeastern part of the United States is, therefore, of great interest. In habitus the species of this genus greatly resemble many of the species of *Sericothrips* but not those of the group to which the genotype belongs. In *Zonothrips* there are only seven segments in the antenna, the seventh and eighth segments being so completely fused that there remains not even a trace of a suture between them, and I know of no species of *Sericothrips* showing even a tendency to such fusion.

Zonothrips osmundae, new species.

Female.—Length 1.1 mm. Orange yellow, head slightly paler, lateral margins of prothorax broadly subhyaline; no dark pronotal saddle-shaped blotch; mesonotum tinged with brownish, abdomen with brown marks; antennae with basal segments light yellow, intermediate ones darkened apically, apical segments dark brown; fore wings subhyaline, with scale and two cross bands of gray brown; legs yellow, slightly tinged with orange brown and contrasting with body color; combs complete on all intermediate segments; all body bristles, except light brown ones on apical abdominal segments, only slightly tinged with yellowish.

Head wider than long; eyes hardly bulging, sparsely pilose, and with large facets; cheeks almost straight, slightly converging caudad; occipital carina not darkened, very faint medially; lateral ocelli remote from eyes, ocellar crescents maroon; ocellar area elevated, brownish; frontal costa roundly, deeply emarginate; anteocellar bristles, interocellars, and inner postoculars subequal in length, colorless and almost indiscernible; anteocellar region with transverse lines postocellar and occipital regions faintly, minutely roughened; antennal segments I whitish, II and III yellow lightly tinged with orange, with III lighter, paler

[1] Treubia, vol. 8, Supplement, pp. 50, 51, 260.

than II and very faintly tinged with grayish apically; IV and V light yellow, light grayish brown in about apical one-third; VI and VII dark brown, with VI lightened basally; III–VI pedicellate, VII with base narrowed.

Pronotum with transverse, sparsely anastomosing lines, those within the area usually occupied by the colored blotch mostly about two μ apart, those in front of blotch much farther (about four μ) apart, lines on mesoscutum and metascutum closer than those on pronotal blotch; inner of dark forewing bands occupying about the second one-fifth of wing, outer about the fourth one-fifth, the inner somewhat the longer; costa with about 23 bristles, main vein with 3 + 17, the outer one of the 17 farther separated from the others than they are from one another; two bristles in row back of main vein; postangular bristles strongly inclined inward; laterad of each postangular a pair of short, stout, strongly curved bristles, pointing inward (Fig. 1, *b*).

Abdominal terga II–VII with antecostal lines very dark brown, those on II–IV paler or even subinterrupted medially on II; tergum II brown, terga III–VII each with a brown band back of and adjacent to antecostal line, these bands somewhat broader laterad, band on III the broadest, paler medially, band on IV the narrowest, and those on V–VI successively increasing in width; complete combs, composed of hairs of equal length, on VII and VIII, medial hairs on VI somewhat shorter, medial hairs on V distinctly shorter, on III and IV the hairs on mesal one-third irregular, exceedingly short, barely more than stubs; on III the comb may be interrupted medially; comb hairs faintly tinged with yellowish and almost impossible to see medially on basal segments except in caustic-cleared specimens; hair bands distinct, composed of long, slightly yellowish hairs, except on brown parts of terga, where the hairs are brown; these hair bands wanting, except at extreme bases of terga, on medial portions of intermediate segments.

Measurements (in microns): Head, total length 100, length from front of eye 90, width across eyes 140, greatest width across cheeks 130; anteocellar bristles, interocellars, and inner postoculars 30, prothorax, median length 120, width 168; postangulars 36; hind tibia 144, hind tarsus 80; bristles on tergum IX, 60, on X, 64; comb laterally on VIII, 24.

Antenna:	I	II	III	IV	V	VI	VII
Length	24	40	44	43	43	49	23
Width	28	26	20	20	19	17	6

Male.—Length 1.0 mm. Very similar to the female, except in secondary sexual characters; comb on tergum III broadly, on IV narrowly, interrupted.

Measurements (in microns): Head, total length 92, length from front of eyes 80, width across eyes 120, greatest width across cheeks 112; anteocellar, interocellar, and inner postocular bristles, 28; prothorax, median length 96, width 152; postangulars 32; hind tibia 132, hind tarsus 64; bristles on tergum IX, 58, on X, 56.

Antenna:	I	II	III	IV	V	VI	VII
Length	24	34	40	38	34	44	20
Width	25	24	20	18	17	15	6

Type locality.—Tenafly, N. J.
Host.—Fruiting fronds of *Osmunda cinnamomea.*
Type.—No. 55195, U. S. National Museum.

Described from 42 female and 26 male slide-mounted specimens and many specimens still in alcohol, all collected May 19, 1940 (J. C. Crawford).

Zonothrips karnyi Pr., the genotype, has the head brown, terga II–IV brown, distinctly paler caudad, VII–IX very dark brown, X paler; wings hyaline, with the base and a median crossband gray; hind tibia (230–235 μ) and hind tarsus (100 μ) much longer; antenna much longer, segments III–IV vasiform and V entirely dark.

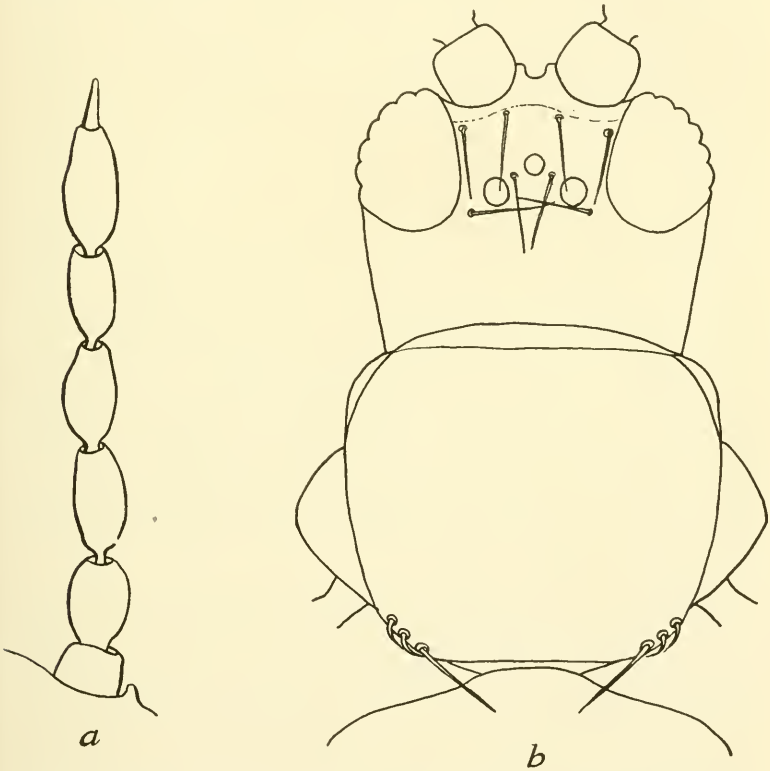

Fig. 1. *Zonothrips osmundae*, n. sp. *a*, Left antenna of female. (All setae omitted.) *b*, Head and thorax of female. (Most minor setae omitted.)

OBITUARY NOTICE OF SAMUEL HENSHAW.

By J. S. Wade and J. A. Hyslop.

Samuel Henshaw, American naturalist and writer, and member of the Entomological Society of Washington since June 12th, 1892, died at Cambridge, Mass., on February 5, 1941. He was born in Boston, Mass., on January 29th, 1852. Descendant of an old Boston family, he was a son of Joseph Lyman and Jane Paine Henshaw. He was educated at the Chauncy Hall School and the Boston Latin School. He married Miss Annie Stanwood on April 28th, 1886 (died March 12th, 1900.) Since early youth he had been interested in the study of natural history, particulary in entomology, and these interests continued throughout his life. He was actively identified with the Boston Society of Natural History from the beginning of his membership in 1871 down to 1901. During this period he served as a general assistant under the leadership of Professor Alpheus Hyatt from 1876 to 1891 inclusive, and as Secretary and Librarian from 1892 to 1901 inclusive. His duties during these years included considerable general work on various groups of vertebrates and invertebrates as well as much that was strictly entomological in character, also preparation of material regularly for use of Professor Hyatt, who was at that time science instructor in Lowell Institute. His library experience enabled him in time to attain a wide knowledge of scientific literature, and in later years to make outstanding bibliographical contributions in entomology. His work with the Museum of Comparative Zoology at Harvard, succeeding that of Dr. H. A. Hagen, covered the years 1891 to 1927, inclusive. Beginning with part-time assignments in entomology from 1891 to 1898 inclusive, he was Assistant in Entomology and Librarian from 1898 to 1903, inclusive. He was Curator of the Museum from 1903 to 1911, Director from 1911 to 1927, and Director Emeritus from 1927 to 1941.

During the years while he was connected with these institutions, he also had extensive experience with both of them in editorial work, serving for a number of years as editor of various of their publications. One of the founders of the Cambridge Entomological Club, he was one of the editors for a long period of its journal "Psyche." In each issue of this periodical there also appeared for many years a bibliographical resume of the current literature on entomology prepared by Henshaw. His memberships in scientific organizations included the American Society of Naturalists and the American Society of Zoologists. He was also a fellow of the American Academy of Arts and Sciences. He received an honorary degree of Master of Arts from Harvard in 1903.

A survey of Henshaw's published entomological works show that his major interests were in the Coleoptera, in biographies of entomologists, and in entomological bibliography. The principal biographical matter written by him pertained to John Lawrence LeConte, published in 1878, to George Henry Horn, 1879, Alpheus Spring Packard 1887, Hermann August Hagen, 1894, and to Philip Reese Uhler 1903. He also published a resume of the Gypsy moth work in 1892. In addition to the bibliographical material already mentioned, he compiled the "Bibliography of American Economic Entomology," parts 1 to 5, covering the years 1860 to 1889, published by the United States Department of Agriculture 1890 to 1896 inclusive, a work later continued to the present time by Nathan Banks and Mabel Colcord. During the period in which these compilations were being made, Henshaw served as Field Agent in the Federal Department of Agriculture. Probably his most important single work is the well known "List of Coleoptera of America North of Mexico," published in 1885, with his three supplements of 1887, 1889 and 1895, respectively. The original "Catalogue of Coleoptera," prepared by Frederich Ernst Melsheimer, revised by Samuel Stehman Haldeman and John Lawrence LeConte, and published by the Smithsonian Institution in 1853, had long been superseded by the longer work by George Robert Crotch, 1873, and the Supplement by E. P. Austin, 1880, and when these in turn were followed by the Henshaw "List," it became at once the most widely used work on the subject and continued thus until the publication of the Charles W. Leng "Catalog" in 1920. Thus, for 47 years the Henshaw "List" was the standard work on the subject and was to be found on the desk of practically every working Coleopterist in the land.

A passionate lover of books, he gradually accumulated a large and exceedingly valuable library, containing particularly many rarities and other noteworthy material relating to the life and work of Gilbert White of Selborne. Henshaw's interest in matters bibliographical also was evidenced in his labors over long years in building up collections and in completing scientific serials in the various libraries with which, from time to time, he was connected.

As would be expected, the span of his lifetime covering so many decades contemporary with one of the most significant periods in the growth and development of American entomology, enabled him to have among his colleagues many notable personalities. Among these friends were such individuals as Alpheus Hyatt, Alexander Agassiz, Walter Faxon, H. A. Hagen, Samuel H. Scudder, George L. Goodale, Henry P. Walcott and many others.

On the whole, the life and career of Samuel Henshaw forms an

excellent example of the superfluity of eulogy toward the careers of men of outstanding accomplishment. In this case, his achievements verily speak for themselves.

Grateful acknowledgment is gladly made to Drs. L. O. Howard, Nathan Banks and Robert T. Jackson for portions of the subject matter here presented.

A NEW SPECIES OF TIBRACA, INJURIOUS TO RICE IN ECUADOR (HEMIPTERA-HETEROPTERA : PENTATOMIDAE).

By Harry G. Barber,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

Recently there has been received for determination by the Bureau of Entomology and Plant Quarantine a number of specimens of a large pentatomid bug belonging to the genus *Tibraca*. These were transmitted by Dr. Francisco Campos, of Guayaquil, with the statement that they were injuring rice in Ecuador. A description of this new species is published at this time in order that the name may become available for use in economic papers.

Tibraca simillima, new species.

(Fig. 1, *A*, *B*.)

Sordid yellow testaceous, rather closely punctate with fuscous. Head of male a little longer than wide (2.80 by 2.48 mm.); lateral margin very slightly concave; jugae rather closely punctate, tylus more sparsely punctate, scarcely exceeding the jugae; anteocular portion 1.68 mm. long, a trifle longer than width of interocular space, which is 1.60 mm. wide. Antenna very nearly as long as head and pronotum conjoined, the lengths of the respective segments as follows: I, 0.72; II, 0.56; III, 1.44; IV, 1.20; and V, 1.36 mm.; black, with exception of basal segment, which is in part sordid yellowish testaceous. Apex of rostrum just surpassing hind coxae. Pronotum but little shorter than head, about two and one-half times as wide as long (6.56 by 2.64 mm.); lateral margin very slightly concavely sinuate at the middle; surface closely and evenly punctate with fuscous, the punctures more crowded along lateral submargin, the extreme edge neither quite so broadly nor so conspicuously pale as in *Tibraca limbativentris* Stål; humeral angle either narrowly rounded or subacute. Scutellum but little wider than long (4.40 by 4.00 mm.), rather closely and evenly punctate with fuscous, except for the narrow smooth area in each basal angle bordering the deep black fovea. Punctations of corium similar to those on scutellum. Membrane fuliginous. Pleura and venter rather coarsely punctate with fuscous, the latter more sparsely fusco-punctate along the broad lateral margin as shown in Fig. 1 *B*. Legs slightly paler than the corium; femora, except basally, faintly

dotted with fuscous; tibiae toward apices and tarsi, dark brown. Length of male 12.80, of female 14.60 mm.

Type, male, Santa Ana, Ecuador, June, 1939, on rice, received from Dr. Francisco Campos. Paratypes: Seven males and 20 females, all from Ecuador. U. S. National Museum catalogue No. 55160.

Tibrica simillima is very closely related to *T. limbativentris* Stål, 1858, described from Brazil and now known to attack rice in Surinam, according to labeled specimens received from D. G. Giejskes. Stål's species differs from *simillima* by having the lateral margin of the venter broadly, conspicuously pale, devoid of fuscous punctures (Fig. 1, *C*), the antenna longer, with the first two segments more nearly equal and the third segment about twice as long as the second. Two other smaller species of the genus *Tibraca* are known from South America, *T. fusca* Haglund, 1868, probably from Brazil, and *T. obscurata* Bergroth, 1914, from French Guiana.

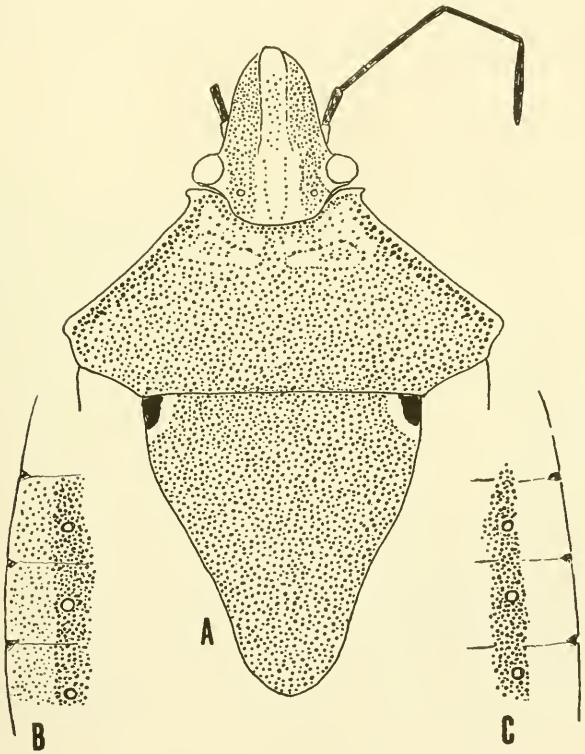

Fig. 1.—A. *Tibraca simillima*, new species.
B. Lateral margin of venter of *T. simillima*.
C. Lateral margin of venter of *T. limbativentris* Stål.

MINUTES OF THE 518TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, APRIL 3, 1941.

The 518th meeting of the Society was held on Thursday, April 3, 1941, in Room 43 of the National Museum. President Ewing called the meeting to order at 8 P. M., and 40 members and 14 visitors attended. The report of the March meeting was approved as read.

The Corresponding Secretary, F. W. Poos, announced that the Scientific Monthly has recently undertaken to issue a Calendar of Scientific Meetings in Washington, D. C., for each of the months October to June, inclusive.

The following were proposed for membership, and, after a few remarks by Miss Russell and Dr. Cory, were unanimously elected:

Theodore L. Bissell, Georgia Experiment Station, Experiment, Ga.

H. L. J. Haller, Bureau of Entomology and Plant Quarantine, Washington, D. C.

G. J. Haeussler, Box 171, Charlottesville, Va.

Phil Rau, 549 E. Argonne Drive, Kirkwood, Mo.

McGovran and Cory called attention to a symposium on chemical control to be held at Durham, N. H., June 25–26, in connection with the summer meeting of the American Association for Advancement of Science.

Snodgrass briefly discussed some recent observations of morphological interest, especially as related to the mechanism of flight in the honey bee.

The regular program was as follows:

1. Insect investigations at the Virginia Truck Crop Experiment Station. Harry G. Walker, Virginia Truck Crop Experiment Station.
2. The development of the silkworm. Walker E. McBath, Bureau of Entomology and Plant Quarantine.

Questions and comments were made by Harris, McIndoo, Anderson, Rees, Gurney and Ewing.

3. The tobacco flea beetle and other insect pests of flue-cured tobacco. W. A. Shands, Bureau of Entomology and Plant Quarantine.

Discussion followed by Anderson and Roark.

Upon invitation from Dr. Ewing, two visitors, John T. Bigham and Karl V. Krombein, greeted the Society.

Adjournment at 10.10 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

Actual date of publication, May 27, 1941.

ANNOUNCEMENT

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F. W. POOS,
Corresponding Secretary,
Address: Bureau of Entomology and Plant Quarantine,
Washington, D. C.

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VOL. 43 June, 1941 No. 6

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OF WASHINGTON



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JUL 29 1941
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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 43 JUNE, 1941 No. 6

LEE ABRAM STRONG

Be it resolved, That the Entomological Society of Washington at its regular meeting on June 5, 1941, express its deep grief at the passing of Dr. Lee Abram Strong, distinguished leader of American entomologists, and its sense of loss at this departure of one of its well loved members. The society knew Dr. Strong both as a friend and as a chief, and felt for him admiration, respect, and affection.

Be it further resolved, That this resolution as well as a biographical sketch of Dr. Strong's services to the entomological work of the United States be published in the Proceedings of the Society and that the secretary be instructed to express to Mrs. Strong and to other members of the bereaved family, our sincere and heartfelt sympathy.

NOTES ON NEARCTIC PANGONIINAE (DIPTERA, TABANIDAE).[1]

By Cornelius B. Philip,

Medical Entomologist, United States Public Health Service.

The recent appearance of the excellent monographs by Brennan (1935) and Stone (1938) on the 2 major subfamilies of Nearctic Tabanidae (deerflies and horseflies) has emphasized the desirability of revising the catalog list of North American species which has been very much augmented since the useful but badly outdated one by Aldrich (1905). The present discussion is intended to partially clear the way for such a catalog by certain additions and emendations to Brennan's treatment of the Pangoniinae.

Types of new species herein described, unless otherwise stated, are in the collection of the author.

STONEMYIA Brennan, 1935.

The wealth of species and variations discussed and figured by Ferguson (1926) for *Scaptia* Walker, 1850, make the writer

[1] Contribution from the Rocky Mountain Laboratory (Hamilton, Montana) of the Division of Infectious Diseases of the National Institute of Health.

suspect that at least the hairy-eyed *S. californica* (Bigot) (Syn. *Silvius jonesi* Cresson), for which Brennan erected the subgenus *Pilimas*, will be difficult to maintain as generically distinct from *Scaptia*, but lack of Australian and certain Neotropical material prevents a more definite opinion at present. Moreover, minute scattering hairs can be seen on the eyes of even the "bare-eyed" species, as also noticed by Aitken. Study of the allotype by the writer and further comparison of the types by Cresson and by Pechuman, have shown the above synonymy of *S. jonesi*. Stone has pointed out that such synonymy does not make a genus monotypic. At the end of this paper the original author has validated *Pilimas* by genotype designation.

Corizoneura ruficornis Bigot, 1892.

This species included by Brennan in *Stonemyia* was misidentified by Hine and others, as specimens kindly compared by Mr. H. Oldroyd with the types (2 males) in the British Museum are not in agreement. Since describing *abaureus* below, the true *ruficornis* was rediscovered by Dr. T. H. G. Aitken, a dichromatic species whose females are extremely difficult to separate from those of the former. The entire thorax is dark in the males, the first tergite and terminal tergites and sternites predominantly so, but the spots on the second to fourth segments described by Bigot are variable. In general, the females are smaller (11–13 mm.) and the scapes of both sexes longer than thick (in *abaureus* these two measurements are equal). Numbers of both sexes were taken by Aitken and colleagues while beating shrubbery at night; its occurrence is reported in the foothills (1500–2500 feet) of the western slope of the Sierra Mountains.

Regarding the types Oldroyd further states, ". . . no specimen so labelled (*ruficornis*) in the collection, but I have 2 ♂♂ labelled as types of '*C. ruficosta*' by Bigot, which fit the description, and have the right data. Evidently Bigot changed the name before publication."

Stonemyia abaureus, n. sp.

Size variable, males 10.5–13 mm., females 13–16 mm. Body and appendages golden yellow, eyes contrasting black, ostensibly bare; wings practically hyaline, the costal margin yellow, veins often faintly margined, vein R_4 with a short to moderate spur basally, the anal cell closed and appendiculate at the margin.

Holotype ♂, 14 mm. Eye facets about uniform; unicolorous green (relaxed). Vertical triangle raised, pale yellow with short concolorous forward-curved hairs posteriorly, the 3 ocelli distinct, brown. Antennae and palpi yellow, the latter produced to three-fourths the length of the stylets, and with predominantly black, shaggy hair from the distal half of the first joints to the end of the second. Hair of face and cheeks yellow. Labium yellowish, retracted, but

stylets little more than half the height of the head. Integument of entire body and legs concolorous, yellowish, covered with yellowish hair except blackish over most of the hind femora and basally on the abdominal tergites, narrowing gradually mesally to about half the width of the segments, the tarsi brownish distally.

Patrick Creek, California, July 19, 1934, G. P. Englehardt. In the collection of the author through courtesy of Dr. L. L. Pechuman. Compared with types of *C. ruficornis* Bigot by H. Oldroyd, and labelled not in agreement, 1939.

Allotype ♀, 14.5 mm. Agrees closely with the male except for sexual differences and shorter vestiture. Front pale yellow, not quite 4 times higher than basal width, slightly widened below; ocellar tubercle very pronounced, concolorous with front; subcallus not widened to the eye margins. Length of palpi as in male, but entirely yellow hirsute; proboscis about two-thirds the height of the head, yellow, darkening on the labellae. Black hairs not evident on the hind femora and shorter, less prominent on the abdomen than the holotype, but with much the same basal distribution.

Shasta County, California, July 24, 1907.

Paratypes.—All from Calif.: ♂, San Felipe Creek, June 23, 1935, C. M. Dammers; 2 ♀ ♀, Kaweah P. O., August 8, 1938, R. H. Beamer; ♀, Santa Rosa, August 16, 1938, Jean Russell; 2 ♂ ♂, ♀ Cuyamuca Lake, July 6, 1929, R. H. Beamer and Paul W. Oman; ♂, Los Angeles Co., May, Coquillett; ♀, Lucerne, July 17, 1935, R. H. Beamer; 4 ♂ ♂, Pinon Flat, San Jacinto Mts., May 28 and 30, 1940, Michener, Gerhardt, and Daniels; ♂, Mineral King, July 31, 1935, Bohart; ♂, Sunset Valley, Santa Barbara Co., June, 1939, White; ♂, Vauville, June 6, 1932, Harris; ♀, San Jacinto Mts., Kern Co., June 5, 1939, Gerhardt. In the collections of the British Museum, Kansas University, Rocky Mountain Laboratory, Drs. L. L. Pechuman and T. H. G. Aitken, and the author.

Male and female, Los Angeles, Calif., no date, Coquillett, in the U. S. Natl. Museum, under "*abaureus*."

The number and distribution of black hairs on the abdomens, femora and palpi of the paratypes are subject to variation while occasional males show some darkening of a few ventral sclerites of chest and abdomen. See also Brennan (1935), who adds Wyoming (Yellowstone) to his California records of "*ruficornis*." I have never seen it from outside the latter State. Aitken collected 2 males on blossoms of *Eriogonum fasciculatum*.

S. pigra (O. S.) 1875.

Add North Carolina and Pennsylvania. May be the same as *Silvius isabellinus* Wied., 1828, but the missing type will need to be consulted for definite opinion; the Ohio specimen listed by Walker is *S. rasa* (Lw.).

Pangonia macroglossa Westwood, 1835.

This has been attributed to "Ga." but may now be definitely removed from North American lists as recheck of the type in the Hope Collection, Oxford Museum, by Dr. B. M. Hobby and H. Oldroyd proves it to be *P. gulosa* Wied. from South Africa, to a locality in which one of the original labels, "Geo," refers.

ESENBECKIA Rondani, 1864.

E. delta (Hine) 1920. A specimen taken by the writer at El Paso, adds Texas to the distribution.

E. incisuralis (Say) 1823. Kröber (1934) placed this (*incisa* Wied. 1828) as *Ricardoa*. Through courtesy of Dr. K. Delkeskamp of the Berlin Museum, the writer was loaned the type of *Ricardoa latifiagrum* End., and considers it a light form of *incisuralis* which varies as indicated by Brennan (1935). Add Arizona.

Since *Pangonia* (*Fidena*) *incisuralis* Macquart, 1847, a valid Neotropical species according to Kröber, is preoccupied by Say's name, and the name *macquarti* has already been used by Guerin for an allied species, *Fidena abominata* n. n. is here proposed.

GONIOPS Aldrich, 1892.

G. chrysocoma Osten Sacken. The inclusion of "Dakota" by Ricardo (1900) in the distribution of this species is an obvious error in referring to Aldrich's location when his *hippoboscoides* (= *chrysocoma*) was described.

CHRYSOPS Meigen, 1803.

C. beameri Brennan. Add Ill., N. J., N. Car. and Ga. A number of eastern records of *sequax* are actually this species, such as those of Daecke (1907) and Brimley (1938). I have 3 males from Massachusetts which differ in certain essentials from *sequax* as discussed by Brennan (1935) and are without doubt the undescribed males of *beameri*, the wing pictures and 4 abdominal black stripes readily associating them with the recently described female.

Allotype ♂, 7.5 mm. In addition to the abbreviated, lateral, pollinose stripes on the face, there is a short subantennal tooth of pale pollen. Palpi brownish. Middorsal thoracic stripes and scutellum plumbeus instead of yellow. Lateral abdominal stripes fading in the middle of each tergite, but evident even on the first, the median pair complete as in the female. The hyaline triangle narrow, just reaching vein R_{2+3}, the apical spot broadly invading cell M_1; the posterior subhyaline areas only a little darker than in the female, most evident margining

the entire length of the cubital vein, but the heavy anterior infuscation abruptly limited by veins M and Cu_1, as in the female, cell Cu_1 not clouded posteriorly as reported for *sequax*, and cell 2nd M with only restricted, indefinite tinges basally.

"Woods Holl" (sic), Mass., Aug 9, 1899. Two other specimens in same series, essentially agree, the lateral abdominal stripes more pronounced, and complete in one.

C. bishoppi Brennan.

The male of *C. atricornis* described by Bigot (1892) is this according to a specimen compared by H. Oldroyd. Add Oregon.

C. callidus Osten Sacken, 1875.

Unfortunately this well-known name is preoccupied according to the International Rules, Article 35, paragraph "d," by *C. calidus* Walk. 1848, and the name *callidula* is here proposed, preserving the name by addition of the diminutive in as nearly the original form as possible.

C. celer Osten Sacken.

The feminine, to agree with other specific names changed in gender, is *celeris*.

C. ceras Townsend.

This species was wrongly synonymized with *C. megaceras* Bellardi by Hine (1925) and omitted by Brennan (1935). The writer has transferred it in a new genus, *Assipala*, in another paper for reasons given therein (Philip, 1941).

C. coloradensis Bigot.

The male of *C. pachycera* Will., 1887, ascribed by Adams (1903) and Brennan (1935) to *C. proclivis* O. S. but doubted by Philip (1935), proves to be that of *C. coloradensis*. The amount and intensity of melanization, particularly of the legs and palpi varies considerably in the 7 specimens studied, 4 of them being considerably darker than Williston's specimen as redescribed by Brennan under *C. proclivis*. Two of the latter were taken with considerable series of females near Davis, California, by Spurlock.

C. dimmocki Hine.

The describer states, "type taken . . . eight other specimens . . ."; the five "cotypes" seen by Brennan (1935) are therefore incorrect.

C. flavida Wiedemann.

The variability of this species is confusing, and includes a northern form which approaches *brunnea* Hine, especially in wing pattern, doubtless leading to some errors in distributional records of the two (see also Daecke, 1907). I have difficulty in accepting *reicherti* Fairchild, 1937, as more than a subspecies of *flavida* due to variation in the diagnostic characters of a long series of the latter studied.

C. inda Osten Sacken.

C. pilumna Kröb. is a male of this according to a specimen compared for the writer by Mr. G. S. Walley in Ottawa, and later verified by the author.

C. hyalina Shannon.

Since this is the only clear winged species of the genus in this country, Surcouf's (1921) reference to a doubtful Ohio *Nemorius* is not clear. The latter, like *Zeuximyia*, would appear to be intermediate between *Chrysops* and *Silvius*, and it is doubtful if *hyalina* is congeneric in the restricted sense with the European *vitripennis*.

C. lugens Wiedemann.

Type male in Copenhagen Museum, not Vienna.

C. noctifera Osten Sacken.

Study of a considerable series of this and *pertinax* Will. from collections of various western institutions, including 2 males from Lake and Klamath Counties, Oregon, has convinced me that the latter species represents a melanistic, more widespread, northern subspecies of *noctifera*. In most *noctifera* the lateral red on the abdomen is pronounced, but occasional specimens show marked reduction, and 2 females from Alameda and Placer Counties, Calif., are entirely dark with whitish lateral pile as in *pertinax*. On the other hand, one each from Harney County, Ore, and Coolin, northern Idaho, have some lateral red a little more extensive than seen in a few *noctifera* from Calif. There is usually an extension of the outer margin of the cross-band in cell R_3 approaching that seen in *nigripes*, but the yellow vestiture and more distinct median abdominal triangles of the latter should prevent confusion with such variants as the Idaho specimen mentioned above, in addition to the broader attachment of the apical spot to the cross-band.

It is doubtful if the unknown male of *noctifera* will be separable from *pertinax* males. There is no red on the abdomen of either of the latter. Typical *pertinax* females were taken in the same

series with the Klamath, Oregon, male, and the Coolin, Idaho, female. Until better evidence is shown for their separation than color, and robustness in only the females mentioned by Brennan (1935), I prefer to consider *pertinax* as a subspecies of *noctifera*, although the latter predominates only in California, admitting it is strange that more than the 2 northern intermediates mentioned have not been seen in that rather common form in Montana and other northwestern States. The Ontario and New Hampshire records by Kröber (1926) seem doubtful, as also does the description of his male with "Spitzenfleck hauchfein."

C. pachycera Will.

I consider both *C. hungerfordi* Brennan, 1935, and *C. dilata* Rowe and Knowlton, 1937, to be at most subspecies of this. The former is differentiated on the basis of lateral, abdominal spots on tergite 2 in both sexes, the latter by fenestrations in the crossband of the wings. The abdominal pattern is especially variable, but not more so than in some other species of *Chrysops* and the lateral spots may be found in all degrees of intensity to complete disappearance in the same series; *hungerfordi* represents the dark phase. Similar variations occur in the abdominal pattern of male paratypes of *dilata*, but the extent and distribution of the clear areas in the wings of both sexes are more constant in this form from southern Utah. I have seen several specimens of *hungerfordi* from western Texas, in addition to the types from southern New Mexico and Arizona. The Oregon record of *pachycera* listed by Brennan (1935) is doubtless based on Cole and Lovett's (1921) misidentification of *C. coloradensis*, the listed specimen of which I have seen.

C. pikei Whitney.

Since Bequaert (1933) mentions "only fragments of four" of the 11 cotypes remain at the Museum of Comparative Zoology, a complete, well-preserved cotype on the original long, white pin labelled "Mo." and later "Daecke Collection" "from Whitney" in the Pennsylvania State Agr. Collection at Harrisburg, is here selected as lectotype. A duplicate with one wing missing is in the collection of the author through kindness of Dr. A. B. Champlain.

C. proclivis O. S.

The Colo. record of *C. atricornis* Bigot (type ♀ only) is unusual, but the wing pattern agrees here according to comparison by Oldroyd. Since the true male of this has not previously been known (see *coloradensis*) it is here briefly described.

Length of 2 specimens, 6.5 and 8 mm. Predominantly black, with a very narrow, but complete, bare, yellow midfacial stripe, yellow pollinosity confined

to lateral facial stripes, palpi and antennae dark,the latter brownish basally on the first segment, thoracic dorsum with the usual pale stripes faint anteriorly, the grayish lateral stripes above and below the wing base more pronounced, the abdominal incisures very narrowly yellow, and notched with a faint streak of the same color half or a little more across the second tergite on each side (and the 3rd and 4th mesally in one specimen); fore and hind tibiae basally tinged, and middle legs with the whole tibiae, and apical half of the femora yellow. Apical spot pronounced and narrow along the costal margin, but indefinite and fading behind; the entire basal part of the wing infuscated (paler behind) except for a small diagonal hyaline spot at the apex of the 2nd M cell, the cross-band reaching the posterior border in cell M_3.

A specimen each seen from Cle Elum, Wash., and Yosemite Valley, California.

Whether these are more properly assigned to the subsp. *surda* O. S. will have to await the accumulation of more specimens.

C. sepulcralis Fabricius (*sepulchralis* Kirby?).

The lack of any confirmatory specimens over the years for Kirby's and Walker's early identifications of this northern Palaearctic species, impel the writer to follow Osten Sacken (1878, p. 54) and Ricardo in discarding it from the Nearctic list.

Chrysops abata, n. sp. (from Latin, inaccessible).

Holotype ♀, 8 mm. *Head* with pollinosity of front and face including a complete, narrow, mesal stripe to the oral margin, yellow; vertical, frontal and facial callosities and cheeks black, the integument on either side the mesal pollinose stripe narrowly yellowish with brownish shades. Frontal callosity but little broader than tall. Antennae slender, the flagellum black, equal in length to the 2 yellow basal segments combined. Palpi not grooved, dark, with yellowish tinges on the extreme base. Eye pattern with heavy maculations, the occipital border contiguous to, the other spots separated from the eye margins, arrowhead connected only with the median spot. *Thorax* and scutellum plumbeus, the usual 5 dark stripes distinct; pleurae predominantly yellowish. Legs smoky, the fore pair and all femora darkest; fore coxae dull yellowish on the basal half. Abdomen yellow and black. The patterns of it and the wings as figured Plate 15 (1 and 2 A, respectively). Ventor yellow, a very narrow median line on the first 2 sternites, expanding on the third, the remainder dark with yellowish tinges and incisures. A fine yellowish pubescence over the whole abdomen, both above and below, and especially noticeable posteriorly.

From "Jacksonville, Florida, June 21." No year or collector.

This fly has affinities with the variable *pudica* group but would run to *inda* O. S. in Brennan's (1935) key to female *Chrysops*. It is distinguished by its complete median, yellow pollinose stripe on the face, black frontal and facial callosities,

broad though separated apical spot, strongly bowed outer margin of the crossband, completely infuscated first and hyaline second "basal" cells of the wing, and distinctive abdominal pattern. Of the North American *Chrysops* females known to the writer, *C. abata* is unique in the possession of an uninterrupted though narrow, mid-facial pollinose stripe comparable to that seen in some males. In females of *C. discalis*, this stripe is broad and also reaches the oral margin below, but widens to meet the genal stripes above the mouth presenting a very differ- arrangement.

C. aestuans Wulp.

The 2 outstanding characters of this species are the uniformly narrow, outer, costal infuscation ("apical spots") of the wings, and the lateral black triangles on the second abdominal segment. Variation and intergradation with closely related *C. callidula* Philip, particularly as regards the latter character, have long troubled students of the group, and Kröber (1926) has described a variety, *confusa*, with complete absence of these lateral triangles, which Brennan (1935) prefers to relate to *callidula*. However, I have an undoubted specimen of *aestuans* from Yakima, Washington, showing such reduction of the abdominal infuscation that the 2d to 4th tergites appear predominantly yellow with simply a median row of reduced geminate spots, although the wing picture is typical.

Of greater consequence because of certain misassignment by the unintiated in a major couplet of existing keys, is a variation which occurs in 4 specimens of *aestuans* from Clark County, Kansas, sent to the writer and to Dr. R. R. Parker by the late Professor Hine. Reduction, though not complete absence of the lateral spots on the 2d tergite, is also seen in these, yet the specimens appear as no more than an extreme variation of *aestuans*. The condition is remarkably parallel to variation seen in *C. proclivis* O. S. (Philip, 1935).

Chrysops aestuans subsp. **abaestuans** nov.

Holotype ♀, 8.5 mm. Differs from characteristic *aestuans* in the breadth of the apical spot of the wing and reduction of the lateral triangles on the second abdominal tergite. The hyaline triangle crosses vein R_{2+3} broadly while the apical spot increases in width just before the termination of that vein to a little over twice that at its juncture with the crossband so that slightly over half the upper margin of vein R_4 is shaded (Plate 15, Fig. 2 B); the posterior margin of the apical spot is very indefinite. The cross-band terminates before the posterior margin in cell M_3. The body colors have the usual bleached yellow appearance of *aestuans*, but the lateral triangles on the second segment are narrow and reduced, widely separated from the median geminate spot, their bases and apices rounded, the latter not reaching the middle of the segment. Anal cell barely

closed at margin. The palpi and legs are predominantly dark, the upper, anterior edge of the former, the middle tibiae, extreme bases of fore and hind tibiae and of all the tarsi yellowish, antennae deep yellowish on the first 2 and base of the third segments.

From "Clark County, Kansas, June, 1962 ft. F. H. Snow."

Allotype ♂, 9 mm. Essentially like the female except for the usual sexual differences but darker in appearance, the antennae are black, the yellow of the abdomen is deeper, the lateral triangles in the second segment less tall and the apical spot occupies about the same width distally, but crosses into the wing tip more extensively and occupies the whole of cell R_1 (Fig. 2 D).

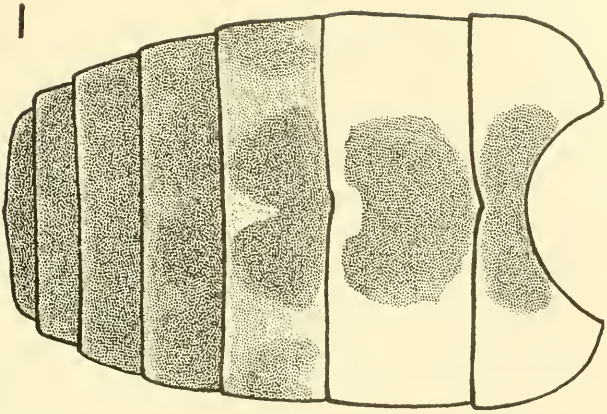
From "Ft. Collins, Colo., May 30, 1931."

Paratypes: 2 ♂ ♂, "Indian Head, Saskatchewan, 13, VII, 1926, Eric Hearle," and "6 mi. W. Logan, Utah, 7–29–35, Armstrong and Smith"; like the allotype, but darker generally, the lateral triangles larger, about normal, connected below with the median maculations; in the Saskatchewan specimen the cross-band reaches the posterior margin faintly as it usually, but not necessarily, does in *callidula*. Three ♀ ♀ all same data as the holotype; the triangles showing greater reduction than the holotype (mere dots in one); the wing patterns show slight variations from that of the holotype, anal cells more open, less or none of the hyaline triangle crossing vein R_{2+3} and either more (Plate 15, Fig. 2 C) or a little less of the apical spot crossing vein R_4 apically, and in one specimen only, the cross-band almost reaches the posterior margin in cell M_3; the legs are predominantly yellow in all but one of these females. One ♀, "Sterling Reservoir, Colo., July 10, 1921" in the collection of L. L. Pechuman also agrees.

The wide apical spot is, of course, the important feature of this variety. Omitting this character, the closeness of *aestuans* and *callidula* is again emphasized in this series of specimens in the intergrading of certain critical criteria, such as the density and width of the apical spot at its juncture with the cross-band, the close approach of the latter to the posterior margin in one of each sex, the increasing amount of yellow on the abdomen and legs, with consequent reduction of the lateral abdominal triangles.

Chrysops aberrans n. sp. (from Latin, wandering, hence variant).

This is the form heretofore placed under *striata* O. S. having yellow to brownish frontal callosities, apical spot broader including most or all of cell R_3, usually brighter thoracic and abdominal stripes, the latter seldom joined anteriorly on tergite 2, the lateral ones often obsolescent anteriorly but pronounced posteriorly.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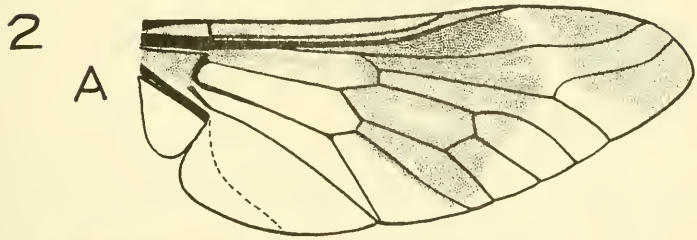
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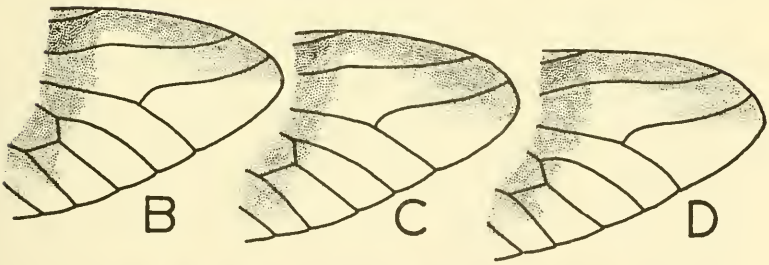
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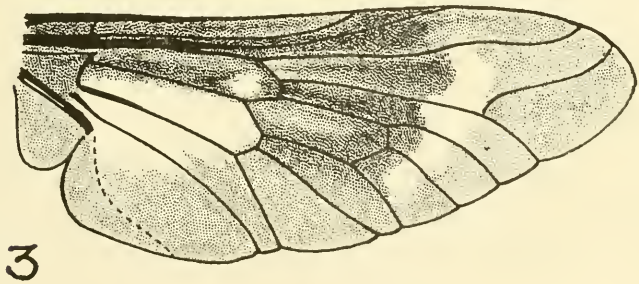
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Holotype ♀, 8 mm. *Head* with frontal and lateral facial pollinosity, frontal callosity, facial and genal integument, first 2 antennal segments and palpi yellow; narrow upper border of frontal callosity, ocellar tubercle and most of third antennal segment dark; antennae slender; palpi not grooved; no mid-facial pollinose stripe. Eye pattern with all spots isolated, the shaft complete and border divided as figured by Daecke (1906) for *striata*. *Thorax* with the usual stripes brighter than in typical *striata*, the plumbeus mid-stripe continuing as an inverted acute triangle onto the disc of the scutellum, narrowly dividing the lateral reddish margins at the apex. Lateral thoracic stripes yellowish. Wing very like *striata*, cell R completely infuscated, 2nd M and Cu hyaline, the cross-band reaching the posterior margin in M_3, but the apical spot broader almost filling cell R_5, leaving the furcation barely included in the apex of the hyaline triangle, anal cell open at the margin. Legs yellow, the middle and hind coxae, basal third of hind femora, distal third of fore tibiae, and fore tarsi brown. *Abdomen* yellow with 4 subequal dark stripes on tergites 2 to 5 inclusive, tergite 1 with indications of a geminate spot beneath the scutellum and isolated shadows at the terminations of the lateral stripes; yellow incisures widest on posterior tergites, 6 and 7 otherwise dark. Venter yellow, a broad, median, dark band abruptly terminating anteriorly on sternite 5, and indications of 2 lateral, narrow stripes reaching forward midway on sternite 2.

Ramsay County, Minnesota, Aug. 12, 1934, C. B. Philip.

Allotype ♂, 8 mm. Like the female except for the usual sexual differences. Facial integument entirely yellow, and scutellum completely plumbeus without lateral red. Wings almost entirely clouded, lighter in the anal and cubital areas, a small diagonal hyaline spot crossing the apex of cell 2nd M into the extreme base of Cu_1, the apical spot filling out cell R_3 including the furcation and invading cell R_5 faintly; anal cell barely closed at margin. Abdomen with the 4 stripes complete dorsally, the lateral ones terminating on the middle of tergite 1, and the middle pair converging but not quite joining anteriorly on tergite 2; the midventral band produced forward on all sternites, narrowing and discontinuous on 2 and 3. Maculations of eye pattern isolated from occipital border and from each other.

Washington County, Minnesota, July 11, 1911.

Paratypes: Minn., 7 ♀ ♀, same data as holotype; 8 ♂ ♂ and 127 other females, various localities, July 8 to Aug. 11 (including 3 ♂ ♂ and 2 ♀ ♀ reared by the writer) Philip, Telford, Stehr, Mickel, Knight, Pletsch, Beamer and Peters, Tinkham, Hoffman, Hill, and Denning, collectors.

Mich., 77 ♀ ♀ various localities, July 7 to Aug. 8, Brennan, Boesel, Hubbell, Byers, Gaige, Cantrall, Gloyd, Bigelow, Oliver, Steyskal, collectors.

Wisc., ♂, Dane Co., July 10, 1900.

Ill., ♀, Volo, July 8, 1932, Ross, Dozier, Mohr; 2 ♀ ♀, "Ill." (*striata* ?, teste Osten Sacken).

Ohio, 3 ♀ ♀, Sandusky, Cedar Point, Aug. 7, 8, and 14, 1902; ♂, Sandusky, Aug. 7, 1920, D. G. Hall.

Mass., ♂, Woods Holl (sic), Aug. 9, 1899.

Conn., ♀, "Williston."

Me., ♀, Lincoln County, Aug. 23, 1938, D. J. Borror; ♀, Paris, Aug. 17, 1936, C. A. Frost.

R. I., ♀, Westerly, July 23, 1936, M. Chapman.

N. Y., 2 ♂ ♂, 19 ♀ ♀, various localities, Dreisbach, Palm, Blanton, Babiy, Pechuman, Blanton and Borders, collectors.

N. J., 2 ♂ ♂, Palmyra, Aug. 7 and 12, 1925, L. B. Parker; ♂, Evesboro, Aug. 17, 1925, L. B. Parker.

Penn., ♂, no other data (*striata* ? by Osten Sacken).

In the collections of the Berlin, Vienna, British and U. S. National Museums, the Museum of Comparative Zoology, California Academy of Science, Universities of Minnesota, Michigan and Kansas, the Rocky Mountain Laboratory, Cornell University, L. L. Pechuman, T. H. G. Aitken and the author. Additional localities for the U. S. National Museum material through Dr. Alan Stone include Indiana (Bluffton), Mass. (Essex), and Que. (St. Placide).

Variations in individual characters occur within limits but compositely there is little difficulty in distinguishing this from true *striata*. Some specimens of *aberrans* show at most dark brown frontal and facial callosities (only three specimens of the long series studied had entirely black callosities), the hyaline triangle seldom reaches much forward of the furcation while a spur of the apical spot not infrequently invades cell R_5 as in some *univittata* or *vittata;* many including the males show no reddish on the scutellum, or if so then the emphasis is usually marginal, not apical as in *striata;* the abdominal patterns are quite distinct, brighter yellow and black in *aberrans*, the 4 stripes subequal posteriorly, the lateral pair sometimes fading anteriorly on the second or third tergites, but almost never posteriorly on *each* tergite as in *striata*, while the middle pair frequently unite or are very narrowly separated anteriorly on tergite 2 in the latter, seldom unite in female *aberrans*. I have seen but 2 true *striata* with other than piceous callosities, and none with the borders of the eye pattern separated from the occipital margin as in *aberrans* although this will have to be checked in series in fresh material. A useful supplemental character in those *aberrans* with dark brown frontal callosities is the sharp delimitation of the infuscation on the facial callosities inside the sutures (also duplicated in the males), whereas in *striata*, when present, both sides of the sutures are margined.

I have one male (Minn.) with the reduced apical spot of typical *striata* in which the cubital and anal areas of the wing are subhyaline and the distal spot in cell 2nd M extends inwardly for almost a third the length of the cell, tergite 1 is black

across the anterior half with extensions to meet the stripes, the lateral of which show the same accentuation anteriorly on each segment as in the females, while the median, much heavier pair are united two-thirds of the width of tergite 2 enclosing a small, median, yellow equilateral triangle, and the facial callosities are extensively infuscated on *both* sides of the sutures.

The median pair of stripes in all but one of the 16 males of *aberrans* are also united, but the enclosed yellow triangle is larger, often acuminate and frequently half the width of tergite, there is less black on tergite 1, and the wings are extensively infuscated in all as described above for the allotype. All have small, black facial spots confined inside the sutures only and the scutellums entirely plumbeus.

The "two doubtful specimens from Illinois" at the end of Osten Sacken's original description are *aberrans*, as well as a male (Penn.) labelled "striatus ?" in his handwriting; so also is the wing figured by Brennan (1935, p. 391, no. 39), while that of Daecke (1907, pl. IV, fig. 17) indicates the more correct extent of the hyaline triangle in typical *striata*. All reared specimens reported as *striatus* by me (1931, p. 35) are also *aberrans*. Both species are taken together in series on the wing in appropriate localities.

One of the unlabelled cotypes of *striatus* O. S. ("presumably from the District of Columbia," Fairchild, 1938) was loaned for comparison through the courtesy of Mr. Nathan Banks.

C. hirsuticallus, n. sp.

Length, 7.5–10 mm. Named for the peculiar sparse hairs situated on the lateral edges of the frontal callosity in well-preserved females; after denudation, their lateral location is still marked by fine punctations in the shiny integument. The bodies of the females are greenish-gray covered with golden yellow hairs, and with paired median and often lateral black dashes on the abdomen; wings without evident apical spots, the cross-band abbreviated and broken by fenestrate areas, especially in the discal cell, and margined outwardly by an irregular whitish stripe, the hyaline areas otherwise tinted in varying degrees; anal cell widely open. Males black, eye facets separated along frontal margins, wings more extensively infuscated than in females, fenestration much reduced in the cross-bands, which also have very narrow costal extensions apically. Antennae of both, black, robust but not swollen.

Holotype ♀, 8 mm. Front a little broader than high, pale yellowish pollinose, and yellowish pilose; vertex about ocelli and callosity black, the latter broad and narrow, not quite reaching the eye margins. Face somewhat swollen but not tuberculate laterally, no mesal pollen except immediately above mouth, but lateral pollinose stripes complete to oral margin, black outside the sutures and in a complete stripe below each antenna, leaving 3 bare, yellow vertical stripes, the whole covered with shaggy, yellowish hairs. Antennae, palpi and proboscis black with concolorous hairs on the first 2; palpi blackish, not grooved. *Thorax*

deep yellowish with a narrow mesal and 2 broader lateral black lines, covered with golden yellow hair most pronounced on the pleurae. Legs dark, with yellowish shades on the fore tibiae and femora proximally, the middle and hind tibiae except apices, and the central portions of the middle and hind femora and the basal segments of these tarsi. Wings as figured (Plate 15, Fig. 3). Abdomen deep golden caudally due to vestiture, grading to greenish-gray basally, darker ventrally. The median spots on the first 2 tergites continuous to make a horseshoe not reaching the posterior margin of the second. Four spots on each of the following tergites, barely connected across the base laterally on tergite 3.

Woodland, Calif., May 8, 1933, Elwood L. Creel.

Allotype ♂, 8.5 mm. Cephalic integument and appendages black, with concolorous hair, and 2 narrow yellow, smooth stripes each from the oral margin to the base of either antenna, the lateral, facial, pollinose stripes incomplete inwardly. Eyes narrowly separated, divergent inferiorly, leaving a shiny, wrinkled, black triangular frontal callosity above the antennae. Thorax and abdomen subshiny black covered with black hair, except on dorsum of former where the hair is predominantly deep yellowish. Venter of abdomen, and middle and hind tibiae deep brown. Wings extensively infuscated to include most of the anal area and both basal cells, except small hyaline spots in apex of each; the whitish outer margin of the cross-band prominent.

Davis, Calif., March 28, 1936. In the California Academy of Sciences.

Paratypes: ♀, same data as holotype; 4 ♂♂, Davis, Calif., April 24, 1936, R. M. Bohart (3) and May 4, 1936; 12 ♀♀, Davis, 1936, April 24, R. M. Bohart (4), April 28, May 4 (3), April 21, May 19 and June, M. Cazier, May 19, 1936, A. R. Mead; ♀, Blue Lakes, Lake Co., Calif., June 1, 1938, J. Phillips. In the collections of the British and U. S. Nat'l Museums, Univ. of Calif., and Agricultural College, Davis, Calif. Acad. of Sciences; Museum of Comparative Zoology, Harvard; Univ. of Mich.; L. L. Pechuman, M. Cazier, T. H. G. Aitken, and the author. Two females, Sacramento, Calif., 4–17–30, C. W. Wilson.

This apparently localized species is very distinctive because of the peculiar wing pattern and glaucous color in the females, the sparse hairs laterally on their callosities, and the divided eyes in the black males without swollen facial callosities. The eye pattern in both sexes is more reduced than any *Chrysops* known to the writer, only the lower part of the occipital border and lower frontal spot remain, with usually a vestige of the mid-frontal spot as a reduced streak, the remainder of the eye bright green. Variation occurs in the extent of yellow on the legs and faces of the paratypes from almost totally black to predominantly yellow. The frequency of plant pollen on the bodies of both sexes suggests a specialized habitat, accounting for previous oversight.

Dr. J. C. Bequaert also recognized the distinctness of a part of the above series and graciously forwarded them to the author.

Chrysops pechumani, n. sp.

Among California material of *noctifera* were found two pairs of blackish deerflies, closely resembling the *pertinax* variety but with marked, non-intergrading (in the material studied) differences in the wing pattern.

The cross-band lacks the pronounced, though sometimes variable, tooth-like extension toward the fork of R_{4+5} in cell R_3, and practically fills cell M_3 to the wing margin instead of terminating diagonally across this cell so as to involve about two-thirds of vein M_3 and less than half of vein Cu_1; the apical spot in both sexes is much broader, and likewise separated from the cross-band by a wide hyaline interval. Comparative basal infuscation in each sex is very similar to that of *pertinax*, although the 2nd basal cell in the allotype is less hyaline apically. The male of *C. separata* Hine lacks the hyaline spots apically in the basal cells and the entire anal area is fumose, while the female has the first basal cell completely infuscated and the second hyaline, readily separating that southeastern species.

Holotype ♀, 9.5 mm. Except in wing characters, noted above, not different than *pertinax*. Body and appendages black, reddish tinges basally on the first antennal segments, middle and hind tibiae and metatarsi. Three pale-yellowish, facial pollinose stripes, the middle one incomplete below. Vestiture whitish, black on the antennae, legs except coxae and middle and hind femora, and the dorsum of the abdomen, leaving whitish patches on the sides of the first and second tergites, the lateral margins of the remainder and rather narrow middorsal patches widening behind to include most of the last two tergites, none of these overlying pale pollinosity as in some species. Cells R and 2nd M hyaline in their outer fourth (except extreme tip) and almost half respectively.

Niles, Inyo Co., Calif., April 21, 1918, C. L. Fox.

Allotype ♂, 9 mm. In close agreement with the female except for the usual sexual difference. Vestiture predominantly black with some whitish hairs inter-mixed on the lower cheeks, dorsum and chest of the thorax, fore coxae, and venter of the abdomen, and traces on the extreme lateral and reduced middorsal margins of the posterior tergites. A rather narrow, diagonal, parallel-sided spot crossing the apices of both basal cells of the wing, the outer margin of the cross-band evenly convex and the separated apical spot very broad occupying approximately half of cell R_4 as in the female.

Posmo, Calif., April 25, 1919, E. P. van Duzee. In the California Academy of Sciences.

Paratypes. ♂, Sobre Vista, Sonoma Co., Calif., June 26, 1910, J. A. Kusche. ♀, Tamalpias, Calif., May 28, 1922, C. L. Fox. In the collections of the author and the California Academy of Sciences, respectively. Another ♀ from Steen

Mts., Oregon, has similar outer wing pattern but cell 2nd M is infuscated as in the male, much more than any related females seen of *noctifera*, *pertinax*, or typical *pechumani*, and so is not included in the series.

It is not impossible that additional material might be less easily distinguished from *pertinax* as in the *carbonaria-mitis* and *aestuans-callida* complexes, but the distinctness of the wing pattern of present material justifies its specific separation rather than the subspecies treatment accorded *pertinax*.

Comments and loan of materials from many individuals and institutions have facilitated these studies, and thanks are particularly due Mr. H. Oldroyd, of the British Museum; Messrs. Walley and McDunnough, of the Canadian National Museum; Dr. Alan Stone, of the U. S. National Museum; Mr. Nathan Banks, of the Museum of Comparative Zoology; Mr. E. P. van Duzee, of the California Academy of Sciences; Drs. R. H. Beamer, T. H. G. Aitken, L. L. Pechuman, J. Bequaert, G. B. Fairchild, Donald MacCreary, A. B. Champlain, and Miss Ada L. Olson for various favors.

Summary.

Described for the first time in this paper are: *Stonemyia abaureus* n. sp. (♂, ♀) from California, *Chrysops beameri Bren.* allotype ♂, *C. callidula* new name for *C. callida* O. S., *C. abata* n. sp. (♀) from Florida, *C. aestuans abaestuans* n. subsp. (♂, ♀) from Kansas and the Rocky Mountain region, *C. aberrans* n. sp. (♂, ♀) from the Northeastern States, and *C. pechumanni* and *hirsuticallus* n. spp. (♂, ♀) from California. *Pangonia macroglossa* Westwood is removed from North American lists, being a synonym of *P. gulosa* Wied. from South Africa. New synonymy includes: *Ricardoa latiflagrum* End. = *Esenbeckia incisuralis* (Say), *C. atricornis* Bigot (♂ only) = *C. bishoppi* Bren., *C. pachycera* Will. (♂ only) = *C. coloradensis* Bigot, *C. reicherti* Fchld. = *C. flavida* Wied. subsp., *C. pilumna* Kröb. = *C. inda* O. S., *C. pertinax* Will. = *C. noctifera* O. S. subsp., *C. dilata* Rowe and Knowlton and *C. hungerfordi* Bren. = *C. pachycera* Will. subspp. Some other notes on North American Pangoniinae are included and the new name *Fidena abominata* is proposed for the Neotropical *Pangonia incisuralis* Macq. (not Say).

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Note: Dr. Philip has indicated the need for the validation of *Pilimas* Brennan (1935) by designation of genotype. *Diatomineura californica* Bigot is herewith designated as genotype of *Pilimas* and the name dates from this note. Signed, J. M. Brennan.

ANNAMYIA, A NEW GENUS OF ASILIDAE, WITH A REVISION OF THE GENUS APHAMARTANIA SCHINER (DIPTERA).

By A. Earl Pritchard,
University of Minnesota.

Five species were assigned to the genus *Aphamartania* Schiner (= *Cylindrophora* Philippi) during the nineteenth century, and one species belonging to this genus was described recently in the genus *Cophura* Osten Sacken. Very few published records of these species have appeared since, and up to the present no attempt has been made to show relationships nor to facilitate identification of the species. In the present revision of *Aphamartania*, three new species are added, and two of the previously described species are considered as synonyms. A new genus is herein proposed for a new species from Brazil.

This study is based largely on material in the U. S. National Museum, and types of the new species are in the collection of that institution. The writer wishes to express his gratification to Dr. E. A. Chapin and to Mr. C. F. W. Muesebeck for the privilege of studying this material.

ANNAMYIA, new genus.

Annamyia is closely related to the genus *Aphamartania* from which it differs mainly by having the anterior tarsus greatly lengthened, twice as long as the anterior tibia, by having the face produced strongly, and by having the mystax composed of strong bristles over the face. *Annamyia* differs from the genus *Paraphamartania* Engel by the greatly lengthened fore tarsus, by the face being divergent below, and by the facial gibbosity being well elevated.

Annamyia (Brazil), *Aphamartania* (S. Amer.), and *Paraphamartania* (Syria) are quite closely related, the affinities being particularly evident by the male genitalia which are characteristically enlarged with the ventral plate especially bulbous. These three genera are in turn related to the genus *Cophura* Osten Sacken (New World, mostly N. American) which has small male genitalia that are usually largely concealed by the abdomen.

Generic characterization.—Face at antennae about one-half the width of one eye at this level; front slightly convergent above; face moderately divergent below, the distance between the eyes below nearly twice as wide as that at the antennae. Facial gibbosity gradually developed from the antennae, well elevated orally, projecting beyond the eyes, as seen from the side, by a distance as great as the length of the first two antennal segments. Mystax moderately sparse, covering the entire face, composed of stout bristles and a few hairs. First two antennal segments subequal; third antennal segment one and one-half

times the length of first two segments combined, parallel sided, bare of setae; style acutely tapering distally, as long as second antennal segment, two segmented with the proximal division very short, distally provided with a minute spine. Prosternum reduced to an isolated sclerite; mesonotum moderately arched, with moderate vestiture; metasternum widely divided; mesonotum with strong bristles laterally; one pair posterior dorsocentrals; scutellum moderately convex with one pair marginal bristles. Legs elongate, slender; femora without bristles; anterior tibia with a sigmoid distal spur, the anterior basitarsus provided with several minute nodulations in connection with this spur; anterior tarsus very elongate, twice as long as anterior tibia, the basitarsus a little over twice as long as the following two segments, the distal segments progressively decreasing slightly in length; claws slender, acute; pulvilli well developed, about as long as claws. Wing a little over three times as long as broad; marginal, posterior, and anal cells open, the fourth posterior cell narrowed distally; anal lobe well developed. Abdomen elongate, four times as long as wide, depressed, nearly bare; lateral bristles of first segment hardly differentiated from the hairs. Male genitalia enlarged, strongly developed cephalad and caudad, inverted.

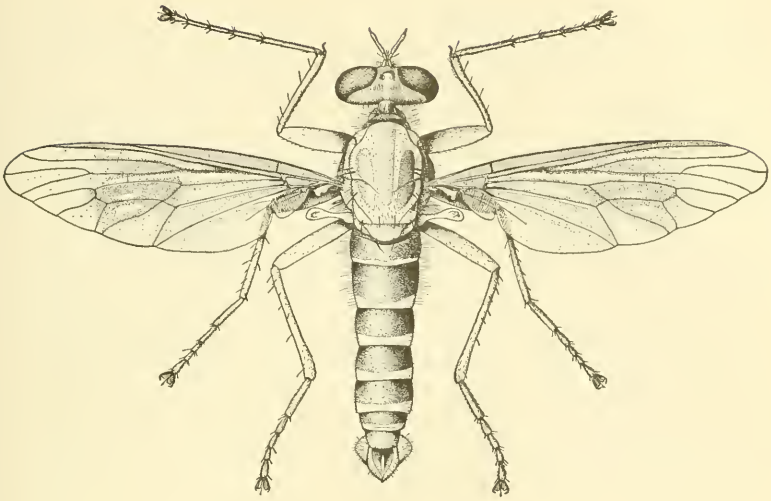
Genotype.—*Annamyia maren*, new species.

Annamyia maren, new species.

A moderately elongate species; thorax reddish with three black mesonotal stripes; abdomen black with a caudal white fascia on each segment; legs castaneous; wings fuliginose, paler distally and in the cells. Length 13 mm. Fig. 1.

Male.—Face and front reddish in ground color, the face white pollinose, bare and shining below antennae, the front brownish pollinose; mystax in large part, bristles of palpi, of proximal two antennal segments, and of ocellar tubercle black; mystax laterally white. Occiput black in ground color, cinereous pollinose, white pilose. Thorax and coxae largely reddish in ground color, the prothorax, mesonotal vittae, scutellum, postnotum, and posterior coxae black in ground color; thoracic pollen thin above, rather buff colored, denser on sides below and whitish; pile of prothorax and pleura white; three mesonotal vittae bare, dull black, broad; mesonotal setae mostly dark brownish, recumbent; mesonotal bristles black; one pair posterior dorsocentrals, and on either side two presutural, one or two supraalar, one or two postcallar; scutellum with one pair marginal bristles. Legs castaneous, shining, clothed with sparse white hairs and black bristles; tarsal setae black. Wings fuliginose, the distal fourth paler, cells interiorly paler, with a clear hyaline streak in first marginal and first basal cells, inner portion of fourth posterior cell and discal cell. Abdomen black in ground color, dull black pollinose, each segment except last with a transverse whitish pollinose fascia covering the caudal fifth and widening on lateral margins to cover most of the segment. Genitalia shining dark yellowish, the distal process of inferior forceps black; ventral plate deeply impressed as seen from above, with a distal bifid prolongation as seen from below; hairs on genitalia above white, bristles below black.

Holotype.—Male, Diamantina, Minas Geraes, Brazil, 14, 18 Nov. '19. (Cornell University Expedition); type no. 54192 in the collection of the U. S. National Museum.



ANNAMYIA MAREN

Fig. 1. Dorsal view of male.

APHAMARTANIA Schiner.

1865. *Cylindrophora* Philippi (preoccupied by Solier, 1849, Coleoptera), Verhl. Zool.-Bot. Ges. Wien, 15 : 704. Genotype, *C. murina* Philippi by original designation.

1866. *Aphamartania* Schiner, Verh. Zool.-Bot. Ges. Wien, 16 : 671. Genotype, *A. frauenfeldi* Schiner by original designation.

1889. *Lynchia* Williston (preoccupied by Weyenbergh, 1881, Diptera), Psyche, 5 : 255. New name for *Cylindrophora* Philippi.

1889. *Myiothera* Williston, Psyche, 5 : 259. New name for *Lynchia* Williston.

1891. *Theromyia* Williston, Trans. Amer. Ent. Soc., 18 : 73. New name for *Myiothera* Williston.

1909. *Aphamartania* Hermann and *Cylindrophora* Hermann, Berl. Ent. Zts., 53 : 155 (1908).

1909. *Aphamartania* Kertesz, Catal. Dipt., 4 : 143.

1930. *Aphamartania* Engel, Flieg. Palae, Reg., 24 : 440.

1932. *Aphamartania* Bromley, Dipt. Patagonia and S. Chile, 5 (3) : 266.

Both Schiner, in erecting the genus *Aphamartania*, and Williston in renaming the genus *Cylindrophora* recognized a generic distinction between the pulvillate and rudimentarily pulvillate forms. Hermann, however, did not favor such a distinction, and Kertesz united these genera in his catalogue. Engel followed Hermann and Kertesz in uniting the groups, and also erected *Paraphamartania* as a new subgenus for the

old world species. *Paraphamartania* is considered a separate genus in this paper. Three distinct groups are recognized in the genus *Aphamartania* in its present sense, each of which may be considered worthy of higher rank in the future.

The three groups may be easily recognized by habitus. The species of the *murina* group are short and stocky, those of the *frauenfeldi* group are robust, but more depressed and elongate; the *marga* group includes a slender species.

The *murina* group is known only from the west side of the Andes, in Chile and Peru. The *frauenfeldi* group appears to be generally distributed over South America east of the Andes, extending northward into Panama. The *marga* group is known from Argentina. *Aphamartania* appears to be a South American complement of the almost entirely North American *Cophura*. *A. marga* is somewhat of a link to the *sodalis* group of *Cophura*.

Aphamartania breviventris (Macquart) is not included in the following key. A new species of the *frauenfeldi* group from Chapada, Brazil (Amer. Mus. Nat. Hist.) is at hand, but is not included due to poor condition of the material.

Key to Species.

1. Pulvilli rudimentary, one-fourth the length of the claws; basitarsus as long as distal tarsal segment; mystax very dense (*murina* group) 2
   Pulvilli well developed, as long as the claws; basitarsus as long as distal two tarsal segments; mystax moderately dense or rather sparse 3
2. Fore femur with several bristles near middle of anterior side; male hind femur with a dense patch of hairs on proximal portion of ventral side; male hind tibia with heavy, black, antero-ventral bristles (Chile) ..... *murina* (Philippi)
   Fore femur without bristles on anterior side; male hind femur with sparse hairs below; male hind tibia with undifferentiated, whitish bristles (Peru) ..... *nana*, new species
3. Hind tibia very slender proximally, the distal fourth enlarged; hind basitarsus enlarged; mystax rather sparse, not reaching eyes laterally; anal cell closed and long petiolate (*marga* group) (Argentina) ..... *marga*, new species
   Hind tibia stout, rather evenly tapering from base to apex; hind basitarsus as slender as other tarsal segments; mystax moderately dense, reaching eyes laterally; anal cell open or closed in the margin (*frauenfeldi* group) 4
4. Wings uniformly fuscus, the marginal cell brown, and the cross-veins and furcations brown maculate (Peru) ..... *digna*, new species
3. Wings brown on proximal half, hyaline on distal half, the median cord dark brown, the proximal fourth with a luteous tinge (Venezuela, Panama) ..... *frauenfeldi* Schiner

Aphamartania murina (Philippi).

1865. *Cylindrophora murina* Philippi, Verh. Zool.-Bot. Ges. Wien, 15 : 704.
1868. *Cylindrophora calopyga* Schiner, Reise Novara : 166. New synonymy.
1891. *Theromyia calopyga* Williston, Trans. Amer. Ent. Soc., 18 : 73. New Synonymy.
1891. *Theromyia murina* Williston, Trans. Amer. Ent. Soc., 18 : 73.
1909. *Aphamartania calopyga* Kertesz, Catal. Dipt., 4 : 144. New synonymy.
1909. *Aphamartania murina* Kertesz, Catal. Dipt., 4 : 144.
1932. *Aphamartania murina* Bromley, Dipt. Patag. and S. Chile, 5 (3) : 266.

Types.—Of *murina*, probably in the Museo Nacional, Santiago; of *calopyga*, probably in the Naturhistorische Staatsmuseum, Wien.

Remarks.—Schiner recognized a good possibility that his species could be synonymous with that of Philippi; but his material differed from the description of *murina* in several color characteristics, that of the abdomen, legs, and wings. The abdomen in the series at hand varies from shining to dull pollinose and from black to various degrees of reddish. The depth of color of the legs is somewhat variable. Schiner's type pair possessed the essential wing maculations, since he described (p. 167), "die kleine Querader und die äusserste Basis der oberen Zinke der Cubitalgabel etwas verdickt." Male genitalia, Plate 16, Fig. 3.

Distribution.—Type locality of *murina*, Santiago, CHILE: of *calopyga*, CHILE. Bromley recorded *murina* from Santiago, CHILE. Material at hand is from Santiago, Angol (December), and Valparaiso, CHILE.

Aphamartania nana, new species.

Closely related to *murina* (Philippi) from which it differs essentially in lacking the bristles which are located medially on the anterior side of the fore femur of *murina;* in lacking the dense brush of white hairs on the proximal portion of the ventral side of the hind femur and the heavy, black, antero-ventral bristles of the hind tibia of the male of *murina;* and in having the periproct of the male genitalia unarmed.

Male.—Head whitish pollinose anteriorly, ochreous pollinose posteriorly; vestiture pale yellowish, nearly white anteriorly. Mystax very dense; ocellar tubercles with many short bristles; occiput densely clothed with hairs and bristles. Thorax black in ground color except the humeral calli, which are reddish. Mesonotum ochreous pollinose with a dull brown, geminate middorsal stripe, and with a moderately wide lateral stripe on each side, which is bright, velvety black, interrupted at the transverse suture; clothed with moderately dense, rather fine, pale yellowish hairs; dorsocentrals post sutural, but little differentiated; lateral bristles strong, pale yellowish; on each side four presutural, three or four supraalar, and three on posterior callus. Scutellum entirely tawny pollinose, with five pairs strong marginal bristles. Thoracic

pleura brown pollinose, with pale yellowish vestiture. Femora shining black except narrow distal tip yellowish; moderately clothed with fine, white hairs and distal yellowish bristles above; posterior femur with a dorso-lateral row of five pale bristles, the ventral aspect with only a few scattered hairs and scarcely differentiated bristles. Tibiae and tarsi yellowish, the tibiae fuscus below especially distally; clothed with pale yellowish bristles, the bristles below at distal ends of tibiae and below on tarsi dark brown; anterior tarsus including claws about as long as anterior tibia; claws black, yellowish at base; pulvilli about one-fourth length of claws. Wings pale brownish with fuscus maculations at forks of veins on median cord of wing and at distal fork of posterior radial vein. Abdomen shining, the first segment thinly brown pollinose; segments one to three entirely black, the distal segments deep yellowish except for dorsal black maculation on four and brownish caudal margins of the segments; vestiture consisting of moderately dense hairs laterally, pale yellowish, more distinctly yellowish caudally. Genitalia bright yellowish with strong, yellowish bristles; periproct and superior forceps simple; inferior forceps with an elongate distal projection which is bifid and directed inwards at distal end; ventral plate strongly developed. Length, 11 mm.

Holotype.—Male, Verrugas Canyon, Lima, PERU, 7,000 ft., 7 . 7 . 28 (R. C. Shannon); type no. 54193 in the collection of the U. S. National Museum.

Aphamartania frauenfeldi Schiner.

1866, *Aphamartania frauenfeldi* Schiner, Verh. Zool.-Bot. Ges. Wien, 16 : 671.
1867. *Aphamartania frauenfeldi* Schiner, Verh. Zool.-Bot. Ges. Wien, 17 : 372.
1891. *Aphamartania frauenfeldi* Williston, Trans. Amer. Ent. Soc., 18 : 73.
1909. *Aphamartania frauenfeldi* Kertesz, Catal. Dipt., 4 : 144.
1929. *Aphamartania frauenfeldi* Engel, Konowia, 8 (4) : 468.
1931. *Cophura panamensis* Curran, Amer. Mus. Nov., 487 : 6. New synonymy.

Types.—Of *Frauenfeldi*, probably in the Naturhistorische staatsmuseum, Wien; of *panamensis*, in the American Museum of Natural History, New York.

Remarks.—It seems entirely reasonable that *panamensis* is the same as *frauenfeldi*. Schiner has given an excellent description which holds equally well for material from Panama. Dr. Curran first recognized the true generic reference of *panamensis*. The type of *panamensis* has been seen by the writer. Male genitalia, Plate 16, Fig. 1.

Distribution.—*Frauenfeldi* was described from VENEZUELA; *panamensis* from Barro Colorado Island, CANAL ZONE (Jan.–Feb.). Material at hand is from Alhajuelo, PANAMA (March). The writer feels that Engel's record from Bolivia should not be accepted until the identification is rechecked.

Aphamartania digna, new species.

Closely allied to *frauenfeldi* Schiner, differing essentially in having the wings rather uniformly fuscus rather than hyaline on the distal half; the male genitalia smaller with the distal section of the inferior forceps but little widened with the median tooth very small (Plate 16, Fig. 2). The front is entirely pollinose, the frontal setae black; the mystax extends above more on either side; the lateral hairs of the first abdominal segment are black, the mesonotal setae and the bristles on the legs are entirely black; and the legs are tawny rather than castaneous.

Male.—Head ochreous pollinose, the front and vertex brown pollinose; mystax, beard, vestiture of palpi, occiput, and proximal antennal segments whitish, frontals and ocellars in part black; antennae brown. Thorax tawny in ground color except for black mesonotal vittae; ochreous pollinose except for vittae; mesonotum clothed except on the vittae with black, stout setae; several black posterior dorsocentrals poorly differentiated; lateral bristles yellowish or black: three presutural, two supraalar, three postcallar on either side; mesonotal vittae rather broad, dull black, the lateral vittae nearly divided at the transverse suture. Scutellum ochreous pollinose, with four pairs strong, marginal, yellowish bristles. Vestiture of prothorax, coxae, and hypopleura pale. Legs tawny, the femora a little darker; bristles entirely black; fine setae on femora and tibiae pale; anterior basitarsus about twice as long as distal tarsal segment. Wings rather evenly fuscus, the costal cell and cross-veins and furcations brownish. Abdomen dull black above, brown pollinose, the lateral margin evenly and the venter tawny; lateral hairs short, thin, white. Genitalia tawny with pale yellowish hairs; distal portion of inferior forceps with broad inner projection, beyond this elongate, with the small median tooth, curved inwardly. Length, 9.5 mm.

Female.—Similar, the legs a little paler, the distal abdominal segments tawny. Length, 11 mm.

Holotype.—Male, Shishmay, Huanuco, PERU, September 17, 1937 (Felix Woytkowski); type no. 54194 in the collection of the U. S. National Museum.

Paratype.—Female, Shishmay, Huanuco, PERU, September 17, 1937 (Felix Woytkowski).

Aphamartania breviventris (Macquart).

1847. *Dasypogon breviventris* Macquart, Dipt. Exot., suppl. 3 : 181. Fig.
1854. *Dasypogon breviventris* Walker, List. Dipt. Brit. Mus., 6, suppl. 2 : 435.
1891. *Theromyia breviventris* Williston, Trans. Amer. Ent. Soc., 18 : 73.
1909. *Aphamartania beviventris* Kertesz, Catal. Dipt., 4 : 143. Species name is misspelled.

Types.—Possibly in the Museum Histoire Naturelle, Lille, or in the Museum National d'Histoire Naturelle, Paris.

Remarks.—*A. breviventris* has not been recognized nor included in the key. Macquart's description clearly indicates

close relationship in the *frauenfeldi* group, but the diagrammatic drawing showing the mystax is misleading.

Distribution.—Described from Rio-Negro.

Aphamartania marga, new species.

Marga differs from all other species included in the genus by the slender body, the slender legs, the enlarged hind basitarsus and distal end of the hind tibia, the small, scant mystax, and the single pair of marginal scutellars.

Male.—Head with pollen of face buff, of front and vertex dark brown, of occiput cinereous. Hairs of head white; mystax sparse, not reaching eyes laterally and nearly divided medially; ocellars short, numerous. Thorax largely yellowish in ground color except disc of mesonotum, buff pollinose except disc of mesonotum. Prothorax rather sparsely clothed with long white hairs. Mesonotum except lateral margins and calli black, velvety brown pollinose; clothed laterally and along the line of the dorsocentrals with long white hairs; postsutural dorsocentrals long; lateral bristles white: three presutural, three supraalar, and three postcallar on either side. Scutellum with disc brownish pollinose, marginally cinereous pollinose, with two white scutellars. Hypopleural bristles fine. Legs shining brown, the hind femur below and proximal two-thirds of hind tibia tawny; bristles of anterior four legs black, of posterior pair whitish; setae of legs white except on anterior four tibiae and tarsi black; anterior basitarsus twice as long as last tarsal segment; hind femora slender especially proximally, without bristles; hind tibia incrassate on distal fourth, hind basitarsus incrassate. Wings brownish on proximal half, fading into a paler fuscus distally; costal cell darker brown; anal cell closed and long petiolate. Abdomen shining black above, the lateral margins yellowish and extending inwards along caudal margin of each serment; rather long, white hairs sparsely on sides of proximal two segments. Genitalia yellowish, the superior forceps brownish; clothed with white hairs and bristles (Plate 16, Fig. 4). Length 9 mm.

Female.—Similar. Length, 10 mm.

Holotype.—Male, Tucuman, ARGENTINA, 7.XII.1927 (H. E. Box); type no. 55469 in the collection of the U. S. National Museum.

Paratype.—Female, Tucuman, ARGENTINA, XI.30.28 (H. A. Jaynes).

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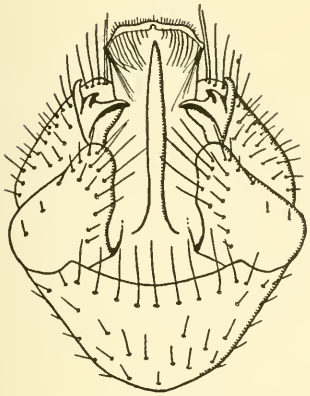
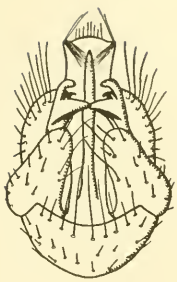
—— —— 1930. Die Fliegen der Palaearktischen Region, 24, Asilidae, Stuttgart : 440–441.

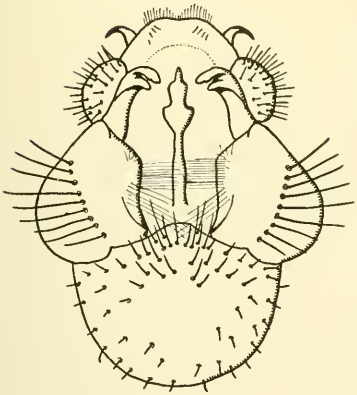
HERMANN, F. 1909. Beitrag zur Kenntnis der Asilidae (IV) Dipt. Berliner Entomologische Zeitschrift (1908), 53 : 155.



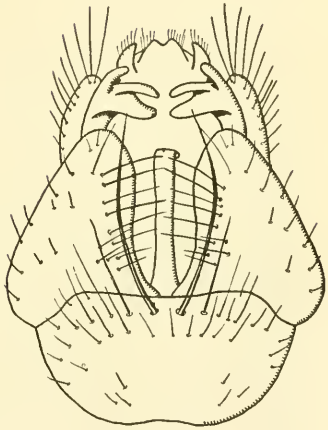
1. A. FRAUENFELDI



2. A. DIGNA



3. A. MURINA



4. A. MARGA

Explanation of Plate.

Ventral aspect of male genitalia: 1. *Aphamartania frauenfeldi*, Schiner, male, Alhajuelo, Panama, March 4, 1912 (August Busck); 2. *A. digna*, new species, holotype male; 3. *A. murina* (Philippi), male, Angol, Chile, December 27, 1929; 4. *A. marga*, new species, holotype, male.

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Williston, S. W. 1889. Notes on Asilidae. Psyche, 5 : 255, 259.
—— —— 1891. Catalogue of the described species of South American Asilidae. Transactions of the American Entomological Society, 18 : 73.

A NEW STEATOCOCCUS FROM MEXICO (HEMIPTERA, COCCOIDEA).

By Harold Morrison,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The following description of a new Mexican *Steatococcus* has been prepared for immediate publication at the request of its collector, Dr. Sally Hughes-Schrader, who wishes the name for use in connection with her publication of extended cytological studies on the species.

Steatococcus tuberculatus, new species.

Adult female.—Shape characteristic for genus, strongly ovoid, broadest and high convex through middle of abdomen, anterior end much narrowed. Length of fully distended adult up to 7 mm. long by 6 mm. wide across abdomen and about 4.5 mm. high. Color in life, according to notes supplied by the collector, blue purple dusted with wax, and showing dorsally four tufts of whitish or yellowish wax and eight pairs of marginal tufts of white wax; dried specimens reddish brown, with the dorsal wax tufts mostly inconspicuous or not evident and the marginal tufts sometimes similarly inconspicuous but with a recognizable maximum total of ten pairs of wax-covered spots, individuals evidently, under some conditions, more or less heavily dusted with wax powder; dorsal surface likewise exhibiting four rows of short but very evident digitate tubercles, each bearing several stout setae, the two inner, submedian rows each including three or four such tubercles, apparently on the three thoracic segments and the head, the two outer, intermediate, rows usually each including six such tubercles; in addition with two similar more or less conspicuous marginal tubercles

on each side, apparently associated with the thoracic spiracular region of the body margin; and with morphologically similar but inconspicuous tubercles around the entire body margin, apparently one to a segment on each side; these tubercles less conspicuous in old, fully distended and sclerotized adults, but apparently characteristic for the species, as nothing comparable has been observed in any other species.

Antennae characteristic for genus, 10–11 segmented, measurements of one: I, 148; II, 117; III, 140; IV, 148; V, 97.5; VI, 98; VII, 108; VIII, 113; IX, 105; X, 183 (all unspecified measurements in microns). Legs characteristic for genus, measurements for a posterior leg: Coxa, 354; claw, 108; digitule, 46. Beak short and stout, 1-segmented as usual, 400 long. Spiracles characteristic for genus, thoracic opening into an obvious groove running towards margin and gradually fading, a loose cluster of disk pores at margin opposite each thoracic spiracle and a similar but smaller cluster around each abdominal spiracle, as well as on each margin of each remaining abdominal segment. Dorsal disk pores circular to slightly elliptical, usually with 10 loculi and faintly bilocular center; ventral disk pores a little less strongly sclerotized and more variable in size and number of loculi, these running from 5 to 10; disk pores within marsupium largest of all, most lightly sclerotized and with 10 to 11 loculi; disk pores around anal opening likewise larger than those on adjacent dorsal derm, and less strongly sclerotized; dorsal pores distributed well over the surface, but not uniformly, appearing more abundant on anterior portion of body and lacking in a small circular area around each of the tubercles; an occasional concentration of these pores into loose clusters dorsally. Body setae varying conspicuously in size, all those dorsally, except the group around anal opening, stout spinelike, observed size variation on disk of dorsum 43 to 261; some on tubercles even longer, up to an observed 385; ventral setae likewise varying much in size, but much more slender, observed size range 39–433; setae within marsupium still more slender, but showing comparable size variation as do those in the marsupial ring. A relatively few scattered small and inconspicuous hairs both dorsally and ventrally; anal area not unusual, the setae in cluster around opening more slender than average dorsal setae. Ventral cicatrices three, large, the middle nearly quadrate, the laterals somewhat kidney shaped. Marsupial opening elongate elliptical, distance from anterior margin to nearest point in sclerotized posterior coxal attachment plate a little greater than the long diameter of the opening.

Described from three mounted adult females and a few unmounted collected on *Acacia pennatula*, Oaxaca, Oaxaca, Mexico, November, 1933, by Dr. Sally Hughes-Schrader (No. 41–1) (holotype and paratypes), and on *Caesalpinia coriaria*, San Geronimo, Oaxaca, Mexico, by the same collector (paratypes). First-stage larvae of the species have been studied. The types are in the United States National Collection of Coccidae.

This insect differs from all other known members of the genus in the possession of the dorsal and marginal digitate tubercles described in detail above.

A NEW TAENIOTHRIPS FROM MICHIGAN (THYSANOPTERA).

By J. C. Crawford,

U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine.

The material on which this description is based was received from Mr. J. E. Walter, who has collected and given to me many interesting novelties. Therefore, I take great pleasure in dedicating this species to him.

Taeniothrips walteri, new species.

Female.—Length (distended) 1.5 mm. Pale yellow, slightly tinged smoky orange, except on head, and more distinctly so on apical abdominal segments; bases of terga II–VI each with a faint brown band that is wider and darker laterad; legs about concolorous with thorax; antenna, except basal segment, mostly brown; fore wing light grayish brown, with base to beyond tip of scale (except a median light stripe) and a narrow cross band occupying the fourth 1/9 distinctly darker; this cross band beginning at about the point of insertion of the first of the bristles on the hind vein and fading out beyond the third bristle; median dark line of hind wing extending almost to tip of wing; sterna III–VII each with a row of about 4–6 accessory bristles, sternum II with one pair; fore vein with two distal bristles, hind vein with 10–12 bristles; body bristles light yellow, slightly darker on apical abdominal segments; tergum VIII without comb.

Head wider than long, eyes strongly protruding but head not constricted behind eyes, cheeks almost straight, slightly divergent posteriorly, so that they are widest just anteriad of where they narrow to posterior margin of head and narrowest at eyes, with extreme base of head minutely narrower than trans-postocular line; occiput with about 3–4 transverse anostomosing lines in front of occipital carina; ocellar crescents bright red; interocellar bristles between hind ocelli, about on a line tangent to their anterior margins; postocular bristles all short; antennae elongate, slender, pedicel of III long, apparently composed of two parts, a slender basal part set off apically by a ring from the wider apical portion, the latter swollen in distal half and then constricted at apex so that the segment appears notched; segment II barrel shaped, III and IV with sides gently convex, V subcylindrical, VI with the sides almost straight but tapering to apex; pedicel of IV and V very short, VI with base strongly narrowed; antenna I white, II light yellow brown, III and IV white in basal one-fourth, then brown, V lightly tinged brown in basal one-fifth, lightest just beyond pedicel, and with base of pedicel darker, the rest of the segment brown, VI–VIII brown, hardly darker than apices of segments IV–V; frontal costa very deeply, roundly emarginate.

Prothorax broader than long; inner and outer postangular bristles subequal in length; posterior margin with 2 pairs of bristles between the posterior angulars, of which the inner is about twice as long as the outer and about two-thirds as long as the posterior angulars; disk of pronotum with the scattered, slightly brownish bristles arranged mostly in two rows across anterior half of notum,

with only two pairs back of middle, these laterad, one behind the other, the anterior of these two pairs distinctly longer and stronger than any of the other discal bristles, but shorter than the inner pair on the posterior margin; in addition there are, at each extreme lateral margin, anterior to the middle, one pair of very weak and colorless bristles.

Abdomen slender, but wider than pterothorax, sternal bristles hyaline, almost invisible, especially the accessory bristles, except in caustic-cleared specimens.

Measurements (in microns, taken from a paratype): Head, total length 128, from front of eye to occipital carina 108, width across eyes 148, greatest width across cheeks 130, width behind eyes 124, width at base of head 120; prothorax, length 174, width 176; pterothorax, length 90, width 196; interocellar bristles, 52; posterior angular bristles, 56; inner pair of posterior marginal bristles, 40; wings, length 700, medial width 40; bristles on tergum IX, inner pair 92, middle pair 92, outer pair 100; on tergum X, inner pair 112, outer 120; ovipositor 260.

Antennae:	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Length	30	36	55	58	48	69	13	24
Width	30	28	21	21	16	16	8	6

Male.—Unknown.

Type locality.—Kalamazoo, Mich.

Described from 14 specimens (2 of which are somewhat crushed) taken October 6, 1940, from midcreases of grass blades by Mr. J. E. Walter.

Type No. 55441 United States National Museum.

None of the hitherto described North American light-colored species of *Taeniothrips* has a distinct dark cross band on the fore wing and they also differ as follows: *T. albipennis* Moult. lacking accessory ventral bristles (according to Dr. Andre), ocellar crescents colorless, antennal segments much shorter, with I–V white and VI–VII gray brown, and tergum VIII with a comb; *albus* Moult. lacking accessory sternal bristles, a complete comb on tergum VIII (according to specimens from Iowa determined by Moulton for Andre), antennal segments I–III white, IV brown with base whitish, rest of antenna brown, and antennal segments much shorter; *costalis* Jones (which Moulton suggests is a synonym of *albus* Moult.), from the original description, very similar to the preceding; *vaccinophilus* Hood much smaller, antennal segments much shorter, with III equal to VI in length, interocellar bristles much shorter, hind vein with only three bristles and these in distal one-half of wing, pronotum with only one pair of posterior marginal bristles, and accessory sternal bristles wanting.

MINUTES OF THE 519TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, MAY 1, 1941.

The 519th regular meeting of the Society was held at 8 P. M., Thursday, May 1, 1941, in Room 43 of the National Museum. President Ewing presided, and 34 members and 13 visitors were present. The report of the April meeting was accepted as read.

The following new members were elected:

Clarence O. Bare, P. O. Box 7062, Richmond, Va.

John T. Bigham, Bureau of Entomology and Plant Quarantine, Washington, D. C.

Karl V. Krombein, Bureau of Entomology and Plant Quarantine, Washington, D. C.

Forrest W. Miller, Department of Biology, Hartwick College, Oneonta, N. Y.

The following talks comprised the regular program:

1. The Hoboken plant quarantine inspection house.
George G. Becker, Bureau of Entomology and Plant Quarantine.

Mr. Becker discussed the new inspection house at Hoboken and described the many ways in which it is well suited to handle the large amount of inspection service for which it was especially designed. Accompanying photographs showed fumigating tanks, inspection rooms and other interesting features, as well as members of the staff who intercept insects and plant diseases. (Secretary's abstract.)

2. Foreign parasite introduction activities at Hoboken, N. J.
T. R. Gardner, Bureau of Entomology and Plant Quarantine.

Some of the present activities conducted by the Division of Foreign Parasite Introduction were reviewed by Mr. Gardner. He discussed the importation of foreign species, their breeding in this country and their later release in areas infested by given hosts. (Secretary's abstract.)

3. A new method for studying the activities of certain bees and wasps.
Carl G. Hartman, Carnegie Institution of Washington.

Dr. Hartman showed some unusually good motion pictures of various wasps engaged in nesting and hunting activities. Species of *Odynerus* and *Trypoxylon* in particular were studied, and it was found that a horizontal cylindrical glass tube attached to the outdoor wall of a building or other object provided an acceptable nesting site and enabled one to photograph directly through the walls of the tube. Photographs included the bringing of prey to the nest and the laying of eggs. (Secretary's abstract.)

The foregoing talks were discussed by Becker, Anderson, McIndoo, Cushman, Muesebeck, Hoyt, Harned and Snodgrass.

Gahan, Yeager and Miss Colcord noted a fire that had occurred that morning in the Entomology Building at the Beltsville Research Center.

Two visitors, Theodore R. Hupper and N. A. Klagsbrune, greeted the Society.

Wood suggested that the annual spring picnic be considered.

Adjournment at 9.45 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

Actual date of publication, June 27, 1941.

ANNOUNCEMENT

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PROCEEDINGS OF THE
ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 43 OCTOBER, 1941 No. 7

A NEW UNITED STATES LISTROCHELUS (COLEOPTERA: SCARABAEIDAE).

By LAWRENCE W. SAYLOR,
Washington, D. C.

Since the appearance of my recent "Revision of the United States Listrochelus," [1] I have received for study from Dr. Philip Luginbill a New Mexican species that is undescribed.

Phyllophaga (Listrochelus) luginbilli, new species.

Male.—Oblong-oval, the color rufo-castaneous, with the thorax somewhat more rufous; dorsal surface shining. Clypeus moderately long and reflexed, somewhat arcuate in shape, with the center apex truncate; disc finely and densely punctured. Antenna 9-segmented, unicolorous testaceo-castaneous; club subequal to funicle. Head with a well-indicated transverse carina on the vertex, the surface impunctate posteriorly; front flattened, minutely rugose, with fine punctures separated by about their own diameters. Thorax with a complete basal marginal line; the lateral margins are faintly crenate and ciliate, and are nearly straight before and behind the rounded median dilation; disc glabrous except for a medio-basal patch of erect hairs, the punctures of moderate size and rather closely and regularly distributed. Elytra with sparse, short, and erect hairs; surface ecostate other than for the well-indicated sutural costae; disc somewhat rugosely punctate, the punctures of the same approximate size and distribution as those of the prothorax. Pygidium convex and highly polished; disc with very fine and sparse punctures, each bearing a minute erect hair. Abdomen flattened; the disc highly polished, and the punctures fine and very sparsely placed, each with a short procumbent hair; 5th sternite flat, and with about a dozen scattered, minute tubercles near the middle apex; 6th sternite half as long as the 5th and with sparse, minute tubercles, and minute erect hairs. Front claws short and broad, each with a short, triangular, median tooth, the margin basad of this tooth minutely crenate; claws of mid and hind feet lacking in this specimen. First two segments of hind tarsus unequal in length, and long and narrow. The genitalia are bilaterally symmetrical and of rather simple type for the genus; in enface view (i. e., posterior view) they approach those of *L. texensis* Saylor in form, but each lateral lobe is broader at the middle and the apex of each lobe is more pointed. Length 14.5 mm. Width 6 mm.

[1] Proceeding of the United States National Museum, Vol. 89, #3095, 1940, pp. 59–130.

The unique male Holotype is from "Grant, New Mexico, June 14, 1939, collected at light by E. V. Walter." The type has been deposited in the United States National Museum at the request of Dr. Luginbill, to whom I am indebted for the privilege of studying it.

L. luginbilli will key to the Texan *L. cushmani* Saylor in my revisionary key but differs mainly from that species in the structure of the male genitalia; it may be separated on external characters by the polished, rather than opaque, elytra, and by the much finer and sparser punctation of the head.

A RESTUDY OF PARASIMULIUM FURCATUM MALLOCH (DIPTERA, SIMULIIDAE).

By Alan Stone,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

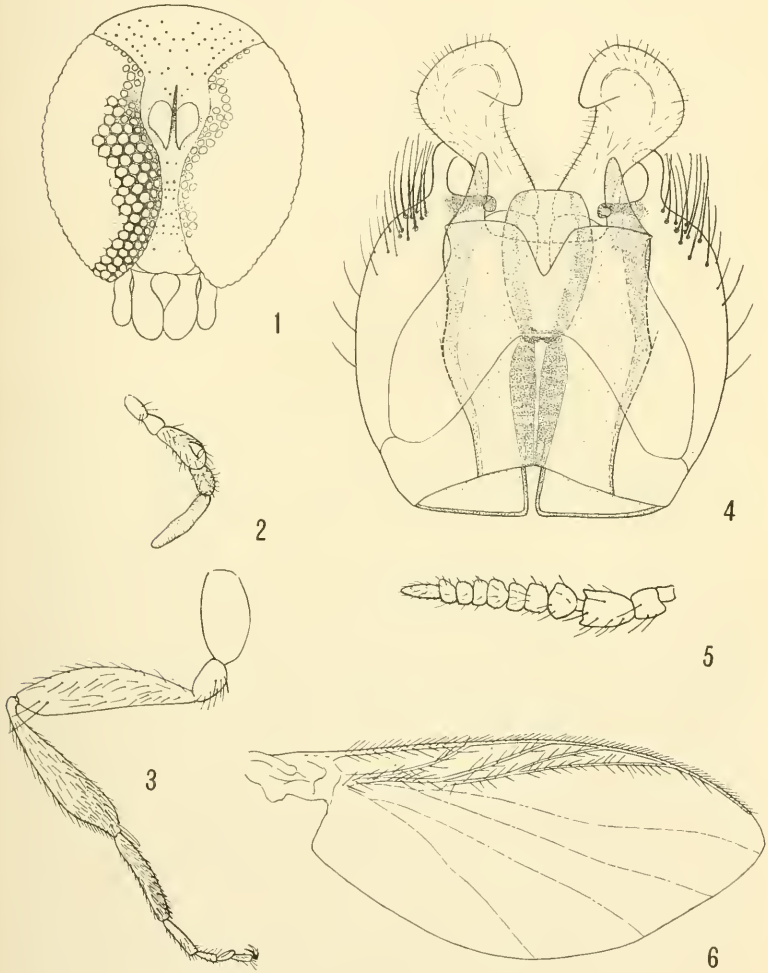
J. R. Malloch (1914, p. 24) described the genus *Parasimulium*, basing it upon a single specimen collected at Bair's Ranch, Redwood Creek, Humboldt County, Calif., by H. S. Barber. Malloch described the specimen as a female, presumably because of the rather small eyes and broad vertex and frons. Knab (1915, p. 180) considered the specimen to be a male because he found the clasping organs to be plainly visible. Dyar and Shannon (1927, p. 3) redescribed the specimen but did not indicate the sex. Rubzov (1940, pp. 251 and 469) recognized it as a male.

The specimen that caused this difference of opinion was mounted in two parts on a cardboard point. One of the parts was the head, with both antennae, one palpus, and one leg attached. The other was the body, with three legs and one wing. The specimen was mostly yellowish brown, somewhat shiny. Because of its broken condition and because it was impossible to study properly the specimen as it was, the writer removed the fragments from the point, treated all but the wing with potassium hydroxide, and made a slide mount of the wing, terminalia, and rest of the body, under three cover glasses. It then became possible to see the structures, and the accompanying drawings, made by Mrs. Mary F. Benson, artist of the Bureau of Entomology and Plant Quarantine, depict them.

The frons is broad and greatly widened posteriorly, a most unusual condition for the male, although the eyes of the male of *Simulium* (*Gigantodax*) *femineum* Edwards are narrowly separated above. The eyes approach each other below the antennae, considerably constricting the face, and the face is somewhat sunken between the eyes. The eye is 0.4 mm. high, with the facets rather large ventrally and gradually decreasing in size dorsally. The palpus and antenna

are as figured, the antenna being 0.46 mm. long and eleven-segmented, if we agree with Malloch that the first segment is very small and weakly sclerotized. The present writer is not certain that this is a true segment.

The wing, 1.7 mm. in length, is as shown in the figure, although, since the submedian fold and anal veins are not discernible in the balsam mount these are not indicated. In the dry specimen the submedian fold was visible, and in



Explanation of Figures.

Parasimulium furcatum Malloch.

1. Head (antennae and palpi not shown). 2. Palpus. 3. Hind leg. 4. Terminalia, dorsal view. 5. Antenna. 6. Wing.

certain lights a very indistinct fork appeared to be present. No basal cell is evident and vein Cu_2 is nearly straight. The apical portion of the hind tibia is somewhat concave dorsally, with many short, rather stout hairs in the concavity. The hind tibia has a rather small, slender, apical spur but no calcipala, and the hind basitarsus has no pedisulcus.

It may be seen at once, from an examination of the figure of the terminalia, that the specimen is a male, although the structures are quite different in detail from those of any other described species in the family.

The terminalia from the base of the side piece to the apex of the clasper, are about 0.25 mm. long. The ninth tergite is rather weakly sclerotized and has a broad, rather deep emargination anteriorly and a narrower notch posteriorly. No tenth tergite can be seen. Below the ninth tergite lies the aedeagus, distinctly sclerotized, particularly laterally, broadened apically, narrower basally, with a dorsal angle and heavy sclerotization at the middle. Below this lies the adminiculum, a broad, flat plate, the posterior margin nearly straight medially, but with a strong posterior projection at each side. Each sidepiece is stout, rather densely pilose on the posterolateral angle, with an apical projection as shown in the figure. Mediad of this projection is another heavily sclerotized area, which is probably part of the sidepiece, but perhaps is attached to the base of the clasper, and from this a small, curved projection extends dorsally to surround, partially, the posterior projection from the adminiculum. The claspers are large, swollen apically, and twisted, the apex pointing upward and inward. They are densely clothed with pubescence. The tergites and sternites of the rest of the abdomen are large and well sclerotized.

This species is so different from any other of the Simuliidae known to the writer that it is difficult to determine its relationships. A knowledge of the female and the immature stages would be of great value. The species resembles *Prosimulium* Roubaud in having a forked radial sector, setose radius, no small spines on the costa, and no calcipala or pedisulcus, but differs in lacking a basal cell and in having vein Cu_2 nearly straight. It resembles *Gigantodax* Enderlein in having a nearly straight vein Cu_2, in lacking a basal cell, in having no pedisulcus, and in having very little hair on the hind coxae, but differs in having a simple radial sector, in having no spinules on the costa, and in not having the hind basitarsus unusually elongate. The genus *Austrosimulium* Tonnoir differs from *Parasimulium* in having the radial sector simple, spinules on the costa, and the calcipala and pedisulcus well developed. The genus *Cnephia* Enderlein agrees with *Parasimulium* in having no pedisculcus or calcipala, but usually the radial sector is simple (never distinctly, broadly forked) and the costa has minute spinules. The genus *Eusimulium* Roubaud has a simple radial sector and a distinct calcipala and pedisulcus. *Parasimulium furcatum* differs from all these in having veins R_1, R_{2+3}, and R_{4+5} widely separated

at the costa, the frons broad and the face narrow, the lower facets of the eye larger than the upper ones, and in the shape of the sidepiece, clasper, and adminiculum of the terminalia.

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TWO NEW REARED SPECIES OF DORYCTES (HYMENOPTERA: BRACONIDAE).

By C. F. W. Muesebeck,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The two species of *Doryctes* Haliday which are treated in this paper have apparently remained undescribed, although one is a common parasite of a serious house pest in New Zealand, and the other occurs in various tropical regions of the world and has frequently been received for identification.

Doryctes ambeodonti, new species.

In combining an unusually long submediellan cell, a completely smooth second tergite, incomplete notaulices, a curved third abscissa of radius, and nonangulate hind coxae, this species is at once distinguished from all other species of the genus known to me.

Female.—Length about 3 to 5 mm. Head subcubical, about as wide as thorax, smooth with only a little granular sculpture below each antenna and on the frons; temple at least one and one-half times as wide as eye; malar space about as long as transverse diameter of opening between clypeus and mandibles; ocellocular line twice as long as postocellar line; antenna about as long as body, 27- to 33-segmented; first flagellar segment one and one-half times as long as second; flagellar segments successively shorter to apex of antenna.

Thorax not depressed; pronotum rugose; mesoscutum abruptly declivous in front and with a weak median longitudinal groove on dorsal surface extending to posterior margin; notaulices sharply impressed anteriorly, obliterated beyond middle; median lobe shining, only very weakly roughened; posterior half of

mesoscutum granulose; scutellar fovea rugulose, two-thirds as long as scutellum and divided by a delicate median longitudinal carina; scutellum slightly convex, faintly coriaceous, shining; propodeum rugose, with areola, petiolar area, and basal areas more or less distinct; mesopleuron mostly smooth, but with a coarsely foveolate longitudinal impression below; propectus and mesopectus smooth; first abscissa of radius equal to greatest width of stigma and about one-half as long as second abscissa, third abscissa of radius arched and attaining extreme apex of wing; nervulus postfurcal by much more than its length; recurrent vein interstitial with first intercubitus or entering first cubital cell very near first intercubitus; first brachial cell closed; anal cell with a faint cross-vein just basad of nervulus; lower abscissa of basella shorter than nervellus, and about one-fourth as long as mediella; nervellus strongly inclivous; postnervellus wanting; hind coxa smooth, not angulate at base beneath; anterior tarsus about as long as tibia, the latter without a row of short, stout spines on inner side; hairs of posterior tibia short, decumbent.

Abdomen as long as head and thorax combined; first tergite about as broad at apex as long, longitudinally rugosostriate, strongly convex, sharply margined laterally; second and following tergites completely smooth and polished; suturiform articulation not evident; ovipositor sheath about as long as head, thorax, and abdomen combined.

Reddish brown, with pronotum, lateral lobes of mesoscutum, and dorsum of abdomen beyond first tergite piceous; antenna brown, the scape reddish; wings rather uniformly infumated, stigma yellowish brown, veins darker; legs yellow, femora apically, especially posterior pair, tibiae, and tarsi brownish; ovipositor sheath reddish yellow, black at extreme tip.

Male.—Agreeing with the female in all significant characters.

Type locality.—Papakura, New Zealand.

Type.—United States National Museum No. 55679.

Host.—*Ambeodontus tristis* (F.) in *Dacrydium cupressinum.*

Described from 24 females and 2 males reared by K. Harrow, 20 females (including type) and 1 male in July, 1940, and 4 females and 1 male, November 1, 1940. The material was referred for identification by Dr. Donald Spiller, assistant entomologist of the New Zealand Department of Scientific and Industrial Research, with the notation that the host of the parasite "is our most important beetle attacking houses." Paratypes in the collection of the New Zealand Department of Scientific and Industrial Research.

Doryctes parvus, new species.

In Nixon's key to the Indian and African species of *Doryctes* [1] this runs to couplet 6, but it is not at all similar to either of the two species that fall there. It is characterized by its unusually small size, small number of antennal segments, flat dorsal surface of mesoscutum, very short notaulices, and conspicuous median longitudinal groove on posterior half of mesoscutum.

[1] 1939, Ann. Mag. Nat. Hist., (11) 3 : 481.

Female.—Length 2 to 2.5 mm. Head subcubical, smooth and shining, except the face, which is very finely, transversely aciculate; malar space about as long as transverse diameter of impression between clypeus and mandibles; temple not receding, not quite, or barely, as wide as eye; ocellocular line less than twice as long as postocellar line; antenna about as long as body, usually 20- to 24-segmented; first flagellar segment only very slightly longer than second, flagellar segments beyond the second each imperceptibly shorter than the one preceding it.

Thorax a little depressed, at tegulae as wide as head; dorsal surface of mesoscutum unusually flat, finely coriaceous, with a sharply defined median longitudinal groove on posterior half; anterior declivity vertical; notaulices very short, not extending beyond middle of mesoscutum; scutellar furrow less than half as long as scutellum, with several longitudinal carinae; scutellum very slightly convex, faintly punctate; propodeum finely rugulose, with the usual areolation; mesopleuron smooth and polished, with a narrow, indistinctly foveolate, longitudinal impression near lower margin; prosternum and mesosternum polished, stigma emitting radius from a little before its middle; first abscissa of radius shorter than width of stigma and a little less than one-half as long as second; third abscissa straight, attaining apex of wing; third cubital cell, measured on cubitus, slightly longer than second; last abscissa of cubitus obsolescent toward wing margin; first cubital cell receiving recurrent vein very near first intercubitus; nervulus postfurcal by about its own length; first brachial cell closed; radiella not developed; mediella a little longer than lower abscissa of basella, the latter about twice as long as nervellus; mediellan cell not short, gradually widening distad; postnervellus indicated, strongly inclivous; anterior tibia with an irregular row of short spines on inner side; posterior coxa not angulate at base beneath; all femora short and stout, posterior femur less than three times as long as broad; posterior tibia with hairs on outer side short and decumbent.

Abdomen about as long as thorax, at its widest point at least as wide as thorax; first tergite broader at apex than long, closely, longitudinally rugulose and with two well-developed carinae on basal half which arise at basal lateral angles and converge slightly caudad; the following tergites smooth and polished except for a short, longitudinally aciculate, transverse area at base of second which does not extend to the lateral margins of the tergite; ovipositor sheath slightly longer than posterior tibia.

Head yellowish brown, antenna dark brown except scape, pedicel, and first flagellar segment, which are concolorous with head; thorax brown, propodeum black or blackish; wings hyaline; legs entirely yellow; abdomen dark brown to blackish above, the connate second and third tergites paler.

Male.—Essentially like female except that the head and thorax are usually darker.

Type locality.—Mayaguez, Puerto Rico.
Type.—United States National Museum No. 55678.
Host.—*Dinoderus minutus* (F.).

Described from 71 specimens reared by H. K. Plank, in April and May, 1941, from *Dinoderus minutus* in bamboo. A considerable number of additional specimens are in the col-

lections of the National Museum. No definite hosts are recorded for most of these, but one series from British India is said to have been reared from Bostrichidae "in case wood" arriving at Philadelphia, and another lot is labeled "ex Sanday wood, Ancon, Canal Zone." There are also several specimens from Cuba marked as reared from an insect infesting *Gynericum sagittatum*, specimens from bamboo coming from India and Java, and two labeled "bred from *Lyctus*, Queensland, Australia."

THE LARVA AND PUPA OF CYLINDROCOPTURUS FURNISSI BUCHANAN (COLEOPTERA, CURCULIONIDAE).

By William H. Anderson,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

In consideration of the thorough investigations carried out by Mr. R. L. Furniss, Division of Forest Insect Investigations, United States Department of Agriculture, on the biology of *Cylindrocopturus furnissi* Buchanan, it seemed desirable to prepare a description of the larva. While studying this species it was necessary to make observations on the larvae of other species of the genus which were available, in order that a proper analysis of the importance of the characters could be made. Some of the information so obtained has been incorporated into the short key to species included herewith.

CYLINDROCOPTURUS Heller. [1]

Larva (fig. 1) stout, curved, cylindrical. Head retracted for approximately one-half its length into prothorax, broader at middle than at anterior border, longer than wide (fig. 4). Endocarina distinct. Epicranial suture more than one-half as long as head to base of clypeus; frontal suture extending to base of antenna. Principal setae distributed on anterior fourth or third of head, as

[1] Since the larvae of only a few of the genera which are closely related to *Cylindrocopturus* are known, features of supergeneric importance probably have been included in the generic characterization. For literature treating other species of this and related genera see the following:

Böving, A. G.
1926. Immature stages of *Eulechriops gossypii* Barber, with comments on the classification of the tribe Zygopsini (Coleoptera : Curculionidae). Ent. Soc. Wash. Proc., v. 28, n. 3, pp. 54–62, fig.

Dampf, A.
1929. Una nueva plaga del nopal (*Opuntia* sp.) *Cylindrocopturus biradiatus* Champion (Inst. Col., Fam. Curculionidae). Bol. Mens. Defensa Agr. Sec. Agr. Fom. Mexico. a. III, t. III, Nos. 1–4, pp. 7–17, fig.

Keifer, H. H.
1930. The larva of *Cylindrocopturus crassus* Van Dyke. Pan-Pacific Ent., v. 6, n. 4, pp. 167–170, fig.

Gardner, J. C. M.
1934. Immature stages of Indian Coleoptera (14) (Curculionidae). Indian Forest Rec., Ent. Ser., v. 20, pt. 2, pp. 11–15, fig.

shown (fig. 4). One ocellus, with convex lens, on each side of head laterad of antenna. Antenna with one basal article bearing two sensory pores, a terminal conical sensillum, and four minute processes or setae. Epipharyngeal rods (fig. 7) strong, nearly straight, convergent, joined at their posterior extremities. Three anterolateral and three anteromedian setae on each side of epipharynx. Two pairs of setae between epipharyngeal rods and, on each side anterior to setae, a cluster of three sensory pores. Mandible (fig. 12) with two teeth. Outer surface of mandible with two well separated setae, subequal in length, one ventral and slightly posterior to the other. Maxillary mala (fig. 11) with seven dorsal and five ventral setae, along inner margin. Body rather uniformly covered with simple asperities, these particularly dense and conspicuous on posterior half of pronotum. Spiracles biforous (figs. 2, 3). Prothorax, dorsad of thoracic spiracle, with eleven setae on each side, one of them arising from the field of dense asperities. Pleural lobe of prothorax with two subequal setae. Pedal areas each with nine setae, two of them minute, and several sensory pores. Thoracic scutoscutella, on each side, with four setae of which the two dorsal ones are subequal and shorter than the two subequal lateral ones. Abdominal segments, dorsally, with three folds. Scutella of eighth and ninth segments with two setae on each side, the more dorsal one the shorter. Epipleural lobes with two setae. Hypopleural lobes with one or with two setae. Ninth abdominal segment without low, conical, sclerotized process. Anus terminal, surrounded by four lobes. A pair of setae on dorsal lobe and two setae on each lateral lobe.

The characterization given above has been based on the following species:

1. *Cylindrocopturus furnissi* Buchanan. Douglas fir, La Grande, Wash., R. L. Furniss, collector. Hopk. U. S. No. 31,798–A.
2. *Cylindrocopturus eatoni* Buchanan. ex *Pinus*, Lassen National Forest, Calif., C. B. Eaton, collector. Hopk. U. S. No. 31,631 e.
3. *Cylindrocopturus crassus* Van Dyke. ex *Chrysanthemum*, San Mateo County, Calif., A. W. Tate, Jr., collector. (No specimens of this species were studied, the information concerning the characteristics having been adopted from the description by Keifer, l. c.)
4. *Cylindrocopturus operculatus* (Say). ex roots *Hymenopappus* sp., Texas (various localities and collectors).

Cylindrocopturus furnissi Buchanan.

Mature larva.—Head capsule (fig. 4) anteriorly on each side with oval, dark-colored spot, its area about half that of labrum. Apical part of mandible not abruptly set off from basal part along dorsal inner margin (fig. 9). Spiracular air tubes short, not annulated (figs. 2, 3). Hypopleural lobes of first through eighth abdominal segments with one seta.

First-stage larva.—Identical to mature larva in setation and general habitus. Head without pigmented area posterior to antenna. Spiracular air tubes with indication of two or three annuli.

Pupa.—Head (fig. 5) without setae except two minute pairs at tip of rostrum. Pronotum dorsally and dorsolaterally with five pairs of setae distributed as shown (fig. 10). Meso- and metathorax each with two setae on each side, those of mesothorax closer together than those of metathorax. Each femur with two setae near tip. Each of first eight abdominal segments, on dorsal surface, with two setae on each side. Ninth abdominal segment apparently without setae. Third ventral (first visible) segment with a single seta on each side near base, the five segments posterior thereto with two setae on each side. Each pleuron from first through eighth segments with two setae. Spiracles nearly round, with irregularly scalloped margin. One thoracic and seven abdominal spiracles on each side. Ninth segment, laterally on each side, with projection, the latter slightly sclerotized at tip and terminating in two or three minute projections.

KEY TO MATURE LARVAE OF KNOWN SPECIES OF *Cylindrocopturus*.

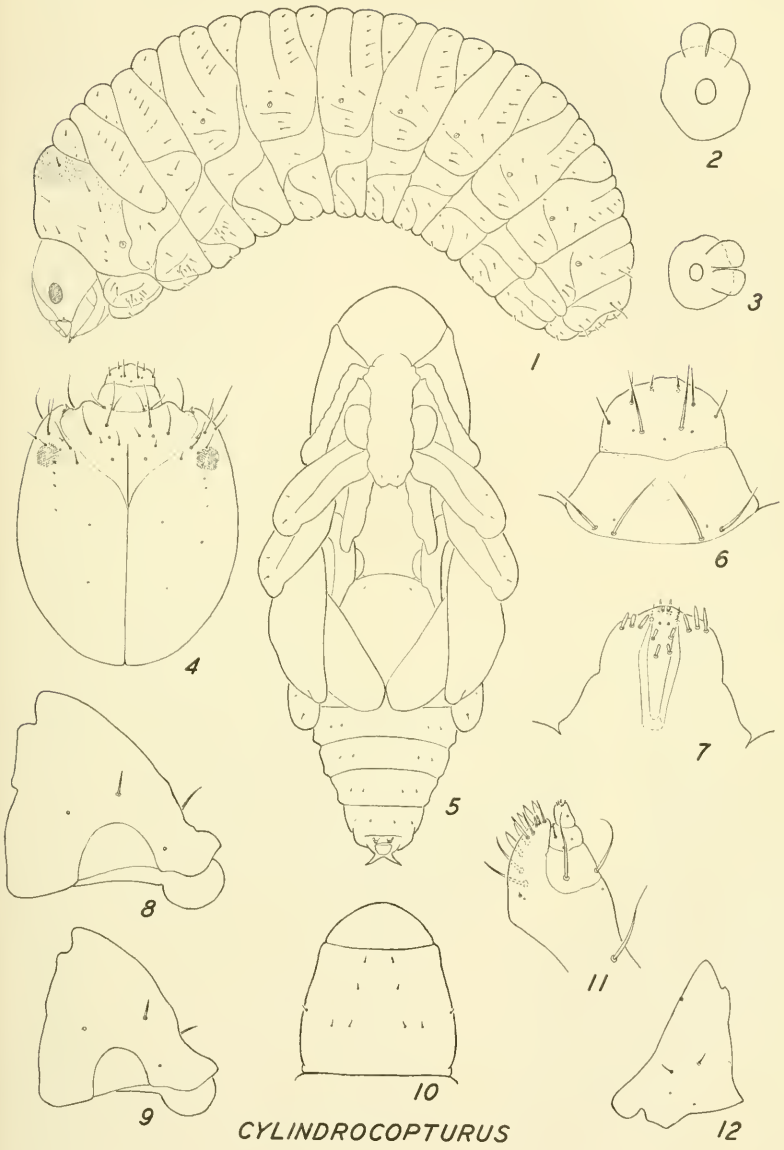
1. Hypopleural lobes of first eight abdominal segments each with one seta; spiracular air tubes without annuli (head with oval, dark-colored area posterior to antenna)..... 2
   Hypopleural lobes of abdominal segments each with two setae; spiracular air tubes with annuli (head with or without dark-colored area posterior to antenna)..... 3
2. Apical portion of mandible abruptly separated from basal portion on dorsal inner margin (fig. 8)..... *eatoni* Buch.
   Apical portion of mandible not abruptly separated from basal portion on dorsal inner margin (fig. 9)..... *furnissi* Buch.
3. Head without oval dark-colored area posterior to antenna..... *crassus* Van D. [2]
   Head with oval dark-colored area posterior to antenna..... *operculatus* (Say) [2]

EXPLANATION OF FIGURES.

(*Figures drawn by author*).

1.	*Cylindrocopturus furnissi* Buch.,	larva, lateral view	x24
2.	"	"	thoracic spiracle	x280
3.	"	"	seventh abdominal spiracle	x280
4.	"	"	head, dorsal view	x40
5.	"	"	pupa, ventral view	x24
6.	"	"	clypeus and labrum	x140
7.	"	"	epipharynx	x140
8.	"	*eatoni* Buch.,	right mandible, dorsal view	x80
9.	"	*furnissi*	right mandible, dorsal view	x80
10.	"	"	pupa, pronotum	x24
11.	"	"	distal end of left maxilla	x140
12.	"	"	left mandible, lateral view	x80

[2] Considering the difficulties involved in finding means of separating *eatoni* Buch. from *furnissi* Buch., it is expected that species groups rather than the species indicated will key out under these two names.



CYLINDROCOPTURUS

LEE ABRAM STRONG.

By Avery S. Hoyt, Stanley B. Fracker, and Mabel Colcord.

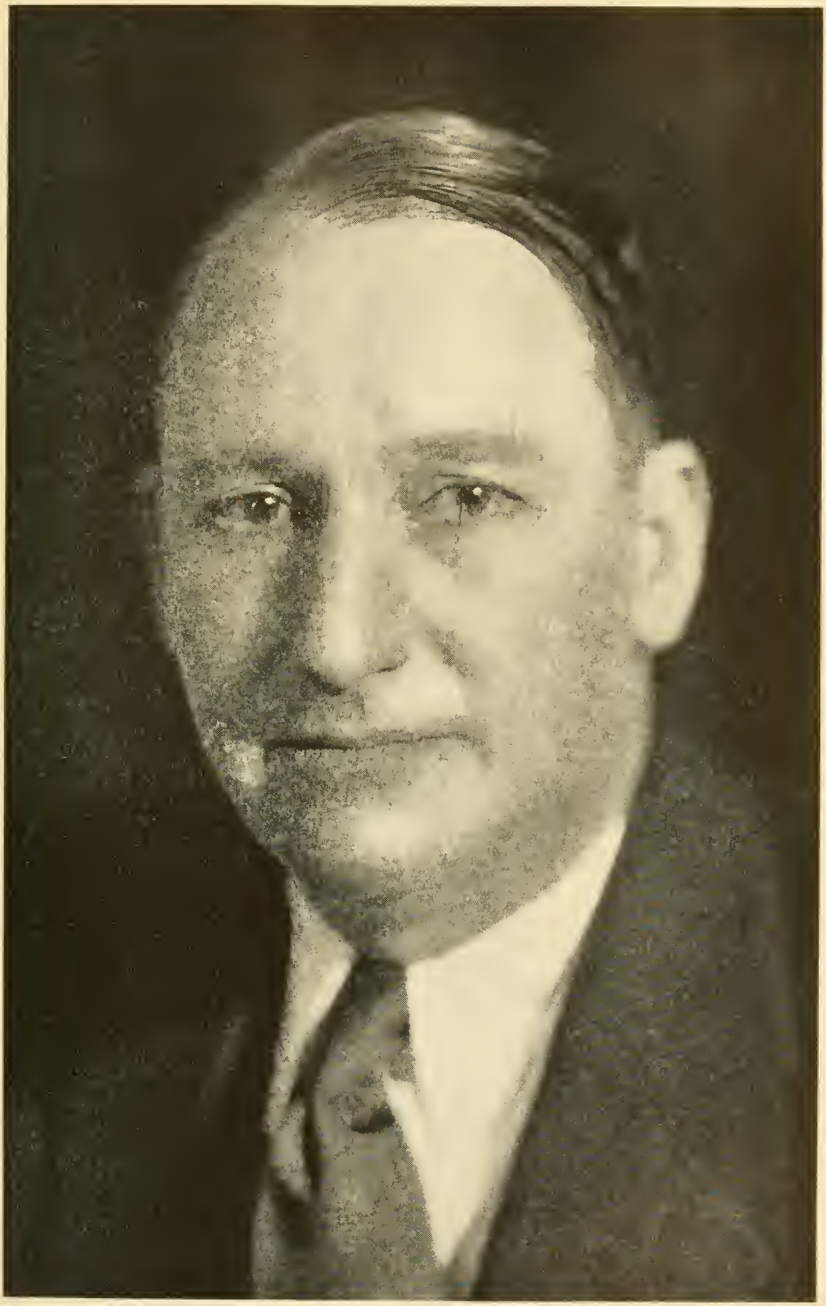
The Bureau of Entomology and Plant Quarantine on June 2, lost by death at Tucson, Ariz., the man who has been its chief since its establishment in 1934. While Dr. Strong had been in ill health for more than two years, the end came unexpectedly while he was asleep at night following a day of activity. Up to within a few hours of his death, he was busily engaged in numerous matters involving important decisions relating to the work of the Bureau. He was buried with military honors in Arlington National Cemetery.

Dr. Strong carried the responsibility of leadership not only of the Department's entomological research work but also of its regulatory and service activities along the lines of insect and plant-disease control. He was the fifth chief of the entomological work of the United States Department of Agriculture since this work was set up as a "Division," in 1883. He was the first to die in office. Two of his predecessors, Dr. Howard and Dr. Marlatt, are still active, though retired; Professor Comstock was head of the Department of Entomology at Cornell University for many years after his services with the United States Department of Agriculture, and Dr. Riley resigned the year before his death in 1895.

Lee Strong was born at Russell, Iowa, on June 17, 1886, and at the time of his death was a few days less than 55 years old. He was the son of Hez G. and Julia B. (Ashby) Strong. At the time of Lee's birth, his father was an Iowa farmer but shortly thereafter moved with the family to Nebraska, where Lee was brought up as a farm boy in the Missouri Bluff section of that State. He was educated in the public schools of Nehawka, Nebraska.

During vacations and after he finished school, Lee worked in Nebraska in various occupations, including employment on a railroad. His interest in entomology was first aroused in connection with work on a fruit farm in Nebraska, where he was employed in what is said to have been the first spraying for the codling moth that has ever taken place.

In 1910 the family moved to California, where Mr. Strong's public employment began with his appointment as a horticultural inspector for Los Angeles County. After 2 years' service in this capacity he was appointed a plant-quarantine inspector for the California State Department of Agriculture and was assigned to the inspection of incoming boats from foreign countries and from Hawaii at the port of San Francisco. His unusual interest, vigor, and leadership became apparent during the 6 years of his service in port inspection.



LEE ABRAM STRONG

In March, 1918, Mr. Strong enlisted in the 537th Engineers of the United States Army and served with that regiment until July, 1919, spending 12 months in France. During this period he was a sergeant on construction work and obtained his first experience in handling considerable numbers of men under difficult conditions.

On returning from military service Mr. Strong was again employed by the California State Department of Agriculture, which he served from 1919 to 1923, the latter part of this time as chief quarantine officer of the State. His outstanding ability along these lines attracted the attention of the Federal Horticultural Board of the United States Department of Agriculture, and in 1923 he was placed in charge of the maritime port inspection work of the United States. His Civil Service appointment at that time was based on the special regulations providing for the employment of "experts," the Civil Service Commission recognizing that Mr. Strong was already such an outstanding leader in his field that a competitive examination was not required.

Before coming to Washington Mr. Strong married Miss Edith M. Colton on March 2, 1921, at San Francisco. Two of their three children were born in California, the youngest in Washington, D. C. They are Madeleine Virginia, Lee A, and Helen Tesora, all now living in Washington. Madeleine and Lee have finished high school in Washington, and Helen Tesora is still in school.

After 2 years in the Federal port inspection work Mr. Strong returned to California in 1925, as assistant director of the California State Department of Agriculture, where he remained until 1929. During this period he was a leader in the establishment of the National Plant Board and the group of regional boards which now provide the basis for cooperation in plant-quarantine matters throughout this country. He was elected chairman of the National Plant Board at the time of its organization in 1925, and continued as chairman until it was necessary for him to leave the Board on being called once more to the United States Department of Agriculture.

In December, 1929, Mr. Strong was appointed chief of the recently organized Plant Quarantine and Control Administration and chairman of the Plant Quarantine Board of the United States Department of Agriculture. He was instrumental in having the name of that Administration changed to the Bureau of Plant Quarantine, a change which became effective on July 1, 1932. As chief of the Plant Quarantine and Control Administration, and later of the Bureau of Plant Quarantine, Mr. Strong showed his unusual administrative and organizing ability in handling the many complicated plant-quarantine

and field-eradication problems coming up during that period. Among those which attracted public attention was the eradication of the Mediterranean fruitfly in Florida, for which he became responsible in the middle of the campaign when he came to Washington in December, 1929, and which, under his leadership, was carried to a successful conclusion 2 years later.

During the fiscal year 1934, the Secretary of Agriculture recommended to Congress the combining of all entomological and plant-quarantine activities, together with such field-control projects as the eradication of citrus canker and the Dutch elm disease and the control of black stem rust of grain and white pine blister rust. This new organization was built by the Secretary of Agriculture largely around the personality, ability, and judgment of Mr. Strong, who became chief of the newly established Bureau of Entomology and Plant Quarantine on July 1, 1934, following a period of 9 months during which the component parts of the organization were gradually being placed under the new leadership.

In addition to the chairmanship of the National Plant Board, to which reference has been made, Dr. Strong's honors include the presidency of the American Association of Economic Entomologists in 1935, the honorary degree of Doctor of Science given by the Louisiana State University in 1938, and various offices in the Entomological Society of Washington. Dr. Strong was also a member for a time of the Entomological Society of America and of the Biological Society of Washington.

Dr. Strong was outstanding for his prompt decisions and keen administrative judgment. Throughout his life he was active, vigorous, and popular. He enjoyed and played an excellent game of golf and was a skillful fisherman. He was a member at different times of various country clubs around Washington, the most recent of which was the Kenwood Club. He was also a member of the Cosmos Club, and a Mason.

The papers of which Dr. Strong is personally listed as author in the library of the Bureau are the following, in addition to numerous official quarantine orders and regulations:

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CORRECTION OF THE NAME OF AN AFRICAN BEE.

By T. D. A. Cockerell.

Allodape calidula (Cockerell).

Dufourea (?) *calidula* Cockerell, Ann. Mag. Nat. Hist., April, 1908, p. 337. (Benguella.)

This species is known by the entirely black face, black abdomen, and clear hyaline wings. The basal nervure falls far short of the nervulus, as in *Allodape microsticta* Ckll.; in *A. friesei* Brauns it meets the nervulus. The outer side of the second submarginal cell is arched, and not far from vertical; in *A. microsticta* and *A. friesei*, and allied species, it is strongly

oblique. The clypeus is not coarsely punctured as it is in *A. tristis* Ckll. The face is very much narrower than in *A. stellarum* Ckll. In Strand's table of *Allodape* it runs to *A. planiceps* Strand, which is not at all the same. When describing this species, I stated that I thought it might form a new genus, but although it is peculiar, it may be placed in *Allodape*. *Allodape monticola* Ckll., otherwise different, agrees in the entirely black face. The basal nervure is much more arched than in *Macrogalea candida* (Smith), but the shape of the second submarginal cell suggests that species. *Allodape calidula* is in some respects intermediate between *Allodape* and *Macrogalea*, and should perhaps be placed in a separate subgenus.

MINUTES OF THE 520TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, JUNE 5, 1941.

The 520th regular meeting of the Society was held at 8 P. M., June 5, 1941, in Room 43 of the National Museum. Twenty-eight members and 8 visitors attended, with President Ewing presiding. The report of the May meeting was approved.

J. M. Valentine, of the Division of Insect Identification, Bureau of Entomology and Plant Quarantine, was unanimously elected to membership.

Resolutions relative to the death of the late Chief of the Bureau of Entomology and Plant Quarantine, Lee Abram Strong, were presented by S. B. Fracker and adopted by the Society. These resolutions appeared in the June issue of the Proceedings. A biographical sketch of Dr. Strong, prepared by A. S. Hoyt, S. B. Fracker and Mabel Colcord is in the current issue.

W. B. Wood announced that the Society as a group would not take part in a spring picnic. The Recording Secretary read a report issued by the Committee of Public Relations of the Southern California Academy of Sciences which told of recent plans for the reorganization of the Los Angeles County Museum of History, Science and Art. It was stated in the report that these plans would virtually abolish the divisions of Science and History, and the hope was expressed that sufficient interest might be aroused as to insure the continuation of scientific work at that institution.

Under Notes and Exhibition of Specimens, Gurney reported finding specimens of a psocid, *Psyllipsocus ramburii* Selys, on vinegar barrels in the cellar of his home in Massachusetts. The species is dimorphic and is known from only a few American localities, though it is widespread in Europe. Psocids of the genus *Lepinotus* were also mentioned briefly. (Author's abstract.)

L. J. Bottimer discussed the vetch bruchid, *Bruchus brachialis* Fahr., and reported collecting three specimens about 8 miles south of Madison, Morgan Co., Ga., April 28, 1941. They were swept from the host plant (*Vicia villosa*) growing along the road. This appears to be a second locality record for Georgia, the first record being based on a single specimen which he took in 1936, at Clarkston, DeKalb Co. (See Jour. Econ. Ent., vol. 29, p. 807, 1936). (Author's abstract.)

L. A. Hetrick gave an account of the reactions of honey bees to a certain mosquito repellent. For some unknown reason the bees in the particular instance described were greatly excited by the repellent and vigorously stung several people who were using it as protection against mosquitoes. R. A. St. George gave a brief note about termite injury.

The main program was as follows:

1. The application of the aerosol to fumigation. L. B. Goodhue, Bureau of Entomology and Plant Quarantine.

A resumé of experiments with about 200 organic compounds was given. Dr. Goodhue gave special attention to such substances as derris, pyrethrum and orthodichlorobenzene. (Secretary's abstract.)

2. Forest insect investigations of the Virginia Agricultural Experiment Station. L. A. Hetrick, Virginia Agricultural Experiment Station.

For many years the Virginia Agricultural Experiment Station has been interested in the study of forest insects, especially the Southern Pine beetle, *Dendroctonus frontalis* Zimm. An outbreak of this bark beetle in Eastern Virginia in 1937 and 1938 prompted the establishment of a field laboratory for the study of forest insects. Since it was apparent that the bark beetle epidemic was subsiding when work was started in 1938, a study was made of the factors in the natural control of the species. It was found that an endoparasitic nematode of the genus *Anguillonema* and an entomophagous fungus of the genus *Beauvaria* were most important in causing high mortality of the overwintered brood and the ultimate subsidence of the epidemic in the summer of 1939. Insect parasites of *D. frontalis* were of little importance in the natural control of the species.

Life-history studies of a number of species of pine-defoliating sawflies are being conducted. Of these, *Neodiprion americanum* (Leach) appears to be the most important. This single-brooded sawfly defoliates the pines during May. The larvae consume the old needles and the developing new growth takes care of the requirements of the trees. The pines are not killed by repeated defoliation and no bark beetle outbreaks have followed the sawfly injury, but wood production of defoliated trees is reduced.

A study of the effects of the low temperatures of January, 1940, on overwintering pupae of *Rhyacionia frustana* (Comst.) was conducted. Many of the pupae were dead in the shoots and there was a relatively high survival of the insect parasites of *R. frustana*. However, infestation of pine shoots by this species during the summer of 1940 was comparable to infestation during the previous summer. In most of the areas studied during the summer of 1940, *R. frustana* had three generations, but in a few areas only two generations were observed.

Lantern slides of pines killed by Southern Pine beetle and other pines defoliated by larvae of *Neodiprion americanum* were shown. A bark exhibit contrasted the engravings of *Dendroctonus frontalis* and *Ips calligraphus* Germ. (Author's abstract.)

3. Termites and the National Defense Program. R. A. St. George, Bureau of Entomology and Plant Quarantine.

Mr. St. George discussed different types of buildings, from the standpoint of

termite protection, and showed photographs of both recommended and undesirable types of building construction. He emphasized the importance of providing an ample separation of soil and wood by the use of concrete, stone or other foundation materials which prevent all subterranean termites of this region from infesting the wooden parts, if care is taken to remove any tubular outside galleries that the insects may construct in an effort to reach food. (Secretary's abstract.)

Adjournment at 9.50 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

BOOK NOTICE.

Butterflies: A Handbook of the Butterflies of the United States Complete for the Region North of the Potomac and Ohio Rivers and east of the Dakotas, by Ralph W. Macy, Professor of Biology, College of St. Thomas, and Harold H. Shepard, Assistant Professor of Entomology, University of Minnesota. 8 vo., cloth, 247 pp., 4 col. pl., 47 illus., Minneapolis, Minn., University of Minnesota Press, 1941.

It is the purpose of this book to serve as a guide to all the butterfly species known to occur in that part of the United States and adjacent Canada lying east of Nebraska and the Dakotas and as far south as the northern borders of Missouri, Kentucky and Virginia. Local distribution in Minnesota has been emphasized because of the background of experience and interest on the part of the authors and the entomological facilities at their disposal. However, additions have been made by them, from other sources, of data likely to be of general interest or value to collectors and students throughout the region covered. The keys for the identification of species previously have been used to a considerable extent in local entomology classes, and have been found sufficiently simple and workable to enable those having little or no previous knowledge of the subject to determine without difficulty the more common butterflies. The nomenclature and the order of McDunnough's "Check List of the Lepidoptera of Canada and the United States" have been generally followed in the interests of uniformity. In a few cases, however, notably in that of the Hesperiidae, there have been made slight changes here and there in the light of more recent information. Only a few selected references, those most likely to be useful or those affecting the status of a given scientific

name, are given. Since the book has been prepared to meet the needs of the amateur student rather than those of the advanced specialist, no attempt has been made to include anything like complete lists of references for the various species. The text illustrations of various butterflies are from photographs furnished by Austin H. Clark. The four-color plates were prepared from original specimens in the collection of the University of Minnesota, with financial assistance from the College of St. Thomas.

Other works which have attempted to cover somewhat the same general scope, though otherwise excellent, either have omitted treatment of some of the common species, may be lacking on much recent information, or, like the larger monographs, notably Scudder's "The Butterflies of the Eastern United States and Canada, with Special Reference to New England," have been long out of print and for the average student are prohibitive in cost. It would appear therefore that there is a definite need for a work of this kind.

— J. S. W.

Actual date of publication, October 30, 1941.

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Prices for back volumes and single numbers of the Proceedings of the Entomological Society of Washington are as follows until further notice:

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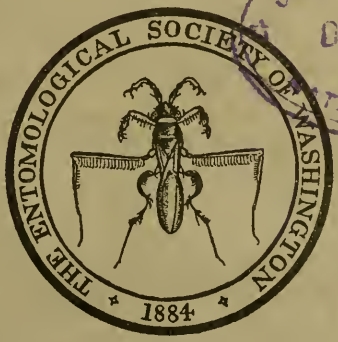

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PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 43 NOVEMBER, 1941 No. 8

NEW SPECIES OF CHAETOCNEMA AND OTHER CHRYSOMELIDS (COLEOPTERA) FROM THE WEST INDIES.

By DORIS H. BLAKE.

The present paper is in part an attempt to straighten out the identity of species of *Chaetocnema* in the West Indies that in the past have been labelled indiscriminately as *Chaetocnema apricaria* (Suffrian). The rest of the paper is made up of the description of new species collected by P. J. Darlington.

DICOELOTRACHELUS, n. gen.

Elongate oblong, small, (3–4.5 mm.), yellow brown beetles with blue or bronzy green elytra, usually coarsely and densely punctate above, the pronotum with a deep round hole on either side near the middle. Elytra covered with fine pale pubescence.

Head long and narrowed in lower front, the antennae inserted half way down head; tubercles above the antennal base distinctly marked but not prominent; interocular space usually a little more than half the width of the head; occiput and vertex rugosely or deeply punctate; color yellow brown, in two species, with a dark occipital spot. Antennae in one of the three species extending almost to the middle of the elytra, in the others not quite so long, rather heavy; the first two joints wider than the third, the second almost equal to third, third not quite so long as fourth, the remainder approximately equal. Prothorax broader than long, with sides arcuate, a very small tooth at anterior and basal angles, basal margin somewhat sinuate over the scutellum in two of the species; disc with a small deep hole on either side about halfway down; the surface coarsely or rugosely punctate, sometimes polished in places, with a more or less developed transverse depression across the middle; color yellow brown with darker lateral and median shadings in two species. Scutellum well rounded at the tip, somewhat pubescent. Elytra broader than the prothorax, elongate oblong with prominent humeri, a deep intrahumeral sulcus and a transverse depression before the middle and in two species another less marked one behind the middle; in these two species a rounded callosity at the apical curve; surface lustrous blue or bronzy green, coarsely and densely punctate and with a fine silky pubescence. Epipleura broad at base and gradually narrowing and disappearing before the apex. Body beneath finely pubescent, anterior coxal cavities open, legs modertely long, femora robust, tibiae unarmed, claws toothed. (δις two, κοίλος hole, τράχηλος neck, i e. thorax.)

Genotype.—*Dicoelotrachelus darlingtoni*, n. sp.

Distribution.—Island of Hispaniola.

This genus is not very closely related to any North American one known to me. It belongs among the Galerucinae, probably near *Trirhabda*, having the anterior coxal cavities open, the tibiae unarmed, the claws toothed, the epipleura extending well down the elytra, and the antennae filiform with the 3d and 4th joints approximately equal, the 4th being only a trifle the longer. In its long parallel elytra, as well as in their pubescence and coloration, it resembles the metallic-colored species of *Trirhabda* but it has not a trace of vittation or pale elytral margins. The simple bowed aedeagus is like that found in *Galerucella*, *Monoxia*, and *Trirhabda*. The presence of two deep pits on the prothorax distinguishes the genus from any other group I have seen among the Galerucinae.

Dicoelotrachelus darlingtoni, n. sp.

Fig. 12.

Elongate oblong, about 4.5 mm. long, coarsely punctate, yellow brown with shining green elytra having a bronzy or rosy lustre and with a fine silky pubescence; pronotum with median and lateral dark shadings.

Head coarsely and rugosely punctate down to the tubercles, these not prominent but distinct; often with a dark spot on occiput, dark shadings on sides below the antennal base and a dark labrum, face elongate and narrowed towards the mouth. Antennae extending below the humeri, second and third joints almost equal and shorter than the fourth, outer joints gradually growing wider and subequal; pale yellow brown with the apex of each joint tending to be dark. Prothorax not quite a third wider than long, with sides rounded, basal margin nearly straight, a small seta-bearing tooth at each corner; surface densely and coarsely punctate, and midway on each side a small round hole; surface between punctures alutaceous; a poorly marked median transverse depression; color yellow brown with dark shadings on sides and a median dark line. Scutellum pale yellow brown, rounded at the apex, pubescent. Elytra wider than prothorax, elongate oblong, a long curving intrahumeral depression and a transverse depression before and after the middle, and on apical curve a rounded prominence; surface densely and confluently punctate, thereby forming irregular transverse ridges; with fine and moderately long pale silken pubescence; color lustrous green, shining with bronzy or rosy lustre. Body beneath reddish brown, darker on prosternum, finely and lightly pubescent. Legs reddish brown, tibiae without spines, tarsal claws toothed. Length 4.1–4.5 mm., width 1.9–2mm.

Type.—Male and 1 paratype (male), Museum of Comparative Zoology Type No. 25241.

Type locality.—Loma Rucilla and mountains north, alt. 5–8000 ft., Dominican Republic, collected in June, 1938, by P. J. Darlington.

Other localities.—Valle Nuevo, southeast of Constanza, Dominican Republic, ca. 7000 ft., and cloud forest, vicinity of

Valle Nuevo, ca. 6000 ft., all collected in August, 1938, by P. J. Darlington.

Remarks.—This species is named in honor of Mr. Darlington, who collected all three species of the genus.

Dicoelotrachelus depilatus, n. sp.

Fig. 10.

Elongate oblong, about 4 mm. long, yellow brown, with a dark spot on occiput, dark median and lateral shadings on pronotum and lustrous bronzy elytra, coarsely punctate, elytra with silken pubescence.

Head long and narrowed towards the mouth, yellow brown with dark spot on occiput, dark shadings below antennae and dark labrum, upper part of head down to the tubercles densely and coarsely punctate. Antennae not reaching the middle of the elytra, yellow brown with the tip of the 7th and 11th and all of the 8, 9, and 10th joints dark. 2nd and 3rd joints about equal in length and shorter than 4th, rest subequal, outer joints gradually becoming wider. Prothorax about a third wider than long with arcuate sides, a small seta-bearing pore at each corner and a nearly straight basal margin; surface densely and coarsely punctate, the interstices alutaceous; a round hole on either side about halfway down; yellow brown with dark sides and a dark median stripe. Scutellum pale with dark edges, pubescent, rounded at apex. Elytra elongate oblong with prominent humeri and well marked intrahumeral sulcus, a transverse depression before and one after the middle; surface lustrous bronzy, densely and coarsely punctate, and with a fine silken pubescence easily rubbed off. Body beneath pale yellow brown with darker prosternum, finely pubescent, femora and tibiae with darker rings and shadings. Length 4.1 mm.: width 1.6 mm.

Type.—Male, Museum of Comparative Zoology Type No. 25242.

Type locality.—La Visita and vicinity, La Selle Range, Haiti, 5–7000 ft. alt., collected Sept. 18–25, 1934, by P. J. Darlington.

Remarks.—Only one specimen, a male, is known. Unfortunately, when it was being cleaned, the elytral hairs rubbed off. It closely resembles *D. darlingtoni*, but has a differently shaped prothorax and differently colored antennae.

Dicoelotrachelus brevicollis, n. sp.

Fig. 11.

Oblong, about 3.5 mm. long, yellow brown, with shining violet blue elytra having in basal half pale margins and sutural edges, elytra coarsely punctate, with fine pubescence.

Head elongate, coarsely and rugosely punctate over occiput to the tubercles, entirely pale. Antennae entirely pale, not extending quite to the middle of the elytra, 3rd joint a little shorter than 4th, remainder subequal. Prothorax about twice as wide as long, with arcuate sides, a small tooth at each corner, basal margin joining lateral at an obtuse angle; disc with a transverse depression

across the middle terminated at either end by a round hole, this depression with a few coarse punctures, the rest of the pronotum only finely and inconspicuously punctate, and shining yellow brown. Scutellum pale. Elytra wider than prothorax, with prominent humeri and long deep intrahumeral depression, another transverse depression before the middle; surface densely punctate and with a pale, fine silken pubescence; lustrous blue violet with side margin and epipleura as far as the apical curve and basal half of the sutural edges yellow, apex dark. Body beneath and legs entirely pale, lightly pubescent. Length 3.5 mm., width 1.7 mm.

Type.—Female, Museum of Comparative Zoology Type No. 25243.

Type locality.—Foothills of Cordillera Central, south of Santiago, Dominican Republic, collected in June, 1938, by P. J. Darlington.

Remarks.—The shorter, differently shaped prothorax and blue elytra make this species at first glance quite unlike the other two, but the peculiar deep holes in the prothorax and the densely punctate and pubescent elytra show its relationship.

Pseudoepitrix hispaniolae, n. sp.

Fig. 1.

Elongate, about 2 mm. long, light yellow brown, shining, prothorax very finely and sparsely punctate, a little more so in the basal depression, elytra with striate punctation, more pronounced at the base.

Head entirely pale yellow brown, polished, rounded, nearly impunctate over occiput, a line running across vertex above tubercles, lower front below antennal bases smooth with a slight depression. Interocular space half as wide as head. Antennae long, extending below the middle of the elytra, entirely pale, 3rd and 4th joints not quite so long as 5th. Prothorax a third broader than long with only slightly curved sides, a small seta-bearing tooth at each corner; basal margin a little sinuate, a wide, well marked depression across basal fourth. Surface polished, finely and densely punctate, the punctures becoming a little thicker in basal depression. Scutellum polished, sub-triangular. Elytra considerably wider than prothorax with prominent humeri, a long intrahumeral depression and large basal callosity between the humeri and scutellum. Punctation striate and well marked, although not so deep towards the apex; surface shining, entirely light yellow brown. Body beneath shining brown, abdomen deeper brown with fine pubescence. Legs pale, tibiae not grooved, first tarsal joint on hind legs long. Length 2.2–2.4 mm.; width 1.2–1.3 mm.

Type.—Male, Museum of Comparative Zoology Type No. 25244.

Type locality.—Cloud forest, vicinity of Valle Nuevo, Dominican Republic, about 6000 ft., collected in August, 1938, by P. J. Darlington.

Remarks.—One other specimen was collected by Darlington,

on Loma Rucilla and mountains north, in August, 1938, at 5–8000 ft., Dominican Republic. Both specimens are males. They differ from the Porto Rican species, *P. hoffmani* Bryant, in being more robust and wider. The eyes in *hoffmani* appear more prominent and the groove behind the tubercles is an inverted V, while in *P. hispaniolae* it is straight across between the eyes. The punctation on the base of the prothorax is not so dense as in *P. hoffmani*. *P. suffriani* Jac. from St. Vincent has differently colored antennae and *P. trinitatis* Bryant from Trinidad appears to be darker and with dark varicolored antennal joints. All four species are very closely related. The aedeagus of *P. hispaniolae* is quite different from that of *P. hoffmani*.

Pseudoepitrix jamaicensis, n. sp.

Fig. 3.

Elongate, about 2 mm. long, pale yellow brown, faintly shining, prothorax very densely punctate, elytra striate-punctate.

Head entirely pale yellow brown, smoothly rounded over occiput, not very shiny, rather alutaceous, a line running across above the frontal tubercles and between the eyes, interocular space half width of head. Antennae extending below the middle of the elytra, gradually deepening in color from the pale yellow brown basal joints to darker brown from the 5th joint, 3rd joint a little shorter than the 4th, and 4th not quite so long as 5th. Prothorax only a little broader than long, with almost straight sides a little contracted towards the base, a tiny seta-bearing tooth at each corner; surface very densely and finely punctate, only faintly shining, and under high magnification alutaceous, basal sulcus well marked. Scutellum triangular. Elytra wider than prothorax, with prominent humeri, long intrahumeral sulcus and a callosity between this and scutellum; the striate punctures stronger near the base and becoming faint at apex, surface moderately shining, entirely pale yellow brown. Body beneath pale with abdomen sometimes darker brown. Legs pale, tarsi deeper in coloring. Length 2.3–2.9 mm.; width 1.1–1.3 mm.

Type.—Male and 1 paratype (female), Museum of Comparative Zoology Type No. 25245, 1 paratype (male) in National Museum, Cat. No. 54185.

Type locality.—Whitefield Hall, Blue Mts., Jamaica, ca. 4500 ft. alt. collected Aug. 13–20, 1934, by P. J. Darlington.

Other localities.—One other specimen, a female, was taken by Darlington on the Main Range, Blue Mts., Jamaica, alt. 5–7388 ft., Aug. 17–19, 1934.

Remarks.—This is a little longer and more slender than *P. hispaniolae*, with much more densely punctate pronotum and larger punctures on the elytra. It is not so shiny as *P. hispaniolae*. The prothorax is more nearly quadrate. It differs from the Porto Rican species, *P. hoffmani* Bryant, in its more densely punctate pronotum and in not having the oblique line

running from the tubercles back to the eye. It differs from *P. suffriani* Jac. and *P. trinitatis* Bryant in not having conspicuously bicolored antennal joints. *P. trinitatis* also has an impunctate pronotum.

Chaetocnema plicipennis, n. sp.

Fig. 2.

Ovate, about 2.5 mm. long, shining aeneous black with reddish brown antennae and legs, the hind femora dark; prothorax densely punctate, elytra with striate punctation, and on each side in the female, at least, two lateral folds.

Head smoothly rounded over occiput with feebly shining alutaceous surface and fine sparse punctures; entirely dark except the slightly paler brown mouthparts; frontal tubercles not marked; interocular space about half the width of the head. Antennae not reaching the middle of the elytra, deep reddish brown, first two joints thicker and longer than third and fourth. Prothorax not quite twice as wide as long with arcuate sides and rounded basal margin, smoothly convex; surface finely alutaceous, shining, and covered with dense distinct punctures. Elytra with strong striate punctation, shining aeneous, the small humeri distinctly marked by an intrahumeral sulcus; a slightly elevated basal callosity near the scutellum, and on either side of the elytra, two well marked lateral folds, the one next to the margin running from below the humerus to the apical narrowing, the upper one not beginning quite so near the humerus. Body beneath black, alutaceous, shining, and without distinct punctures, and with fine pubescence. Legs, except the aeneous hind femora, reddish or yellowish brown. Length 2.4–2.7 mm.; width 1.3–1.6 mm.

Type.—Female, and one paratype, also a female, Museum of Comparative Zoology Type No. 25246. One paratype, a female, in the U. S. National Museum, Cat. No. 54182.

Type locality.—Valle Nuevo, southeast of Constanza, Dominican Republic, collected in August, 1938, by P. J. Darlington.

Remarks.—The two well marked folds on the sides of the elytra of this species distinguish it from others. This feature may not be so pronounced in the male, which has not yet been collected.

Chaetocnema laticeps, n. sp.

Fig. 4.

Oblong oval, about 2 mm. long, densely punctate, shining aeneous black with a rosy or bluish lustre, antennae, tibiae and tarsi reddish brown; interocular space unusually wide.

Head alutaceous, finely and rather densely punctate, interocular space about two-thirds the width of the head. Antennae not extending much below the humeri. Prothorax about a third wider than long, densely and distinctly punctate, with a well marked row of punctures along the basal margin. Elytra lustrous, often with a rosy light, the rows of punctures deep and well marked to the apex. Body beneath shining, segments of the abdomen distinctly punctate, the first and last being particularly well covered. Femora usually deeper brown, tibiae and tarsi paler. Length 1.7–2 mm.; width 1–1.2 mm.

Type.—Male and one paratype (female) Museum of Comparative Zoology Type No. 25247. One paratype in the U. S. National Museum, Cat. No. 54189.

Type locality.—Trou Caiman, Haiti, collected Sept. 4, 1934, by M. Bates.

Other localities.—3 specimens collected at Lake Guánica, Porto Rico, May 31, 1938, by P. J. Darlington.

Remarks.—The unusually broad head and wide interocular space as well as the punctate upper and lower surface of this species are its most distinctive characters.

Chaetocnema perplexa, n. sp.

Fig. 5.

Ovate, about 1.7 mm. long, shining black with an aeneous lustre, antennae and legs, except the hind femora, pale yellowish brown; pronotum densely punctate, elytra broad and without depressions.

Head alutaceous, a small group of punctures on either side near the eye; interocular space about half the width of the head. Prothorax nearly twice as wide as long, the sides slightly curved and only a little narrowed anteriorly, the basal margin somewhat sinuate over the scutellum, surface alutaceous, densely and distinctly punctate. Elytra broad, without any transverse depression, and deeply striate-punctate, the interstices forming small ridges noticeable on the sides, slightly alutaceous. Body beneath finely punctate, shining dark brown. Hind femora dark, rest of legs paler brown. Length 1.4–1.8 mm.; width .7–1 mm.

Type and 8 paratypes, U. S. N. M. Cat. No. 54183, one paratype in the Museum of Comparative Zoology.

Type locality.—Cayamas, Cuba, collected by C. F. Baker.

Other localities.—Soledad, Mina Carlida, Trinidad Mts., Caimito, Baracoa, Havana, Hirradura, Central Manatí, Oriente Province, Majay, Santiago de las Vegas, Central Moron, Camagüey, all in Cuba.

Remarks.—This species so closely resembles the North American species, *Chaetocnema confinis* Cr., that I am unable to distinguish the two except by dissection. The aedeagi are not alike. Unfortunately although there are many specimens, there are very few males in any collection. Besides the Cuban specimens, there are many from other islands of the West Indies,—Porto Rico, Santo Domingo, and Bermuda,—that are also indistinguishable from the North American *confinis* in external characters. In these cases, however, there are no male specimens. One male from Jamaica has a differently shaped aedeagus from either the North American *confinis* or Cuban *perplexa*. The lack of male specimens has prevented me from arriving at any conclusion about the specific standing of these, but I suspect that there may be a different race in each of the islands. Three collectors have taken it on *Convolvulus*.

This species has been confused in collections with *Chaetocnema apricaria* (Suffrian). *Chaetocnema perplexa*, however, is a broad, ovate insect, deep black in coloring and without the transverse elytral depression found in *Chaetocnema apricaria*. It must be a very abundant species as there are many specimens of it in all the collections from the West Indies.

Chaetocnema elachia, n. sp.

Fig. 9.

Oblong oval, about 1.5 mm. long, shining deep brownish black with legs, except the dark hind femora, and antennae paler; head and prothorax alutaceous, the latter very finely and not densely punctate.

Head smooth, alutaceous, two or three punctures on either side near the eye; interocular space a little more than half the width of the head. Antennae pale reddish yellow, not extending much below the humeri. Prothorax nearly a third wider than long, with arcuate sides, surface alutaceous with exceedingly minute and not dense punctures, a row of deeper punctures along the basal margin. Elytra not depressed and with well defined striate punctures, shining. Body beneath dark brown, shining, abdomen finely punctate. Length 1.3–1.7 mm.; width .7–.9 mm.

Type.—Male and 4 paratypes, U. S. N. M. Cat. No. 54184. One paratype in the Museum of Comparative Zoology.

Type locality.—Vieques I., Porto Rico, collected in Feb. 1899 by August Busck.

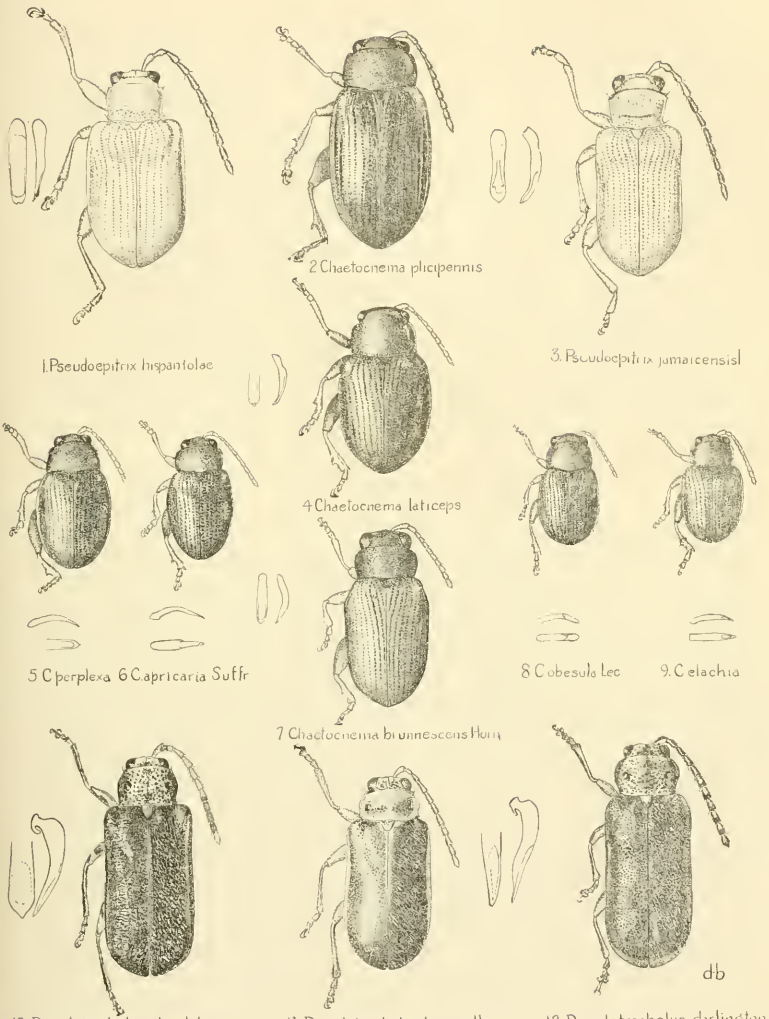
Other localities.—Rio Piedras, Porto Rico, collected July 25, 1912, by T. H. Jones on leaves of *Ipomoea*.

Remarks.—This species closely resembles *Chaetocnema obesula* Lec. from Cuba and North America, but has a differently shaped prothorax which under high magnification is seen to be finely punctate. In *obesula* the pronotum appears nearly impunctate or with the punctures obsolete. There is a slight difference, too, in the elytral punctation. The aedeagus is acutely tipped in the Porto Rico species, and broad at the tip in *obesula*. Jacoby, in his description of *Chaetocnema nana* from Grenada, writes that there is no trace of a row of basal punctures on the pronotum, which are well marked in *elachia*. The thorax in his species appears to be wider also.

Chaetocnema apricaria (Suffrian).

Fig. 6.

Chaetocnema apricaria (Suffrian) has been confused in collections with other species of *Chaetocnema* closely resembling it. It is an oblong oval species, usually deep reddish brown or darker and often with an aeneous lustre, and with paler antennae and forelegs. Its distinctive character is a transverse depression in the basal half of the elytra. The head is punctate on either side of the vertex and the pronotum densely punctate. The


1.Pseudoepitrix hispantolae
2 Chaetocnema plicipennis
3. Pseudoepitrix jamaicensis!
4 Chaetocnema laticeps
5 C perplexa 6 C.apricaria Suffr
7 Chaetocnema brunnescens Horn
8 C obesula Lec
9. C elachia
10 Dicoelotrachelus depilatus
11 Dicoelotrachelus brevicollis
12. Dicoelotrachelus darlington
db

aedeagus is quite acutely tipped. It is represented in the National Museum collection by specimens from Cuba only,—Cayamas, Mina Carlota, Trinidad Mts. Darlington has collected it at Soledad, Cuba.

Chaetocnema brunnescens Horn.

Fig. 7.

Chaetocnema brunnescens, described by Horn from Key West, Florida, where it was collected by Schwarz, appears to be a West Indian species. Specimens are in the National Museum collection and the Museum of Comparative Zoology from Arthurs Town, Cat Island, Bahamas; La Sardinero, Daredo, and Boquironi (collected on *Ginora rohrii*, Lythraceae), Porto Rico; Magen Bay and Charlotte Amalie, St. Thomas, Virgin Islands; and 8 miles up the Macoris River, and Barahona, Dominican Republic. W. A. Hoffman has collected it on mangrove, which may very well be its native foodplant.

It is paler brown than the other species, and has a greenish metallic lustre and a conspicuously punctate head. It is larger and more elongate than the other West Indian species of *Chaetocnema*, except *plicipennis*.

Chaetocnema obesula Lec.

Fig. 8.

Chaetocnema obesula, described by LeConte from Schwarz's collection at Lake Ashby and Baldwin, Florida, has been sent to me by S. C. Bruner, who reports it as common in the rice fields of Cuba. In Cuba it has been collected at the following localities: Central Francisco, Camagüey; Guipuzcoa; 14 miles north of Santiago (on sugar cane); Baragúa; Aguacate; Havana; Central Palma, Oriente Province; St. Tomás, Zapata; Central Morón, Camagüey; Banes. In Santo Domingo it has been collected at San Pedro de Macoris, 8 miles up the Macoris River, La Romana Central, and Duarte. In Santo Domingo it has been collected on sugar cane. There are specimens in the National Museum collection sent from the Louisiana Experiment Station, taken on sugar cane, but the exact locality is unknown.

Suffrian earlier described *Chaetocnema minutissima* in his work on the Cuban Chrysomelidae, but gave Venezuela as the locality. His brief description fits this species very well but it seems inadvisable to adopt his name, in view of the locality given, without examining authentic specimens. Horn describes his *Chaetocnema ectypa* as closely resembling *C. obesula*, but *ectypa* is a longer and more slender beetle with fine punctation on the pronotum. In addition, the aedeagus is quite unlike that of *obesula*.

SOME NEW SPECIES OF THE GENUS BACCHA FROM THE NEW WORLD.

By Frank M. Hull,
University of Mississippi.

In this paper I present the description of two new Syrphid flies from Panama and South America. Types are in the author's collection.

Baccha victoria, n. sp.

Slender, dark brown flies with biannulate hind femora and tibiae; the abdomen with a pair of obtuse, posteriorly indented, acutely pointed spots on the third segment and ill-defined V-shaped spots on the fourth segment, which are inverted. Related to *prenes* Curran.

Male. Length 10 mm. *Head:* vertex brownish-black with golden brown pubescence, the head large and much wider than the thorax, the eyes bare, the post-occiput light yellowish-brown pilose, thickly dusted with pale, yellowish-brown pollen. The pile midway up the occipital margin consists of two rows of hairs; vertical and frontal pile black; facial pile pale yellow, front and face pale yellow, the cheeks barely darker, the front with a conspicuous small black spot above the antennae. Antennae short, brownish yellow, the third joint dark brown along the dorsal edge, the antennal pile black, the arista dark brown. *Thorax* light yellowish brown, including the sides of the mesonotum; the broad middle of the mesonotum is brilliant, brownish-golden over which can be discerned, when viewed at an angle, three stripes of golden-brown pubescence. There is a diffuse, obscure, diagonal, dark brown band running from metanotum to the middle coxae, bordering anteriorly the last spiracle but not enclosing it. Scutellum light, yellowish-brown, somewhat darker on the disc and somewhat translucent. *Abdomen:* slender, first segment short, yellowish, broadly dark brown along the middle and posterior border, second, third and fourth segments about equal in length, the abdomen narrowest at the end of the second segment, the apex of the third segment about as wide as the base of the second, each of these segments approximately five times as long as their narrowest width. The abdomen is dark sepia-brown in color, with near the middle of the second a narrowly divided pair of yellow spots which are slightly oblique in their position. Third segment with, on either side, a yellow, somewhat spear-shaped spot, the base towards the posterior end of the segment and somewhat indented. Fourth segment with a longer, larger, spear-shaped wedge of yellow, shaped almost like a narrow V with sharpened points, the pointed end of which is truncated and reaches the anterior margin of the segment. On the fifth segment there are a pair of wedge-shaped spots on the middle of the segment, somewhat narrowly separated and a second shorter pair lying sublaterally outside of the middle pair. The terminal part of fourth and fifth segment and hypopygium is very dark brown, almost black. The pile of the abdomen is black. *Legs:* almost wholly pale yellow, the hind pair with the basal third and a wide subapical annulus dark brown. The pile of the hind femora and tibiae is dark brown, the middle femora with a narrow posterior fringe of brown pile, the short pile elsewhere golden.

Wings: slender, the alulae reduced to a very narrow strip, the entire wing tinged with brown, the stigmal cell somewhat darker, the subapical cross vein quite sigmoid.

Holotype: a male. Sao Paulo, Brazil (J. Lane, collector), in the author's collection; one paratype male, same data, in the collection of John Lane.

Baccha virginio, n. sp.

Related to *crocata* Austin, but the hind femora are bi-annulate, the hind tibia brownish with dark brown pile instead of pale yellow with yellow pile; besides difference in the abdominal pattern.

Male. Length 7.5 mm. *Head:* face, cheeks and front yellow, the middle of the front broadly light brown with a small blackish spot just above the antennae. The facial and frontal pile is blackish, the antennae are light orange, the third joint brownish dorsally and apically, the arista black. The pile of the upper part of the vertex is black, golden below. *Thorax:* broadly brassy-black with a pair of widely separated golden-brown pollinose vittae and sparse black pile. Sides of mesonotum widely yellow except just before the post-calli. Humeri, pro, meso–, ptero– and upper sternopleurae and post calli yellowish. The scutellum is light ,brownish-yellow with very sparse, black pile, apparently without fringe and also densely black pubescent over the disc. *Abdomen:* moderately constricted basally, flattened, spatulate on the first two segments. The abdomen is dark, brownish-black marked with yellow as follows: lateral anterior corners of the first segment, a broad posteriorly indented fascia just past the middle of the second segment whose lateral ends are attenuated and somewhat diagonally directed towards the posterior corners of the segment. Third segment with a pair of narrowly separated, large, triangular, longitudinally placed vittae which are shallowly indented upon their posterior margins, these spots reach to the base of the segment and extend two-thirds of the length of the segment. Their lateral margins are extended diagonally outward but do not reach the lateral margin of the segment. Fourth segment with, in either side, narrowly separated in the middle, a yellowish-brown inverted V whose apex is truncated and touches the base of the segment and the posterior prolongation of the arms are somewhat rounded and reach almost to the end of the segment; the lateral arms are somewhat shorter than the medial arms of the V's. Fifth segment with a pair of prominent, narrowly separated, yellow-brown vittae from base to apex which basally are narrowly connected with a much shorter vittae, equally wide and lying close to the lateral margins. Abdominal pile black, except for four or five long, golden hairs at extreme base of first segment. Behind these pale hairs are twelve to fourteen long, black ones. *Legs:* first pair entirely light yellow, yellow pilose, Middle femora brown, especially on the basal two-thirds with a posterior blackish fringe, their tibiae and tarsi yellow, yellow pilose. Hind femora and tibiae brown, their tarsi yellow, yellow pilose, femora with a subbasal and subapical annulus, the distal one much darker and more evident.

Femoral and tibial pile dark. *Wings:* rather heavily tinged throughout with brown, the stigmal cell quite dark brown, the allulae linear.

Female. Similar to the male; the front has a continuous, diffuse, slender brownish stripe, the dark pubescence is less in evidence upon the scutellum, and the abdominal pattern is very similar.

Holotype: one male, Sao Paulo, Osasco, April 6–8, 1939, J. Lane, collector. Allotype: one female, same data.

A REMARKABLE NEW SPECIES OF THE GENUS PSEUDACTEON (DIPTERA : PHORIDAE).

By Charles T. Greene,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

In three genera of the dipterous family Phoridae, *Apocephalus* Coquillett, *Melaloncha* Brues, and *Pseudacteon* Coquillett, all of which are known to occur only in the Western Hemisphere, the female has a large, exserted, horny ovipositor. In the new species described below the ovipositor is exceptionally large, being relatively much broader and deeper than in any of the described species of the three genera.

Pseudacteon grandis, new species.

Female.—Length 1.75 mm. Dark brown. Front about as broad as long, gray dusted, with a shining black, central, vertical stripe which bifurcates and extends narrowly around the ocellar triangle; 4 transverse rows of frontal bristles; first, third, and fourth rows with 4 each; second row with 2, 1 bristle on each outer side; on each side of the front between the first and third rows of frontals 2 vertical rows of very minute hairs, 3 in each row; postantennal pair converging, proclinate. Third antennal segment oval, dark brown, with a narrow ochraceous area along the base and with pale microscopic pubescence; arista one and one-half times as long as third antennal segment, microscopically pubescent. Palpi pale yellow, each with 4 black spines apically; proboscis pale luteous.

Thorax much broader anteriorly, faintly dusted; scutellum with 4 bristles, anterior pair much the smaller; halteres yellowish white; legs pale yellow with brown infuscation on the apical third of hind femur. Wing with third vein simple, ending before middle; second costal area twice as long as third; costal fringe short, only slightly longer than thickness of costal vein.

Abdomen dull brown with last 2 segments edged posteriorly with white and with several bristly hairs on each side. Ovipositor (fig. 1) very broad, shining black, horseshoe shaped, bilobed, with a central process which has 4 bristles apically; across basal portion of arch a transparent colorless membrane, and along the edge a row of 10 small hairs; above this row 2 vertical rows of 4 fine hairs each.

Described from two females.

The type is from Negril Point, Jamaica, Station 583, May 19, 1941, Dr. E. A. Chapin collector. Taken in association with the ant *Solenopsis geminata* (F.), found in a deserted nest of a species of *Nasutitermes*.

The paratype is from State College, Miss., November 22, 1934, Dr. M. R. Smith collector. It was observed attacking the fire ant, *Solenopsis xyloni* McCook.

Type and paratype, United States National Museum No. 53862.

This species runs to *Pseudacteon spatulatum* (Mall.) but differs in the shape and much larger size of the ovipositor.

Note.—The ants were identified by Dr. M. R. Smith, Bureau of Entomology and Plant Quarantine.

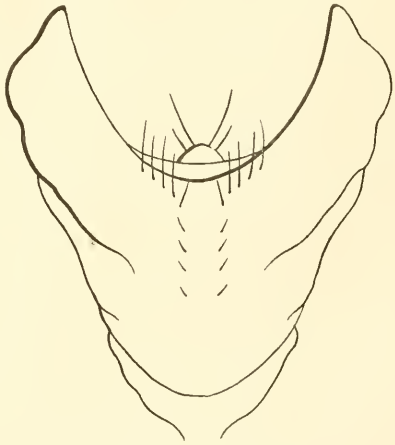


Fig. 1. *Pseudacteon grandis*, postero-dorsal view of ovipositor.

A NEW TAENIOTHRIPS FROM PANAMA (THYSANOPTERA)*

By J. C. Crawford,

U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine.

Species in the genus *Taeniothrips* which have the fore tarsus apically produced into a clawlike projection are so few in number that a new one, differing widely from those already known, is of interest. It is because of this deviation that the specific name has been selected.

Taeniothrips aberrans, new species.

Holotype female (*macropterous*).—Length (distended) 1.48 mm. Deep brown, thorax with slight orange tinge and much red pigment, especially in prothorax; femora concolorous with body, knees somewhat lighter brown, tibiae paler than

femora, paler apically, tarsi yellow; bristles, including those of appendages, brown; antennae elongate; fore vein with many bristles beyond basal group. Fore tarsus with a claw at apex; tergum VIII without comb. Ovipositor very short, weak.

Head very slightly longer than greatest width; antenna brown, segment II paler apically, III tinged brown at base and light brown beyond circlet of major bristles, pedicels of segments IV-VI each with a brown ring at base, beyond this brown ring and including extreme bases of IV-V white, on VI the white a narrow ring; segment I slightly broader than long, scarcely wider at base than at apex, II with gently convex sides, III with sides beyond row of major setae faintly concave, IV elongate vasiform, V subcylindrical, VI pedicellate, tapering to apex; eyes strongly bulging, with many strong, dark-brown hairs, facets large; frontal costa deeply, widely emarginate; ocellar crescents a deep red; interocellars slightly forward of a line tangent to anterior margins of posterior ocelli and about on lines tangent to the inner margins of front and posterior ocelli; cheeks faintly convex in outline, subparallel; head slightly constricted back of eyes; postocular bristles about 4 on each side in almost a straight line across head, with the inner bristle only slightly longer and stronger than the others; about half way between postoculars and ocelli a single, weaker, shorter bristle on each side; head back of postoculars with transverse, anastomosing lines; mouth cone about reaching middle of prosternum.

Prothorax slightly wider than head, sides subparallel, a bright red band of subhypodermal pigment across anterior and posterior margins; discal bristles many, strong; bristle between each pair of posterior angulars long, strong; 2 pairs of posterior marginal bristles between posterior angulars, the inner pair scarcely longer or stronger than the outer pair and no longer than the bristle between outer and inner posterior angulars. Fore wings almost uniformly deep brown; costa with about 29 bristles; fore vein, beyond basal group of 4 (or 5) bristles, with an irregular row of 9–10 bristles which extend outward beyond middle of wing but are widely separated from the 2–3 apical bristles; hind vein with 13–16 bristles. Hind wing brown, median dark streak extending almost to apex of wing. Fore tarsus with a long, slender, apical claw.

Abdomen with marginal bristles strong; tergum X split open above about to circlet of major bristles; ovipositor weak, its base at about middle of eighth segment, venter with no accessory bristles.

Measurements (in microns, mostly from holotype):

Antennae	1	2	3	4	5	6	7	8
Length	25	34	56	78	50	72	20	21
Width	34	30	25	22	17	20	10	6

Head: Total length 160; from front of eye to occipital carina 128; width across eyes 154; width across cheeks 146; interocellar bristles 40; innermost postocular 28; prothoracic posterior angulars, outer 44, inner 60; bristles between each pair of posterior angulars 34, discal bristles 24–28; prothorax, length 120, width 160; pterothorax, length 176, width 216; bristles on tergum IX, inner 120, outer 136; on tergum X, inner 128, outer 124; ovipositor 125.

Allotype male (*macropterous*).—Length (distended) 1.17 mm. Similar to the female but light brown. Postoculars longer and stronger than in female; 2

bristles on each side of head in front of postoculars, of which one is close to and mesocaudad of eye, the other, shorter and weaker, back of lateral ocellus. Major bristles of prothorax slightly longer than in female; inner pair of posterior marginals longer and stronger than outer. Fore vein with 4 basal bristles, then a group of 9 bristles and 2 apical bristles; hind vein with 10–12 bristles. Tergum IX with 3 pairs of posterior marginal bristles in addition to the long pair of lateral marginals, which are somewhat cephalad of posterior marginal row; of the posterior marginals, the lateral and dorsolateral bristles are close together and between each pair is a short, strong (20 μ), recurved bristle; median pair of bristles somewhat more caudad than the other pairs; posterior margin of tergum IX prolonged caudad on each side into a long (25 μ) curved projection very like clasping organ (fig. 1).

Measurements (in microns):

Bristles on tergum IX: lateral margins 128; posterior marginals, median pair 46, intermediate pair 92, outer pair 116.

Antennae	1	2	3	4	5	6	7	8
Length	22	32	40	72	60	94	10	8
Width	32	28	24	24	20	19	6	4

Type locality: Panama Canal Zone.

Type Catalogue No. 55666, United States National Museum.

Described from six females and one male taken at the port of New York on flowers and leaves of *Heliconia* sp., February 10, 1939, by G. Nicolaides.

Two of the female paratypes were collected dead and are somewhat broken.

This species differs from both *inconsequens* Uzel and *calcaratus* Bagn. (which are, I believe, the only described species with similarly toothed fore tarsi) in the lack of a comb on tergum VIII, longer antennal segments, with segment IV distinctly longer than III, greater number of bristles on fore vein, interocellars placed farther forward; from *inconsequens* further in having the ovipositor very short, and in lacking a row of accessory bristles on sterna.

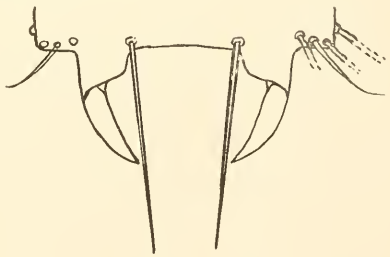


Figure 1.—*Taeniothrips aberrans*, new species. Apical portion of male tergum IX. (Diagrammatic.) Most setae omitted.

RECORDS OF TENNESSEE CHRYSOPIDAE (NEUROPTERA).[1]

By Wm. E. Bickley,
University of Maryland, College Park, Md.

In 1934 I became interested in the family Chrysopidae and subsequently collected several hundred specimens in various parts of East Tennessee. Most of this material is now in the collection of the Department of Entomology of the University of Tennessee. Further studies have been made of Tennessee material in the collections of the University of Tennessee, the U. S. National Museum (courtesy of Dr. A. B. Gurney), the Museum of Comparative Zoology at Harvard University (courtesy of Professor Nathan Banks) and the Academy of Natural Sciences of Philadelphia (courtesy of Messrs. E. T. Cresson, Jr. and John Rehn). At least one specimen of each species in the list that follows was sent for determination or verification to the late Mr. A. N. Caudell, to Professor Nathan Banks, or to Dr. Roger C. Smith, and this help is gratefully acknowledged. The late L. C. Marston, Jr., and David A. Johnson helped with the collecting. Their initials in the list indicate that they collected at Knoxville one or more specimens of the species concerned. Unless otherwise noted, collections are my own.

Allochrysa virginica (Fitch). This species, which is often associated with aphids on oak trees, is known to be of eastern distribution, ranging from Massachusetts to Florida. Specimens are recorded from Knoxville and Byington (D. A. J.). One specimen collected by S. Marcovitch, Knoxville.

Meleoma signoretti Fitch. This species has not previously been reported south of New York. However, there are specimens in the M. C. Z. collection from Plummer's Island, Maryland, and Mountain Lake, Virginia. I collected one specimen at Martel (Loudon County), Tennessee, on August 16, 1934.

Chrysopa lineaticornis Fitch. This species has previously been reported from New England, New York, Michigan, and Maryland. It may be synonymous with *C. ampla* Walk. according to Banks (1903). Specimens are recorded from Knoxville

[1]This paper is based in part upon a thesis submitted to the Graduate Committee of the University of Tennessee in partial fulfillment of the requirements for the degree of Master of Science, August, 1936. I wish to express my appreciation to Professor G. M. Bentley and Dr. A. B. Gurney for help in the preparation of the manuscript.

and Martel (D. A. J.). One U. S. N. M. specimen was collected by R. H. Adams at Nashville.

Chrysopa nigricornis Burm. This is a very common species in Tennessee. It is apparently arboreal and reaches a peak of abundance in May. Specimens were collected at Knoxville and Martel (D. A. J.). One U. S. N. M. specimen from Hamilton County was collected by W. F. Turner.

Chrysopa chi Fitch (and its variety *upsilon* Fitch) is of northern distribution. Specimens are recorded from Knoxville and Martel. The *upsilon* variety was not collected.

Chrysopa oculata Say. Of the several varieties in this species, there is some doubt as to the validity of some of the varietal names.[2] However, the three varieties listed here are believed to be worthy of retention.

Chrysopa oculata Say var. *oculata* Say. This is the most common chrysopid in Tennessee. Over 150 specimens were collected at Knoxville, Concord, Martel, and Gatlinburg (D. A. J. and L. C. M.). One U. S. N. M. specimen from Hamilton County was collected by W. F. Turner.

Chrysopa oculata Say var. *albicornis* Fitch. The venation in this variety is darker than in var. *oculata*. This variety seems to be more abundant in less cultivated areas. Specimens were collected near Louisville (Blount County), Knoxville, Martel, and Gatlinburg (D. A. J. and L. C. M.).

Chrysopa oculata Say var. *illepida* Fitch. The pair of spots on each side of the vertex is joined to form a longitudinal band of dark brown or black. Specimens were taken at Knoxville (D. A. J. and L. C. M.).

Chrysopa plorabunda Fitch. This species is one of marked individual variations. Specimens were taken at Knoxville and Martel (D. A. J.).

Chrysopa harrisii Fitch. Specimens are recorded from Knoxville and Martel. One M. C. Z. specimen from Knoxville collected by W. W. Stanley and one from Roan Mountain Station collected by A. P. Morse.

---

[2] A specimen of *C. oculata* Say which was thought to be var. *bipunctata* Fitch was sent to Professor Nathan Banks. The determination was verified, but he wrote that, "It is useless to retain the varietal name for those forms with two disconnected brown spots on the vertex." Smith (1932) has retained this varietal name.

Chrysopa quadripunctata Burm. Specimens were taken at Knoxville, Martel, and Gatlinburg (D. A. J.).

Chrysopa rufilabris Burm. This is the second most abundant species in Tennessee. Specimens were collected at Knoxville, Concord, and Martel (L. C. M.). Several U. S. N. M. specimens from Roane County and Hamilton County collected by W. F. Turner.

Chrysopa interrupta Schneider. Specimens were collected at Knoxville and Martel.

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Smith, Roger C.

1922. The biology of the Chrysopidae. Cornell Univ. Agr. Expt. Sta. Mem. 58: 1287–1372, figs. 154–163, pls. LXXV–LXXXVIII.

1932. The Chrysopidae of Canada. Ann. Ent. Soc. Amer. 25: 579–600, 1 pl.

1934. Notes on the Neuroptera and Mecoptera of Kansas with keys for the identification of species. Journ. Kans. Ent. Soc. 7: 120–144, 1 pl.

MINUTES OF THE 521ST REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 521st regular meeting of the Society was held at 8 p. m., October 2, 1941, in Room 43 of the National Museum. President Ewing presided, and 42 members and 10 visitors were present. The minutes of the June meeting were read and approved.

It was unanimously voted to elect to membership Neal A. Weber, Department of Biology, University of North Dakota, University Station, Grand Forks, N. D.

E. A. Back exhibited a sample of the so-called California jumping beans, which were actively jumping. These are galls, formed on oak leaves in the Western States by the cynipid, *Neureterus saltatorius* H. Edwards. They are sometimes called "Flea seeds," jumping seed galls or jumping bullet galls. (Secretary's abstract.)

L. A. Hetrick reported large numbers of tree swallows in and about pine trees from which bark beetles (*Ips* sp.) were emerging. He believed the birds were feeding on the beetles and wondered if similar activity had been noted by others. (Secretary's abstract.)

The main program was as follows:

1. Some concepts underlying the work of a naturalist. Adam G. Böving Smithsonian Institution.

Dr Böving gave a terminology to be used in describing the male genitalia of *Phyllophaga* spp. He demonstrated the more important types of genitalia, explaining the application of the terms to them. (Secretary's abstract.) Comments followed by Snodgrass, Rohwer and Ewing.

2. Present status of methyl bromide fumigation. Randall Latta, Bureau of Entomology and Plant Quarantine.

Mr. Latta discussed the original use of methyl bromide in France and its introduction into the United States by F. P. Mackie, of California. It is used extensively in quarantine work to fumigate such materials as nursery stock shipped under Japanese beetle and white fringed beetle quarantines, seeds and produce from the West Indies and Morocco. Another type of use is represented in the commercial fumigation of mill produce, seeds, artichokes, cheese mites, gladiolus corms, and grain bins. (Secretary's abstract.) Remarks were made by Cushman and Hoyt.

Upon invitation from President Ewing, Cushman briefly discussed the classification of the Hymenoptera, with special reference to correlations based on the study of both adults and larvae. At present, evidence is not sufficient to permit the drawing of conclusions regarding the bearing that larvae have on the classification. (Secretary's abstract.)

Adjournment at 9.25 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

Actual date of publication, November 29, 1941

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PROCEEDINGS OF THE

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NOTES ON THE FLATID GENUS ORMENIS IN THE BRITISH LESSER ANTILLES AND TRINIDAD, WITH DESCRIPTIONS OF NEW SPECIES (HOMOPTERA: FULGOROIDEA).

By R. G. FENNAH,

Entomologist, Citrus Pests Investigation, Windward and Leeward Islands, B.W.I.

This paper includes observations on the genus *Ormenis* made in the islands of Montserrat, Dominica, St. Lucia, St. Vincent, Barbados, Grenada, and Trinidad during the last three years, together with descriptions of material collected in the above islands and in St. Kitts and Antigua.

In general the volcanic islands of the Lesser Antilles were originally well wooded, having a low moss-forest on the highest peaks, high forest on the mountain slopes down to about 800 feet above sea level, then passing through a drier zone of mesophytic vegetation to the dry "crotoneta" bush association of the coastal area.

The various species of *Ormenis*, though often found on certain host plants in great numbers, are in fact very general feeders on shrubs or rather woody herbs. Each species, however, is usually restricted to a dry association or to a wet association, a frequenter of the "crotoneta," for instance, never occurring in the high forest. In addition to this segregation of species within islands, species differ between islands, and in the southern half of the Lesser Antillean archipelago a high degree of endemism is found. The importance of these facts, from the systematic standpoint, is that considerable weight can be attached to locality labels as corroborative evidence of correct determination of species. This, however, applies only to a limited extent with regard to Trinidad, which faunistically has strong affinities with the mainland of South America.

The characters which have proved to be most reliable in differentiating between species or groups of species are the form of the genitalia (especially of the male), and the occurrence and position of dark ("black") spots or areas on the tegmen. The latter, however, is not entirely reliable, as in at least two species dimorphic forms occur (a dark and a pale form) and this is apt to

cause confusion, especially when only females are available for study. The shape of the egg has some slight systemic value and is stated where known.

There appears to be little in common between the Trinidad species so far examined apart from the shape of the female genitalia and the possession of two post-tibial spines, but the Lesser Antillean species fall into convenient groups, one of which, the *contaminata* group is very compact. The groups are typified as follows:

(1) Male genital styles excavated on dorsal margin before apex; anal segment with median ventral process; female genital styles small, devoid of tooth-like processes; egg approximately rectangular, pointed at one end, operculate.....*contaminata* group.

(2) Male genital styles variable; anal segment of female very long, genital styles small, devoid of tooth-like processes; egg ovoid, not operculate.....*marginata* group.

(3) Male genital styles not excavated on dorsal margin before apex, apical process spinose or peg-like; anal segment without median ventral process; female anal segment short, genital styles large and thick with tooth-like processes on apical margin; egg ovoid, not operculate.....*plumbea* group.

The distribution of these groups, as far as the writer is aware, is as follows. The *contaminata* group is represented in Montserrat, Dominica, St. Lucia, St. Vincent, Barbados, and Grenada; the *marginata* group in St. Kitts, Antigua, Montserrat, and St. Lucia, while from records it appears to extend to Puerto Rico. The *plumbea* group, into which the Trinidad species fall, has species in Dominica, St. Lucia, and Trinidad.

The separation of species on superficial characters is not easy (except, perhaps, when geographical distribution is used as additional data) and the following key, which does not necessarily indicate the natural grouping of species, and which fails to differentiate morphologically between dark females of two species, is offered for what convenience it may afford to students of the genus.

KEY TO THE SPECIES OF *Ormenis* IN THE LESSER ANTILLES AND TRINIDAD.

(1)(2) Anal segment of male with median ventral process; genital styles excavated on dorsal margin before apex. Anal segment of female not twice length of genital styles, latter devoid of tooth-like spines on apical margin.....*contaminata group* (21)

(2)(1) Male and female genitalia not as above.....(3)

(3)(4) Genital styles of male with two points on apical process. Anal segment of female nearly four times as long as genital styles, latter devoid of tooth-like spines on apical margin. Tegmina with seven dark spots.....*septempunctata*.

(4)(3) Genital styles of male with apical process simple; anal segment of female long or short.....(5)
(5)(8) Anal segment of male with a downward process half way along each lateral margin; female with anal segment three times length of genital styles, or if short, tegmen green with one dark spot.....(6)
(6)(7) Tegmen pale green, with a dark spot at apex of clavus. Female genital styles toothed.....*unimaculata.*
(7)(6) Tegmen dark, with a white submarginal line, or green bordered orange on apical margin. Female genital styles devoid of tooth-like processes.....*marginata.*
(8)(5) Anal segment of male with no processes; genital style with apical process a long spine. Female with short, bluntly rounded anal segment, and genital styles with tooth-like processes on apical margin.....(9)
(9)(12) Tegmina pale yellow, speckled black, or wholly black or smoky.....(10)
(10)(11) Tegmina pale yellow speckled with black.....*nigrospersa.*
(11)(10) Tegmina wholly black or smoky.....*fulginosa.*
(12)(9) Tegmina not as above.....(13)
(13)(16) Tegmina brown or red-brown.....(14)
(14)(15) Tegmina dull brown, two clear spots near middle.....*fortunata.*
(15)(14) Tegmina generally red-brown, species 1½ cm. long.....*rufa.*
(16)(13) Tegmina black with costal area white, or tegmina wholly pale green.....(17)
(17)(18) Tegmina black or leaden with costal area white.....*plumbea.*
(18)(17) Tegmina pale green.....(19)
(19)(20) Hind tibia with one spine before apex.....*silvestris.*
(20)(19) Hind tibia with two spines before apex.....*plumbea.*
(21)(24) Tegmina very dark, costa pale, species not from St. Lucia.....(22)
(22)(23) Tegmen 6 to 7 mm. long.....*albicostalis.*
(23)(22) Tegmen 8 to 9 mm. long.....*palicoureae.*
(24)(21) Tegmina not dark, or if so, species from St. Lucia.....(25)
(25)(28) Tegmina with a dark line overlying Sc and base of C.....(26)
(26)(27) A large black spot, bordered white, on anterodorsal margin of eye; costa dusky throughout length.....*barbadensis.*
(27)(26) No such spot; costa pale except at base.....*sanctaliciensis.*
(28)(25) Tegmina tawny, with no dark line overlying Sc.....(29)
(29)(30) Tegmina with no dark area at base.....*contaminata.*
(30)(29) Tegmina with a dark area at base.....*grenadensis.*

ORMENIS Stål.

1862. *Ormenis* Stål, Rio Janeiro Hemipt., pp. 68, 69.
Genotype, P. rufo-terminata Stål.

Ormenis marginata Brunnich (pygmaea Fabricius).

1767. Cicada marginata Brunnich in Linné Syst. Nat., i (2) p. 710.

1902. Ormenis (Petrusa) marginata Melichar, Ann. Natur. Mus. Wien, xvii, p. 96.
1914. Petrusina marginata Melichar, Gen. Ins., Fasc. 182, p. 75.
1923. Ormenis marginata Wolcott, In. Port., Jour. Dept. Agr. P. R., vii, p. 271.
1929. Ormenis marginata Osborn, Jour. Dept. Agr. P. R., xiii, p. 109.
1935. Ormenis marginata Osborn, Sci. Survey P. R. and Virg. Is., N. Y. Acad. Sci. xiv, p. 221.
1794. Cicada pygmaea Fabricius Ent. Syst., iv, p. 30.
1869. Petrusa pygmaea Stål, Hemipt. Fabriciana, ii, p. 112.
1902. Ormenis pygmaea Melichar, Ann. Nat. Mus. Wien, xvii, p. 96.
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1923. Ormenis pygmaea Wolcott, Ins. Port., Jour. Dept. Agr. P. R., xvii, p. 271.
1929. Ormenis pygmaea Osborn, Jour. Dept. Agr. P. R., xiii, p. 109.
1935. Ormenis (Petrusa) pygmaea Osborn, Sci. Survey P. R. and Virg. Is., N. Y. Acad. Sci. xiv, pt. 2, p. 220.

This somewhat confusing species is here redescribed to define the limits of its variability.

Male.—Length, 4.8 mm.; tegmen, 5.6 mm. Female. Length, 4.8 mm.; tegmen, 5.5 mm. Frons as broad as long, median carina distinct on basal two thirds, only slightly indicated on basal third, lateral carinae indicated at base, lateral margins carinate; no carinae on clypeus; vertex very short; head (with eyes) as wide as thorax; pronotum smooth, no carinae on mesonotum. Hind tibia with only one spine before apex. Costal area granulate, strongly so basally, Sc simple to apex, R, M, and Cu forking at about the same level. Base of R and M granulate. Nodal line parallel to outer margin of tegmen, marked by irregular cross-veins and a depression from the node to near apex of clavus; apical line even and distinct. Basal two thirds of clavus strongly granulate.

Dark form (*marginata* of earlier writers): pronotum fuscous, laterally orange or yellow, mesonotum fuscous near middle line, two pale areas on anterior margin, and two pale spots near posterior margin, two pale lines in position of lateral carinae, remainder fuscous, darker near tegulae; vertex very dark, frons and clypeus very pale yellow; genae pale yellow, antennae and a spot below eyes orange, eyes dark purplish red. Legs pale yellow. Abdominal tergites and genitalia fuscous, sternites and pygofer pale. Tegmina fuscous, a white band between C and Sc to apex, slightly overlapping costal area, a trace of white on veins along nodal line. Wings smoky, veins slightly darker. Insect in life powdered pale grey or leaden grey.

Pale form (*pygmaea* of earlier writers): head, thorax and legs very pale yellow, eyes red; tegmina pale greenish yellow, veins beyond nodal line and membrane pale orange, wings transparent. Insect in life powdered white, appearing whitish green.

There are many intergrades between these two types.

Anal segment of male with a process half way along each lateral margin curving ventrally and anteriorly; apical portion of segment not strongly deflexed. Genital styles with L-shaped apical process, bluntly curved anteriorly at tip.

Aedeagus with two pairs of dorsal processes at apex, the larger half the length of the aedeagus, the smaller two thirds the length of the larger; a pair of lateral processes on dorsal border behind apex, each process terminating in a cone-like point, or in two points, the posterior often more prolonged, and ventrally in a short spine directed anteriorly. Anal segment of female long (1.0 mm.), genital styles small, devoid of tooth-like apical processes. Egg ovoid, smooth.

Redescribed from 38 males and 13 females of the dark form and 33 males and 50 females of the pale form collected by the writer at Ile's Bay (Dec. 30, 1938), Woodlands Estate (Dec. 30, 1938), Foxes Bay (Dec. 31, 1938) and Plymouth (Feb. 22, 1940) Montserrat, B. W. I. on *Lantana camara* and *L. involucrata*, and from material in the writer's possession from St. Kitts (Aug. 2, 1940) and Antigua (Oct. 20, 1938). The species, as noted by Mr. Oman, is dimorphic, and intergrades, though common, are few in comparison with either of the main colour forms, which occur together in nature. The species is not closely related to any other Lesser Antillean species. Material from Montserrat has been deposited in the U. S. National Museum.

Ormenis albicostalis, n. sp.

Male.—Length, 5.7 mm.; tegmen, 6.4 mm. Female. Length, 5.9 mm.; tegmen, 7.2 mm. Frons broader than long (1.5 to 1), median carina distinct on basal half, absent from apical half, lateral carinae only indicated at base, lateral margins carinate; no carinae on clypeus; vertex very short; width of head (with eyes) equal to width of thorax; pronotum with a depression apically on each side of middle line, and a median depression basally; mesonotum without carinae, or median carina slightly indicated at apex. Hind tibia with two spines before apex. Costal area slightly granulate, Sc strong, simple to apex; R arising from M near its base and forking about one third from base of tegmen, M forking basad of R fork, Cu forking slightly basad of M fork. Base of R and M granulate. Nodal line parallel to apical margin, poorly defined by irregular crossveins and a depression from middle of tegmen to near apex of clavus; apical line fairly even and distinct; clavus granulate on basal two thirds.

Pronotum testaceous, mesonotum fuscous, with a paler line on each side of middle line, frons pale yellow, carinae fuscous; clypeus pale yellow, genae pale yellow, antennae light fuscous, eyes red or red-brown. Front and middle legs pale, hind legs light fuscous, paler towards tarsi; abdomen and genitalia fuscous. Tegmen usually very dark fuscous, costal area pale yellow, only narrowly so at base; veins near node pale yellow, a narrow transparent area in middle of tegmen along nodal line. Tegmen sometimes light fuscous, a dark area over base of C and a dark line between Sc and R. Wings smoky, veins dark.

Anal segment of male with ventral process medially, slightly recurved; deflexed part of segment about equal in length to horizontal part. Genital style with dorsal margin excavated before apex, apical process a short twisted peg. Aedeagus with two long spines at apex dorsally, directed anteriorly for

two-thirds length of aedeagus, and ventrally a pair of stouter processes, sometimes curved like a sickle, sometimes like a fish-hook.

Anal segment of female short, bluntly rounded; genital styles small. Devoid of tooth-like processes on apical margin. Egg approximately rectangular, pointed at one end, operculate.

Described from 5 males and 7 females collected by the writer near Plymouth, Montserrat, B. W. I. (Jan. 19, 1939) on *Lantana involucrata* and *Caesalpinia* sp. Type material in the U. S. National Museum, Washington.

This species is a member of the *contaminata* group.

Ormenis septempunctata, n. sp.

Male.—Length, 4.7 mm.; tegmen, 5.3 mm. Female. Length, 4.2 mm.; tegmen, 5.7 mm. Frons broader than long (1.5 to 1), median carina distinct on basal two thirds, absent from apical third, lateral carinae scarcely indicated at base, lateral margins carinate; no carinae on clypeus; vertex very short; width of head (with eyes) equal to width of thorax. Pronotum with a slight depression anteriorly on each side of middle line; no carinae on mesonotum, or median carina slightly indicated at apex, lateral carinae at base. Hind tibia with two spines before apex. Costal area slightly granulate. Sc simple to apex, R forking about one third from base of tegmen, and M forking about same level, Cu forking slightly basad of former two. Base of R and M granulate. Nodal line indicated by irregular cross-veins, well defined in middle; apical line even and distinct. Clavus heavily granulate over basal two thirds.

Pronotum and mesonotum pale testaceous; mesonotum with a long triangular outer spot and a small round inner spot on each side basally. Frons light yellowish-brown, clypeus yellow; genae and antennae yellow, eyes purple. Legs very pale yellow. Abdominal tergites fuscous, sternites pale; genitalia testaceous to deep fuscous. Tegmina stramineous to fuscous, a small dark spot at base of costal area; a small trapezoidal spot at base of radius; an elongated spot (3.5 to 1) between M and Cu basally; a larger semicircular spot distad of this; a small intense spot at apex of clavus; two irregular spots occupying two or three cells near the anterior and posterior ends of nodal line. Apical line and veins distad of it often margined with fuscous, more intense posteriorly. Wings clear or slightly fuscous, veins a little darker. Insect in life powdered a pale fawn, relieved only by the dark spots.

Anal segment of male devoid of ventral process; deflexed part of segment one third of length of horizontal part. Aedeagus with a pair of hooks at apex ventrally recurved anteriorly; arising at same level two ventral processes recurved anteriorly almost as long as aedeagus; a small projection directed outwards distad of centre of aedeagus. Genital styles with apical process broad, a larger prong basally, directed outward, a smaller prong apically directed posteriorly.

Anal segment of female very long (1.4 mm.); genital styles small, rounded, devoid of tooth-like apical processes. Egg ovoid.

Described from 19 males and 16 females collected by the

writer at Ile's Bay, Montserrat, B. W. I. (Jan. 7, 1939) on *Coccoloba uvifera*. Type material is in the U. S. National Museum, Washington.

Ormenis sanctaliciensis, n. sp.

Male.—Length, 6.3 mm.; tegmen, 6.7 mm. Female. Length 6.4 mm.; tegmen, 6.8 mm. Frons broader than long (1.3 to 1), median carina distinct on basal half, absent from apical half, lateral carinae indicated at base, lateral margins carinate; no carinae on clypeus; vertex short. Width of head (with eyes) equal to width of thorax; a slight median ridge on the pronotum anteriorly, and a small depression on each side of it; mesonotum with median carina indicated at apex, lateral carinae at base. Hind tibia with two spines before apex. Costal area slightly granulate, Sc strong, simple to apex, R arising from M near its base, forking one third from base of tegmen, M forking basad of R fork, Cu forking at same level as M. Base of R and M granulate. Nodal line parallel to outer margin of tegmen, poorly marked by irregular cross veins and an antero-posterior depression along a line from node to apex of clavus; apical line even and distinct. Basal two thirds of clavus strongly granulate.

Pronotum testaceous or fuscous, mesonotum pale or dark fuscous, frons testaceous or pale, clypeus fuscous with a pale yellow line each side of middle, curving inward basally; genae and antennae yellow, eyes red, sometimes suffused with dark brown in anterior half. Legs pale testaceous. Abdominal tergites fuscous, sternites paler; genitalia fuscous or very dark. Tegmina tawny, sometimes dark brown, a broad very dark band overlying costa at its base, and lying between Sc and R to apex; veins beyond apical line fuscous, membrane smoky; base of clavus fuscous to fuliginous. Wings pale with veins apically fuscous, or smoky with veins dark. Insect in life powdered pale fawn, pearly grey, or pale green, according to ground colour.

Anal segment of male with a short median ventral process; deflexed part of segment only slightly shorter than horizontal part; aedeagus with a pair of dorsal apical spines less than half as long as aedeagus, and ventrally a pair of curved processes, short and twisted, each ending in a small hook. Genital styles with dorsal margin excavated before apex; apical process a blunt peg directed upwards.

Anal segment of female only a little longer than the genital styles, bluntly rounded; genital styles small, rounded, and devoid of tooth-like processes on apical margin. Egg approximately rectangular, pointed at one end, operculate.

Described from 42 males and 54 females taken at Castries (Nov. 30, 1938), Choiseul (May 14, 1939), and Soufriere (Feb. 2, 1939) St. Lucia, B. W. I., on *Lantana involucrata*, mango, limes, *Coccoloba uvifera*, and many wayside bushes. This species which is endemic, as far as is known, is well separated from its counterparts of the *contaminata* group in other islands by the shape of the ventral processes of the aedeagus. Type material in U. S. N. M., Washington.

Ormenis fortunata, n. sp.

Male.—Length, 5.9 mm.; tegmen, 7.9 mm. Female. Length, 6.4 mm.; tegmen, 8.0 mm. Frons broader than long (1.3 to 1), median carina distinct on basal two thirds, absent or only indicated on apical third, lateral carinae absent, lateral margins carinate; no carinae on clypeus; vertex very short. Width of head (with eyes) equal to width of thorax. Pronotum with a depression anteriorly on each side of middle line; mesonotum with median carina present, or at least indicated, at base, and indicated at apex; lateral carinae slightly indicated at base. Hind tibia with two spines before apex. Costal area slightly granulate, Sc strong, simple to apex; R arising from M near its base, forking slightly basad of middle of tegmen, M forking at about basal third of tegmen, Cu forking at approximately same level. Base of R granulate. Nodal line parallel to outer margin of tegmen, even and distinct, produced distally before turning basad to apex of clavus; apical line fairly even and distinct; basal half of clavus strongly granulate.

Pronotum light fuscous, mesonotum dark fuscous, middle line testaceous anteriorly, frons testaceous, clypeus and genae stramineous, antennae pale with a dark spot dorsally, eyes red. Front and middle legs yellow, hind legs pale fuscous. Abdominal sclerites and anal segment dark or light fuscous, genitalia light fuscous. Tegmina evenly fuscous, veins of costal area and distad of nodal line concolorous, remainder dark fuscous. Two areas of tegmen transparent, a drop-shaped area between middle of tegmen and base of Cu, and a bluntly oval area anterior to middle of tegmen close to nodal line; a dark area in middle of clavus. Wings smoky, veins very dark. Insect in life powdered greyish-brown, a pale spot on middle of tegmen, a black spot on clavus.

Anal segment of male thin, bluntly rounded, distally only slightly deflexed, and devoid of ventral processes. Aedeagus with two sclerotized knob-like processes apically; ventrally, arising near apex, a pair of curved processes equal to half length of aedeagus, curving moderately upwards; at the origin of these processes a transparent spine one-sixth length of the process. Genital styles expanding in width apically; apical process a long spine recurved at tip.

Anal segment of female bluntly rounded, genital styles broad and thick, bordered apically with tooth-like spines. Egg sub-rectangular, tapering towards one end, beset heavily with chorionic processes on one side.

Described from 5 males and 5 females collcted at 700 ft. on Morne Fortunée, St. Lucia, B. W. I., by the writer (Feb. 2, 1940) on *Psidium guayava*. Type material in the U. S. National Museum, Washington.

The species is considered endemic, and in the characters of the male genitalia and of the egg appears to occupy an isolated position.

Ormenis plumbea, n. sp.

Male.—Length, 5.6 mm.; tegmen, 6.5 mm. Female. Length, 5.7 mm.; tegmen, 7.2 mm. Frons only a little broader than long (1.2 to 1), median carina distinct on basal three-quarters, absent from apical quarter, lateral carinae only

indicated on basal third, lateral margins carinate; no carinae on clypeus; vertex very short. Width of head (with eyes) equal to width of thorax. Pronotum with a circular depression anteriorly on each side of middle line; mesonotum without carinae, or only an indication at base of lateral carinae. Hind tibia with two spines before apex. Costal area slightly granulate, Sc strong, simple to apex, R arising from M at its base, and forking about one quarter from base of tegmen, M forking basad of R fork, Cu forking at same level as M. Base of R and M granulate. Nodal line parallel to outer margin of tegmen, marked by irregular cross-veins and a slight depression from middle of apical quarter of tegmen to near apex of clavus; apical line fairly even and distinct. Basal three-quarters of clavus strongly granulate.

Dark form: pronotum fuscous, mesonotum fuscous with pale lines below position of lateral carinae, frons testaceous, clypeus pale yellow, darker medially towards apex, genae and antennae pale yellow, eyes dark red. Legs pale yellow, tarsi testaceous. Abdominal tergites and anal segment fuscous, sternites pale yellow, testaceous, or fuscous. Tegmina black or very dark fuscous, a pale line along costal area, narrowing in basal third, veins paler in depression along nodal line; wings smoky, veins concolorous or very dark. Insect in life powdered a uniform leaden or blue-grey colour.

Pale form: head, thorax, legs, abdomen and genitalia a transparent whitish green; tegmina pale whitish green with a narrow black line along commissural margin; wings milky.

Anal segment of male devoid of median ventral process; deflexed part of segment equal to, or slightly longer than, horizontal part; aedeagus with two short straight spines projecting antero-dorsally at apex, laterally a shallowly-curved process, with the pointed tip sometimes markedly turned dorsally; genital styles expanding in width apically, apical process a long spine curving anteriorly.

Anal segment of female bluntly rounded; genital styles broad, thick, bordered on apical margin with tooth-like processes.

Described from 33 males and 42 females collected at 1,000 ft. in mountain forest near Quilesse, St. Lucia, B. W. I., by the writer (Mar. 20, 1939) on *Miconia* sp. and *Piper* sp. The species is considered endemic, and is separated from allied forms by the short spinose dorsal processes of the aedeagus. No intergrades between the dark and pale form have been found. Type material in the U. S. National Museum, Washington.

Ormenis silvestris, n. sp.

Male.—Length, 4.8 mm.; tegmen, 5.6 mm. Female. Length, 4.8 mm.; tegmen, 6.5 mm. Frons only slightly broader than long (1.1 to 1), median carina distinct on basal two thirds, absent from basal third, lateral carinae absent, lateral margins carinate; no carinae on clypeus; vertex very short. Width of head (with eyes) rather less than width of thorax. Pronotum with a slight depression each side of middle line anteriorly; mesonotum without carinae, or lateral carinae only indicated at base. Hind tibia with only one spine before

apex. Costal area slightly granulate, Sc strong, simple to apex, R arising from M at its base forking about one third from base of tegmen, M forking markedly basad of this, and Cu forking still further basad. Base of R and M granulate. Nodal line parallel to apical margin and poorly marked with irregular crossveins; apical line distinct and even. Clavus strongly granulate.

Pronotum, frons, genae and antennae pale stramineous, eyes dark red; clypeus, mesonotum, legs, and abdomen light yellow, pregenital sternite edged with black, genitalia stramineous and red-brown. Tegmina transparent, very rarely faintly smoky between C and Sc along basal third of tegmen; wings transparent. Insect in life powdered white, and appearing greenish-white.

Anal segment of male with no ventral process; deflexed apical part of segment about as long as horizontal part. Aedeagus with a pair of dorsal spines at apex directed anteriorly for slightly less than half length of aedeagus; two stout ventrolateral processes shallowly curved upwards; genital styles expanding in width apically, apical process a long spine curving anteriorly.

Anal segment of female rather short, bluntly rounded; genital styles broad and thick, bordered with tooth-like processes on apical margin. Egg ovoid, smooth.

Described from 18 males and 9 females collected at 800 ft. in mountain forest near Mahaut, Dominica, B. W. I., by the writer (June 14, 1939) on *Palicourea crocea*, *Phyllanthus* sp., and *Piper* sp. Type material in U. S. National Museum, Washington. This species is interesting in having no dark form, and not corresponding to any dark form in other islands. It is separated from the pale form of *O. plumbea*, its St. Lucian counterpart, by the single postibial spine, and by the length and shape of the dorsal processes of the aedeagus.

Ormenis palicoureae, n. sp.

Male.—Length, 7.2 mm.; tegmen, 8.1 mm. Female. Length, 6.8 mm.; tegmen, 8.9 mm. Frons broader than long (1.3 to 1), median carina distinct on basal half, absent from apical half, lateral carinae only indicated at base, lateral margins carinate; no carinae on clypeus; vertex very short. Width of head (with eyes) equal to width of thorax. Pronotum with a small depression anteriorly on each side of middle line; mesonotum with median carina only indicated at apex, lateral carinae at base. Hind tibia with two spines before apex. Costal area slightly granulate, Sc strong, simple to apex, R arising from M near its base, forking about one third from base of tegmen, M forking basad of R fork, Cu forking still further basad. Base of R and M granulate. Nodal line parallel to apical margin, indicated by a depression from node to near apex of clavus; apical line even and distinct. Clavus strongly granulate on basal two thirds.

Pronotum fuscous, mesonotum dark fuscous, frons and clypeus light fuscous, genae and antennae light fuscous, pale below eyes and antennae, eyes red; front and middle legs testaceous tinged with fuscous, hind legs light fuscous; abdominal tergites and genitalia fuscous, sternites lighter. Tegmina black or

fuliginous, a pale yellow line along costal margin, very narrow in basal third of tegmen, then covering costal area to node; veins near node pale, membrane smoky, veins concolorous, nodal line pale. Wings smoky, veins very dark. Insect in life powdered a dusky blue.

Anal segment of male with a large ventral median process, with a transparent flange projecting distally from its middle line in a broad arc; deflexed part of segment shorter than horizontal part; aedeagus with a pair of spines arising from apex and directed anteriorly for almost half the length of aedeagus; a pair of strongly recurved processes ventro-laterally; genital styles with dorsal margin deeply excavated before apex, apical process twisted, with a sinuate outline laterally.

Anal segment of female broad and bluntly rounded; genital styles small, oval, devoid of tooth-like processes on apical margin. Egg approximately rectangular, pointed at one end, operculate.

Described from 4 males and 10 females collected at 800 ft. in mountain forest near Mahaut, Dominica, B. W. I., by the writer (June 14, 1939) on *Palicourea crocea*. Type material in U. S. National Museum, Washington. This species is a forest dweller, and is endemic in Dominica, as far as is known. It is separated from other dark members of the *contaminata* group by its size and by the shape of the male genitalia. No pale form of this species has been found.

Ormenis barbadensis, n. sp.

Male.—Length, 4.8 mm.; tegmen, 5.5 mm. Female. Length 5.0 mm.; tegmen, 6.1 mm. Frons broader than long (1.4 to 1), median carina distinct on basal half, absent from apical half, lateral carinae present, but not well marked, lateral margins carinate; no carinae on clypeus; vertex very short. Width of head (with eyes) equal to width of thorax. Pronotum with a small depression on each side of middle line anteriorly; mesonotum with no carinae, or median carina only indicated apically. Hind tibia with two spines before apex. Costal area slightly granulate, Sc very strong, simple to apex, R arising from M near its base, forking about one third from base of tegmen, M forking distinctly basad of R fork, Cu forking at same level as M. Base of R and M granulate. Nodal line parallel to apical margin, feebly indicated by an elongated depression from node to near apex of clavus; apical line fairly even and distinct; clavus strongly granulate on basal two thirds.

Pronotum testaceous or fuscous, dark on posterior margin, mesonotum orange or fuscous, frons dark testaceous, clypeus testaceous, genae and antennae pale or testaceous, eyes red, a black spot on antero-dorsal margin, bounded with white; legs pale yellow; abdominal tergites, anal segment and genitalia fuscous, sternites paler. Tegmina pale tawny, costal area very pale yellow as far as node, costa usually narrowly fuscous; a black or dark fuscous line between Sc and R; tegmen shading distally from middle into fuliginous; veins of apical area concolorous, depression of nodal line transparent; base of clavus fuliginous. Wings pale or smoky, veins darker. Insect in life powdered pale fawn or grey.

Anal segment of male with a median ventral process curved anteriorly; apical part of segment strongly deflexed and almost equal in length to horizontal part; aedeagus with a pair of dorsal spines apically directed anteriorly for half length of aedeagus; ventrally a pair of thin processes more than two thirds length of aedeagus, greatly recurved and sometimes crossing apically; genital styles broad with dorsal border excavated before apex; apical process blunt, peg-like, twisted at tip.

Anal segment of female short, bluntly rounded; genital styles rounded, small, devoid of tooth-like processes on apical margin. Egg approximately rectangular, pointed at one end, operculate.

Described from 16 males and 7 females collected by the writer at St. Lawrence Gap, Barbados, B. W. I. (Mar. 30, 1941), feeding on *Coccoloba uvifera*. This member of the *contaminata* group is separated from *contaminata* and *grenadensis* by the pattern of the tegmina, and from *sanctaliciensis* by the long ventral processes of the aedeagus, and, less easily, by the narrowly fuscous costa. Type material in U. S. N. M., Washington.

Ormenis contaminata Uhler.

1895. Ormenis contaminata. Uhler Proc. Zool. Soc. London.

As Uhler at the conclusion of his description noted that he did not find any important differences to separate *O. contaminata* from a species ranging between Northern Mexico and the Southern United States, the following redescription is offered with additional characters to define the species more closely.

Male.—Length, 5.2 mm.; tegmen, 6.4 mm. Female. Length, 5.2 mm.; tegmen 6.7 mm. Frons broader than long (1.3 to 1), median carina distinct on basal half, absent from apical half, lateral carinae not even indicated, lateral margins carinate; no carinae on clypeus; vertex very short. Width of head (with eyes) equal to or slightly wider than thorax. Pronotum with a depression anteriorly on each side of middle line; mesonotum with no carinae, or lateral carinae slightly indicated at base. Hind tibia with two spines before apex. Costal area slightly granulate, Sc strong, simple to apex, R forking about one third from base of tegmen, M forking basad of R fork, Cu forking slightly distad of M fork. Base of R and M granulate. Nodal line marked anteriorly by cross-veins, posteriorly by an elongated depression along a curved line from node to apex of clavus; apical line fairly even and distinct. Clavus strongly granulate in basal two thirds.

Pronotum fuscous, paler near anterior edge; mesonotum lighter fuscous; frons, clypeus, genae and antennae pale yellow, eyes orange-red, a black spot bordered white antero-dorsally. Legs testaceous; abdominal tergites and anal segment fuscous, sometimes green, sternites paler, genitalia testaceous. Tegmina pale tawny, veins yellow, membrane beyond apical line fuliginous, veins concolorous, a dark area in posterior half of tegmen betweem middle and apical line, traversed by pale veins. This dark area may involve the distal half of the tegmen, excluding the costal area. The narrow depression marking the nodal

line transparent. Wings smoky, pale basally, veins darker, varying from pale to completely smoky. Insect in life powdered a pale fawn.

Anal segment of male with a prominent median ventral process, trilobed at apex, middle lobe longest; deflexed part of segment rather shorter than horizontal part. Aedeagus with a pair of dorsal spines apically, projecting anteriorly for two thirds length of aedeagus, ventrally a pair of thin spines, as long as aedeagus, curving downwards, then sweeping upwards and backwards; genital styles with dorsal border excavated before apex; apical process short, blunt, slightly recurved at tip.

Anal segment of female short, bluntly rounded; genital styles small, rounded, devoid of tooth-like processes. Egg approximately rectangular, pointed at one end, operculate.

Redescribed from 4 males and 3 females collected by Mr. F. A. Squire on pigeon pea and mango (May 12 and 13, 1937) and by the writer on pigeon pea (Mar 31, 1941) at Kingstown, St. Vincent, B. W. I. Topotype material in U. S. National Museum, Washington. Differs from *O. grenadensis* in having no dark basal area on tegmen, and in the length of the dorsal spines on the aedeagus.

Ormenis grenadensis, n. sp.

Male.—Length, 5.6 mm.; tegmen, 6.2 mm. Female. Length, 5.6 mm.; tegmen, 6.6 mm. Frons broader than long (1.2 to 1), median carina distinct on basal two thirds, absent from apical third, lateral carinae absent, or only indicated at base, lateral margins carinate; no carinae on clypeus; vertex very short. Width of head (with eyes) scarcely equal to width of thorax. Pronotum with a slight depression anteriorly on each side of middle line; mesonotum without carinae, or only an indication of median and lateral carinae basally. Hind tibia with two spines before apex. Costal area of tegmen slightly granulate, Sc strong, simple to apex, Sc, R and M arising from a common stem, R forking half way along tegmen, M forking markedly basad of R fork, and Cu forking slightly basad of M fork. Base of R and M granulate. Nodal line feebly marked by irregular cross-veins and a depression across tegmen from node to apex of clavus; apical line even and distinct; clavus granulate over basal two thirds.

Pronotum light fuscous, mesonotum light fuscous in middle, orange or testaceous laterad of this, dark fuscous still further laterad. Frons, clypeus, and genae very pale yellow, sometimes very slightly smoky, antennae light fuscous, eyes with a black spot, edged with white, on antero-dorsal margin. Femora pale yellow, tibiae and tarsi pale testaceous. Abdomen in life generally orange, tergites light fuscous, sternites paler, genitalia fuscous. Tegmina tawny, a dark fuscous area basally, and a smoky area distad of nodal line; veins entering dark area pale as far as nodal line, then concolorous. Wings smoky, veins dark. Insect in life powdered a pale fawn.

Anal segment of male with strong ventral median process, almost trilobed on ventral margin; apical part of segment strongly deflexed, shorter than horizontal part. Aedeagus with a pair of spinose processes dorsally, one quarter length of aedeagus, ventrally two slender processes curving anteriorly,

then sweeping posteriorly to tip of dorsal processes; genital styles with dorsal margin excavated before apex; apical process a flattened plate bluntly curved at tip.

Anal segment of female short, bluntly rounded; genital styles small, oval, devoid of tooth-like processes on apical margin. Egg approximately rectangular, pointed at one end, operculate.

Described from 6 males and 5 females collected at Grand Anse, Grenada, B. W. I., by the writer (Mar. 31, 1941) on *Coccoloba uvifera*. The pattern of the tegmen and the short dorsal spines on the aedeagus distinguish this species from others of the *contaminata* group. Type material in U. S. National Museum, Washington.

Ormenis fuliginosa, n. sp.

Male.—Length, 6.7 mm.; tegmen, 9.2 mm. Female. Length, 7.2 mm.; tegmen, 10.0 mm. Frons broader than long (1.5 to 1) evenly rounded laterally and ventrally, median carina distinct only on basal third, absent from apical two thirds, lateral carinae absent, lateral margins carinate; no carinae on clypeus; vertex very short. Width of head (with eyes) equal to width of thorax. Pronotum smooth, with a minute depression anteriorly on each side of middle line; mesonotum without carinae, or median carina slightly indicated apically. Hind tibia with two spines before apex. Costal area slightly granulate, Sc strong, simple to apex, R arising from M near its base, forking about one third from base of tegmen, M forking about level with R fork, Cu forking basad of R fork. Base of R and M slightly granulate. Nodal line distinctly marked with a regular series of cross-veins, produced distally in anterior half, parallel to apical margin in middle, and curving distally before end near apex of clavus; apical line fairly even and distinct; clavus strongly granulate.

Pronotum and mesonotum black or very dark brown, frons dark reddish-brown or fuscous, lateral margins and median carina testaceous, clypeus fuscous laterally, testaceous medially, genae and antennae fuscous or testaceous, eyes dark red; legs pale testaceous or brown; abdomen and genitalia fuscous, sometimes paler. Tegmina wholly smoky brown or black with costal area dark. Wings more or less smoky, veins darker. Insect in life powdered blue.

Anal segment of male with no median ventral process; apical part of segment only slightly deflexed; aedeagus long and only slightly curved, ventrally a pair of short spines, one sixth length of aedeagus, arising near these a pair of long, narrow spinose processes, almost as long as aedeagus; genital styles broad, expanding apically, with dorsal margin entire; apical process somewhat spatulate, twisted inwards, hairy at tip.

Anal segment of female short, bluntly rounded; genital styles broad, thick, with tooth-like processes on apical margin. Egg ovoid, smooth.

Described from 3 males and 6 females collected in Trinidad, B. W. I., as follows: 2 males and 3 females on cacao at Nonpareil Estate (H. A. Ballou, Jan. 6, 1925), 3 females from St. Augustine

(R. G. Fennah, Apr. 20, 1934) and one male reared from a nymph collected on cacao at Brasso (E. McCallan Sept. 20, 1939). This species is distinguished by the smoky costal area and the processes of the aedeagus from other dark species. Type in U. S. N. M., Washington.

Ormenis nigrospersa, n. sp.

Male.—Length, 8.0 mm.; tegmen, 10.4 mm. Female. Length, 8.1 mm.; tegmen, 11.2 mm. Frons broader than long (1.5 to 1), median carina distinct on basal half, absent from apical half, lateral carinae absent, lateral margins carinate; no carinae on clypeus; vertex very short. Width of head (with eyes) equal to width of thorax. Pronotum with a slight depression anteriorly on each side of middle line; mesonotum without carinae, or only an indication of median carina apically and of lateral carinae basally. Hind tibia with two spines before apex. Costal area broad, slightly granulate; Sc strong, simple to apex, Sc, R and M arising from a common stem, R forking just basad of middle of tegmen, M forking basad of R fork, Cu forking basad of former two. Base of R and M granulate. Nodal line well defined by cross-veins, subparallel to apical margin of tegmen, apical line irregular but well marked. Apical margin of tegmen produced into a lobe at junction with hind margin. Clavus granulate.

Pronotum yellow, dark medially, about thirteen dark spots on each side; mesonotum yellow, marbled fuscous in four broad longitudinal bands, scutellum fuscous; vertex yellow with a median fuscous spot and a pair of short dark lines, sloping outwards, near each side; frons, clypeus, and genae very pale yellow, basal joint of antennae pale yellow, a dark spot dorsally, eyes grey. Legs very pale yellow, tarsi testaceous. Abdomen and genitalia white or pale yellow. Tegmina brownish-yellow, transparent distad of nodal line; costal area with about fifteen dark spots occurring singly or in pairs; Sc with four dark spots near base; a dark spot overlying R fork, and a spot basad of it; a broad dark area, somewhat mottled, from node to middle of tegmen, basad of nodal line, then past apex of clavus to posterior apical lobe of tegmen; apical line with dark spots, junctions of veins distad of it spotted, apical margin narrowly edged with fuscous. Wings light fuscous or transparent, veins concolorous. Insect in life uniformly powdered a pale greyish brown.

Anal segment of male long, devoid of a median ventral process; apical part of segment only slightly deflexed; aedeagus tubular with a pair of bifurcate ventral processes arising near apex, and curving anteriorly; length of outer branch of each process three-quarters length of aedeagus, that of inner branch shorter; genital styles with dorsal margin straight, apical process a spine, slightly curving anteriorly.

Anal segment of female short, flattened dorso-ventrally, and bluntly rounded; genital styles broad and thick, bordered with tooth-like processes on apical margin. Egg ovoid.

Described from 5 males and 10 females collected at St. Augustine, Trinidad, B. W. I., by the writer (Apr. 4, 1941) on cacao,

Bromelia pinguin and various shrubs. Type material in the United States National Museum, Washington.

Ormenis rufa, n. sp.

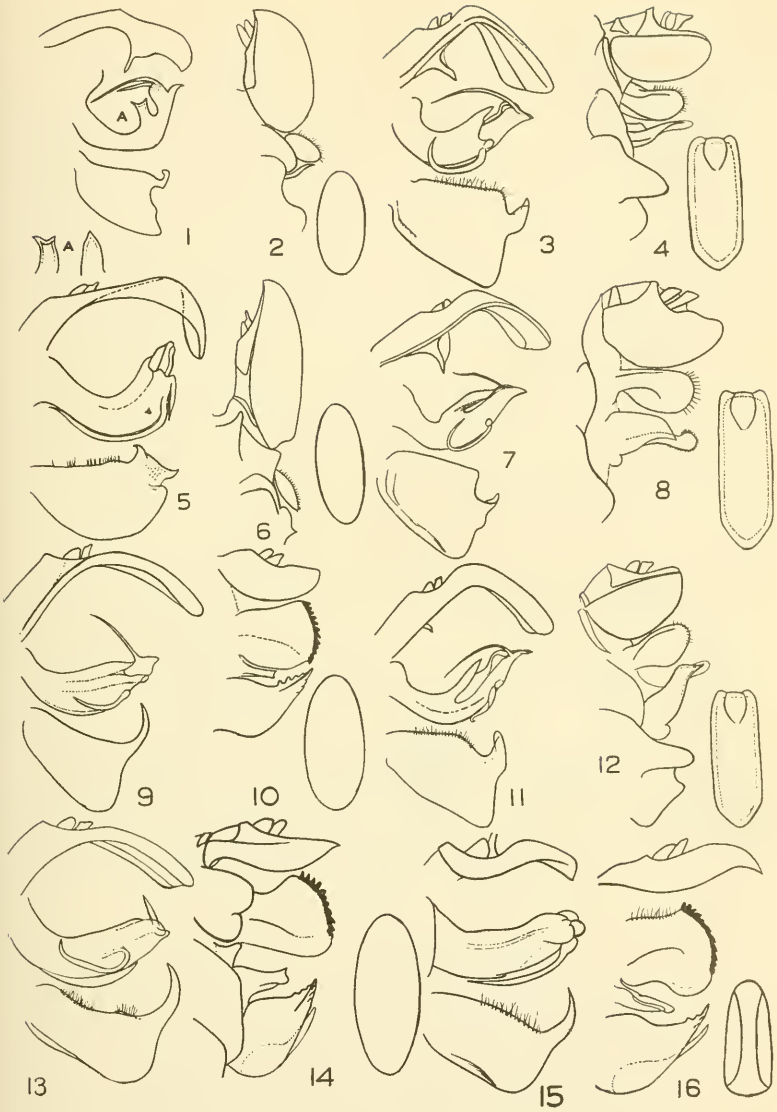
Male.—Length, 9.6 mm.; tegmen, 13.6 mm. Female. Length, 11.0 mm.; tegmen 14.0 mm. Frons broader (1.4 to 1), median carina only moderately distinct on basal half, absent from apical half, lateral carinae absent or only indicated at base, lateral margins carinate; no carinae on clypeus; vertex very short. Head (with eyes) about as wide as thorax; pronotum smooth; mesonotum without carinae, or median carina indicated in apical third, and lateral carinae basally. Hind tibia with two spines before apex; costal area broad, slightly granulate, Sc strong, simple to apex, Sc, R and M arising from common stem, R forking rather less than one third from base of tegmen, M forking slightly basad of R fork, Cu forking slightly basad of latter. Base of R and M granulate. Nodal line clearly defined by cross-veins, deeply incurved about middle towards base of tegmen; apical line even, subparallel to apical margin. Clavus strongly granulate.

Pronotum and mesonotum tawny; frons, clypeus, and genae pale yellowish brown, basal joint of antennae slightly darker, eyes dark purple; legs very pale stramineous, tarsi pale testaceous; abdomen wholly white, genitalia white edged with black. Tegmina yellowish brown, costal area orange brown, area distad of nodal line rufous, apical line pale, a rufous line passing backwards and outwards from a point almost two thirds along costa, a second rufous line from middle of basal half of tegmen to apex of clavus. Wings pale orange broadly edged with orange-red. A pale form of the insect is devoid of markings, being wholly pale stramineous. Insect in life powdered uniformly a pale orange-brown.

Anal segment of male devoid of median ventral process; deflexed apical part of segment about equal in length to basal horizontal part; aedeagus with a pair of saw-edged processes arising apically and projecting anteriorly for rather less than half the length of aedeagus, and lying on its dorsal surface; a round knob close to apex on each side ventrally; on each side two narrow strap-like processes, arising together, the longer almost as long as the aedeagus, the shorter scarcely two thirds of the former; genital styles with dorsal margin straight, apical process a vertical peg, with tip slightly curved anteriorly.

Anal segment of female long, narrow and flattened dorso-ventrally; genital styles thick, expanding apically, bordered by black tooth-like processes on apical margin. Egg drop-shaped, with a large striated flange.

Described from 2 males and 4 females collected at St. Augustine, Trinidad, B. W. I., by H. A. Ballou (Jan 5, 1927) and by the writer (Apr. 4, 1941) feeding on cacao. This species is well distinguished by its large size, the pattern of the tegmina and the male genitalia. Type material in the U. S. N. M., Washington.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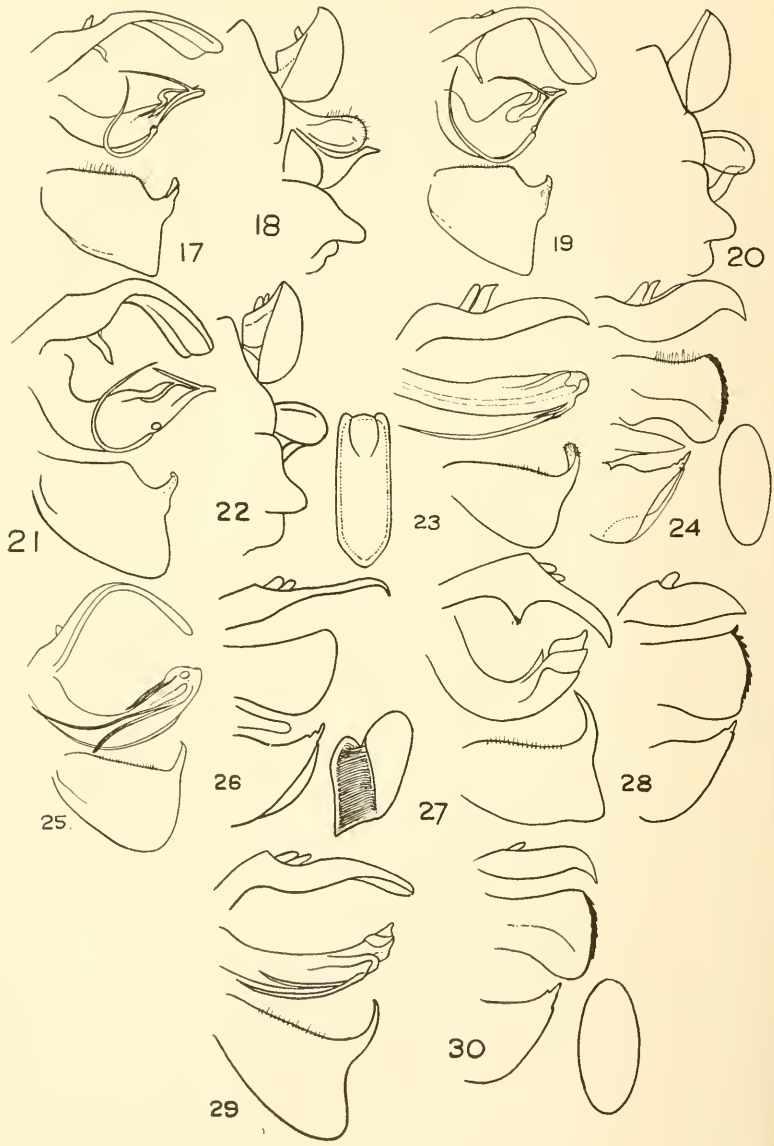
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Ormenis unimaculata, n. sp.

Male.—Length, 4.8 mm.; tegmen, 6.2 mm. Female. Length, 4.6 mm.; tegmen, 6.8 mm. Frons broader than long (1.2 to 1), median carina distinct on basal half, sometimes only indicated, absent from apical half, lateral carinae absent, lateral margins carinate; no carinae on clypeus; vertex very short. Pronotum with a minute depression anteriorly on each side of middle line. Head (with eyes) about as wide as thorax; mesonotum without carinae. Hind tibia with two spines before apex. Costal area granulate, Sc strong, simple to apex, R and M arising together, R forking about one third from base of tegmen, M forking markedly basad of R fork, Cu level with M fork or further basad. Base of R and M granulate. Nodal line arcuate, distinctly indicated by cross-veins; apical line fairly even and distinct. Clavus strongly granulate.

Pronotum and mesonotum greenish white or greenish yellow, frons pale green or yellow, shading into pale yellow or orange, clypeus pale; genae and antennae pale yellow or green, latter orange distally. Legs pale green or stramineous, tarsi testaceous. Abdomen green or pale yellow, sometimes pale orange dorsally, genitalia pale green or yellow. Tegmina green, sometimes white, narrowly margined with orange, a series of dark spots between veins on apical margin, a conspicuous dark spot at apex of clavus. Wings milky. Insect in life powdered white or greenish white.

Anal segment of male with lateral margin produced ventrally into a point basad of apex; aedeagus devoid of processes, except blunt knobs apically; genital styles with dorsal margin entire, apical process spinose, somewhat curved.

Anal segment of female short, bluntly rounded; genital styles broad and thick, bordered with tooth-like processes on apical margin.

Described from 4 males and 2 females collected by Dr. E. McCallan, of the Imperial College of Tropical Agriculture, Trinidad, at Brasso, Trinidad, B. W. I., on various dates between Oct. 5, 1939, and Oct. 25, 1940, feeding on cacao. Type material in the U. S. National Museum, Washington.

Explanation of Plates.

Plate 20.

Fig. 1, 2, *O. marginata* lateral view ♂ and ♀ genitalia, with egg.
Fig. 3, 4, *O. albicostalis* lateral view ♂ and ♀ genitalia, with egg.
Fig. 5, 6, *O. septempunctata* lateral view ♂ and ♀ genitalia, with egg.
Fig. 7, 8, *O. palicoureae* lateral view ♂ and ♀ genitalia, with egg.
Fig. 9, 10, *O. silvestris* lateral view ♂ and ♀ genitalia, with egg.
Fig. 11, 12, *O. sanctaliciensis* lateral view ♂ and ♀ genitalia, with egg.
Fig. 13, 14, *O. plumbea* lateral view ♂ and ♀ genitalia, with egg.
Fig. 15, 16. *O. fortunata* lateral view ♂ and ♀ genitalia, with egg.

Plate 21.

Fig. 17, 18, *O. barbadensis* lateral view ♂ and ♀ genitalia.
Fig. 19, 20, *O. contaminata* lateral view ♂ and ♀ genitalia.

Fig. 21, 22, *O. grenadensis* lateral view ♂ and ♀ genitalia, with egg.
Fig. 23, 24, *O. fuliginosa* lateral view ♂ and ♀ genitalia, with egg.
Fig. 25, 26, *O. rufa* lateral view ♂ and ♀ genitalia, with egg.
Fig. 27, 28, *O. unimaculata* lateral view ♂ and ♀ genitalia.
Fig. 29, 30. *O. nigrospersa* lateral view ♂ and ♀ gentalia, with egg.

FIRST-INSTAR LARVAE OF BUPRESTIS RUSTICORUM (KBY.) AND SCHIZOPUS SALLEI HORN, WITH NOTES ON THE CLASSIFICATION OF SCHIZOPUS.

By Bryant E. Rees,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

This paper has a fourfold purpose: (1) To give illustrated, full descriptions of the first-instar larvae of *Buprestis rusticorum* (Kby.), family Buprestidae, and *Schizopus sallei* Horn, placed in the Buprestidae by many authorities; (2) to call attention to the fact that the first-instar larvae of at least two species of the genus *Buprestis* (*rusticorum* and *aurulenta* L.) possess developments of the tenth abdominal segments similar to those found on the larvae of *Agrilus* and *Eupristocerus;* (3) to demonstrate that at least one species (*Schizopus sallei*) of the order Coleoptera has well developed abdominal prolegs on segments other than the tenth during the first instar; and (4) to call attention to certain characters of the first-instar larva of *Schizopus sallei* that appear to justify the recognition of the family Schizopodidae proposed by Le Conte.[1]

The descriptions and drawings of the first-instar larva of *Buprestis rusticorum* were made from five well preserved specimens received from R. L. Furniss, Division of Forest Insect Investigations, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Portland, Oreg., who also sent eight first-instar larvae of *B. aurulenta*, while those of *Schizopus sallei* were made from seven equally well preserved specimens received from Mont A. Cazier, American Museum of Natural History, New York, N. Y. Mr. Cazier reared these specimens from eggs deposited by adults collected by him in the field, identified, and placed in a rearing box, where the eggs were laid.

BUPRESTIS RUSTICORUM (KIRBY).

First-Instar Larva.

Plate 22.

(U. S. National Museum; one vial and three slides marked: "On Pseudotsuga taxifolia, Le Grande, Wash., July-Sept. 1940, R. L. Furniss, Hopk. U. S. 33–152A.")

[1] Le Conte, J. L. *In* Thomson, Arcana Naturae, p. 122, 1859.

General Aspects.

About 3 mm. in length and slightly more than 0.5 mm. in greatest width; prothorax, mesothorax, and metathorax with length ratios of approximately 2, 1, 1.5 and width ratios of about 1.33, 1.07, and 1, respectively; yellowish white, with mouthparts, head thickenings, posterior prolongations, and prothoracic markings light brown. Body club-shaped, sides converging slightly from prothorax to first abdominal segments, parallel from first to sixth abdominal segment, slightly diverging from sixth to eighth, abruptly converging from eighth to tenth segment, eighth segment about as wide as metathorax; head deeply retracted into prothorax; prothorax transverse-orbiculate, longer and broader than mesothorax or metathorax; dorsal sclerite of prothorax with inverted V-shaped thickening, ventral sclerite with inverted T-shaped thickening; mesothorax and metathorax subrectangular, with mesothorax a little over half as long as metathorax. Body segments, except tenth abdominal, laterally with numerous long, fine, capitate setae. Tenth abdominal segment terminating in a pair of light-brown, heavily sclerotized, rigid, tridentate prolongations. Spiracles lateral in mesothorax and first to eighth abdominal segments, moderate in size, cribriform; mesothoracic spiracle approximately twice as large as abdominal spiracles.

Anatomical Details.

Head (Figs. 1 and 4) somewhat less than 0.5 mm. in greatest width, cordate, generally weakly sclerotized but strengthened by endocarinae; light in color, with mouthparts and mouth frame heavily sclerotized and brownish yellow. Epicranium laterally emarginate near middle, deeply emarginate posteriorly, with epicranial halves (*EPI*) posteriorly divided longitudinally by endocarinae; a single ocellus on each side posterior to and ventrad of base of antenna. Epicranial suture short, indistinct; frontal sutures sharply defined by two straight, oblique, lateral endocarinae (Fig. 3, *LE*) extending and converging posteriorly from bases of antennae to near apex of posterior emargination. Frons (Fig. 3) triangular and bisected by a distinct, heavily sclerotized frontal endocarina (Fig. 3, *FE*) extending in midline from hind margin of epistoma to posterior angle of frons. Epistoma (Fig. 3, *EP*) heavily sclerotized, band shaped, about five times as wide as long, corners rounded, medianly divided by a longitudinal endocarina, posterior margin sharply defined. Hypostoma not a complete bridge, brownish yellow, heavily sclerotized and thickened; area behind mandibular articulation strengthened. Gula (Fig. 4, *G*) narrow, short, somewhat triangular and weak, almost membranous.

Cranial setae and sensory pores (Figs. 1 and 4) with the following arrangement: Three stubby setae immediately on each side of epistomal endocarina; one long and one short seta at anterior tip of each lateral oblique endocarina; two stubby setae posteriorly on each lateral endocarinae, one somewhat posterior to the other; a single long seta postero-laterad of each mandibular articulation; and a short seta ventrally a little over half way from ocellus to gula. A sensory pore immediately ventro-posterior to each mandibular articulation and one on hypostoma near gula.

Ocellus (Figs. 1 and 4) one on each side of head posterior to and ventrad of base of antenna, small, well developed.

Antenna (Fig. 15) in a large oval cavity immediately behind postero-lateral margin of epistoma, retractile into cavity, moderate in size, two-segmented and with large membranous base; proximal segment cylindrical, broader than long, sclerotized, brownish yellow; second segment similar to first but smaller and cup-shaped through the concavity of distal end. Concavity containing two minute papillae, a long slender seta, and a clear, sclerotized, conical sensory papilla; papilla longer than second segment and about one-third as wide.

Clypeus (Fig. 5, *CLP*) small, transverse, approximately one and one-half times as wide as long; no setae.

Labrum (Fig. 5, *LM*) transverse, slightly over twice as wide as long, nearly as long and wide as clypeus; anterior margin with broad, slightly curving median lobe, posterior margin weakly concave, corners rounded. Two long, stiff setae dorsally on each side.

Epipharynx (Fig. 6) membranous; each side with (1) a latero-anterior series of three elongate-lanceolate setae, the series extending inwardly and slightly oblique from lateral margin for about one-fourth the width of the epipharynx; (2) laterad of midline a group of numerous fine setae longitudinally traversing epipharynx for approximately two-thirds its length, and (3) a single, long almost parallel-sided, truncate seta arising immediately anterior to innermost elongate-lanceolate seta; middle of epipharynx without setae. Epipharyngeal bars long, stocking-shaped, and converging posteriorly. A free uvula-like process extending into buccal cavity from extreme posterior margin of epipharynx and terminating in clasping handlike lobes with sharp, fleshy, intertwining fingerlike processes.

Mandible (Fig. 2) yellowish brown with distal half piceous; broad, palmate, with six sharp teeth, inner surface concave; third tooth from ventral surface largest and longest, with slight rounded elevation on inner ridge; second and fourth teeth smaller, stout; dorsal margin with a single small tooth; inner area of dorsal surface sharply depressed forming an incomplete arch about mandibular fossa; condyle with depression on outer surface; molar area heavily sclerotized, not elevated. One long and one short seta on outer surface near fossa; one long seta near base between fossa and condyle.

Maxilla (Figs. 7 and 8) well developed, proximally with a large subtrapeziform membranous area. Ventral surface of maxilla with brownish-yellow sclerites; cardo a small, weak, oblong sclerite bearing two short setae and a sensory pore; stipes subrectangular, broader than long, inner surface near anterior border with a single long seta, laterally along anterior margin with three minute setae. Maxillary palpus short; first segment subrectangular and with a long antero-lateral seta; second segment conical, longer than broad, terminally with rounded membranous area bearing several small sensory papillae. Mala with sclerotized area as broad as long; terminal membranous area rounded, bearing several stout setae and a single peglike seta. Dorsal or buccal surface of maxilla (Fig. 8) membranous and with (1) six stout lanceolate setae grouped at apex of angle formed by mala and palpus, and (2) a series of eight similar setae extending posteriorly and laterally along inner margin from terminal membranous area of mala to posterior margin of stipes.

Labium (Fig. 7) membranous, no distinction between prementum, mentum, and submentum; premental area with a single long seta on each side. Labial palpi (Fig. 7, *LP*) vestigial, faintly indicated laterally near premental setae. Ligula large, conical, deeply bilobed.

Hypopharynx (Fig. 8) membranous, antero-lateral margins with minute fine setae, laterally on each side with numerous fine setae, median area without setae but with a longitudinal depression through the length of which passes a shallow cleft. Hypopharyngeal rods strongly divergent postero-laterally from postero-lateral angles of hypopharynx.

Prothorax (Figs. 9 and 12) transverse-orbiculate, depressed, distinctly longer and broader than either mesothorax or metathorax; laterally on each side with (1) a series of normal setae at antero-lateral angle, (2) a small group of long, fine, capitate setae and a single short normal seta near middle of lateral margin, and (3) a larger number of capitate setae posterior to second group. Dorsal and ventral sclerites present, broadly oval, almost circular, coriaceous, densely covered with asperities; areas outside sclerites with small conical granulae. Dorsal sclerite (Fig. 10) with smooth, light-brown, inverted V-shaped thickening the apex of which almost reaches the anterior margin of sclerite, posterior tips of V not reaching posterior margin; sclerite asperate except for small bare areas at posterior tips of V; each side of sclerite with approximately fifteen small, pale, normal setae generally distributed among the asperities. Ventral sclerite (Fig. 11) with inverted T-shaped thickening, the stem of T not reaching anterior margin of sclerite, the transverse bar lying along and forming posterior margin; sclerite densely asperate but with a small bare area at anterior tip of median stem of T and two smooth areas on each side, one large, circular, centrally located, the other transversely oblong at postero-lateral margin; each side with approximately seven normal setae, four at anterior margin of central smooth area and three lateral among asperities.

Mesothorax and metathorax (Figs. 9 and 12) subrectangular, mesothorax slightly wider than metathorax and a little more than one-half as long; both segments with dorsal and ventral asperate areas; a group of long, fine, capitate setae on each lateral margin; dorsally each segment faintly divided transversely into scuto-scutellar and postscutellar areas and bearing a pair of small normal setae on each side laterad of asperate areas; ventrally each segment similarly divided into anterior and posterior areas and bearing a pair of normal setae on each side within the asperate areas.

Abdominal segments 1 to 8 (Figs. 9 and 12) subrectangular, approximately of equal length; each segment similarly divided as mesothoracic and metathoracic segments; laterally with a group of long, fine, capitate setae, dorsally on each side with a pair of small normal setae antero-laterad of asperate area and dorsad of spiracle, ventrally a single seta on each side within ventral asperate area. Eighth segment widest of abdominal segments and nearly as wide as metathorax. Spiracles lateral near anterior margin of each segment.

Ninth abdominal segment (Figs. 9 and 12) shorter and narrower than abdominal segments 1 to 8; setal arrangement similar to that of other segments except that there are more capitate setae; dorsal surface with a single normal seta on each side.

Tenth abdominal segment (Figs. 13, 14, and 16) longer than wide; posteriorly terminating in a pair of light-brown, heavily sclerotized, rigid, tridentate prolongations; median process of prolongation longest and truncate, dorsal process short and fairly sharp, ventral process very short and blunt; segment dorsally on each side with a short normal seta near lateral margin. Anus a longitudinal slit in a spindle-shaped membranous area situated in ventral concavity between bases of prolongations; walls and floor of concavity weakly sclerotized. A single short seta posteriorly on each side of anal opening.

Spiracles (Fig. 9) moderate in size, cribriform with spindle-shaped openings in the respiratory plates. Mesothoracic spiracle kidney-shaped, large, about twice as large as the abdominal spiracles; respiratory plate elongate and arched posteriorly around bulla; bulla less than one-half as large as respiratory plate. Abdominal spiracles approximately of equal size; respiratory plates and bullae subcircular, bullae approximately one-half as large as plates.

Schizopus sallei Horn.

First-Instar Larva.

(Plate 23)

(U. S. National Museum; one vial and five slides marked: "1st. Instar larvae Mariposa, Calif., VIII–23–1940, Mont Cazier.")

General Aspects.

About 4.5 mm. in length and slightly less than 1 mm. in greatest width; prothorax, mesothorax, and metathorax with length ratios of approximately 1.33, 1, and 1 and width ratios of about 1.16, 1.12, and 1, respectively; yellowish white with ocellar areas and distal portions of mandibles dark. Body cylindrical; sides nearly parallel, converging slightly from mesothorax to eighth abdominal segment, after which angle of convergence is more acute; head deeply retracted into prothorax; integument papillose; prothorax with a large, weakly sclerotized tergite and a weaker smaller sternite; mesothorax and metathorax without sclerites. Thoracic segments legless; abdominal segments 1 to 8 each with a pair of well developed prolegs terminating in hoof-shaped structures; mesothoracic, metathoracic, and abdominal segments 1 to 7 each with a pair of ventral glands, each gland with a protracted duct. Body segments, except abdominal 9 and 10, with four folds; ninth segment with two folds, tenth entire; pleural and hypopleural lobes poorly defined, present on all segments except tenth. Number and arrangement of setae as illustrated (Figs. 8, 10, 13, and 14); setae normal on prothorax, oblanceolate on other segments except for a minute normal seta directly above each spiracle, one on each side of presternum of mesothorax ond one on each side of ventral glands of abdominal segments. Spiracles moderate and equal in size, biforous, lateral, in mesothoracic and abdominal segments 1 to 8. Anal opening a subterminal transverse slit in the tenth segment.

Anatomical Details.

Head (Figs. 1 and 4) slightly more than 0.5 mm. in greatest width, broadly ovate, generally weakly sclerotized but strengthened by endocarinae; glabrous except for a few sensory pores, light in color, darker along epistoma and antennal rings, ocellar areas dark. Epicranium posteriorly rounded and with a small elevation posteriorly on each side of the epicranial suture near occipital foramen, epicranial halves (Fig. 1, *EPI*) strengthened and incompletely divided longitudinally by weak endocarinae; three well developed unequal ocelli on each side posterior to and slightly dorsad of base of antenna. Epicranial suture well defined, extending slightly less than one-half the distance from occipital foramen to anterior margin of epistoma; frontal sutures poorly defined, gradually diverging from epicranial suture to approximately three-fourths the distance to anterior margin of epistoma, where they abruptly spread at a 180-degree angle, extend laterally, then anteriorly, ending mesad of ocellar areas. Frons T-shaped, the stem posteriorly acutely angulate, bisected by a weak frontal endocarina extending anteriorly to the inverted U-shaped superior retractile muscle attachment, the arms of which spread posteriorly and extend to frontal sutures. Epistoma between dorsal mandibular condyles heavily sclerotized, band-shaped, about eight times as wide as long, narrow at the midline, expanded laterally, posterior margin clearly marked. Hypostoma a complete bridge, heavily sclerotized and thickened, area behind mandibular articulation strengthened. Gula lacking, gular suture very faint. Occipital foramen large, one-fourth longer than wide.

Cranial setae and sensory pores (Figs. 1, 4, and 11) few in number and in the following arrangement: Two short setae and a sensory pore on each side of midline at anterior margin of epistoma, a single long seta immediately latero-dorsad of each mandibular condyle, four sensory pores dorsad of each ocellar area and within lateral arms of frons. Each epicranial half (Fig. 1, *EPI*) with ten sensory pores; two pores within dark ocellar area, one posterior to dorsal ocellus, one posterior to ventral ocellus; two pores ventrad of ocellar area; two within the meso-anterior angle formed by frontal suture; three in a longitudinal line laterad of junction of frontal and epicranial sutures; and one near the posterior margin of epicranial half.

Ocelli (Figs. 1 and 11) well developed, middle one about one-half as large as other two which are approximately equal to each other.

Antenna (Fig. 12) in a deep circular cavity ventrad of dorsal mandibular condyle and between ocelli and base of mandible, retractile into cavity; short, two-segmented, with membranous base. Similar to that of *Buprestis rusticorum*, differing only in having minute papillae of second segment slightly larger.

Clypeus (Fig. 5, *CLP*) transverse, approximately four times as wide as long; no setae.

Labrum (Fig. 5, *LM*) transverse, about three times as wide as long, medianly about as long as clypeus and approximately two-thirds as wide, anteriorly truncate, posterior margin nearly straight and clearly defined, corners rounded; two long, stiff setae dorsally on each side.

Epipharynx (Fig. 6) membranous; each side with (1) a latero-anterior series of nine strong, elongate-lanceolate setae arranged in a shallow curving arch

extending inwardly from lateral margin, (2) a more median group of many fine setae traversing epipharynx for nearly its entire length, and (3) numerous fine setae along anterior margin; middle of epipharynx without setae along anterior margin; middle of epipharynx without setae. Epipharyngeal rods approximately as long as clypeus, gradually converging posteriorly.

Mandible (Fig. 2) brownish yellow with distal half piceous; stout, broad, palmate, tridentate, inner surface concave; ventral tooth longest, sharp, with a strong, sharp ridge longitudinally traversing mandible for a little over one-half its length; median tooth small, rounded, with a longitudinal ridge traversing and almost bisecting the concavity, ridge with a rounded elevation; dorsal tooth more acute, broad, flattened, with a weak carina; small accessory tooth on dorsal margin near base of dorsal tooth; no molar. Two small setae on exterior surface near base.

Maxilla (Figs. 7 and 9) well developed and of normal size, proximally with a large, subtrapeziform, membranous area, ventral surface with two long setae, one disto-medial, one lateral, inner dorsal surface with a weak subrectangular sclerite. Cardo a weak figure-8-shaped sclerite; stipes brownish yellow, sclerotized, retractile into proximal membranous area, anterior third free, ventral surface with sensory pore near middle, dorsal surface glabrous; ventral surface of intersegmental membrane distad of stipes with a single seta and a small rectangular pore, dorsal surface with five to six equal setae. Mala brownish yellow, cylindrical, about as long as first segment of palpus and one-half as wide, well sclerotized on ventral surface, lightly sclerotized on dorsal surface; distal membranous area of mala rounded and bearing three normal setae and four peglike setae. Palpus brownish yellow, two-segmented, and about as long as stipes; first segment sclerotized, cylindrical, about twice as wide as long, small pore ventrally near distal margin; intersegmental membrane bearing a short seta laterally; second segment sclerotized, subconical, slightly longer than wide, with a light membranous terminal area bearing several sensory papillae; accessory process not free.

Labium (Figs. 7 and 9) membranous, no distinction between prementum, mentum, and submentum; submental area with two long setae near each of which are two pores, premental area with two long setae. Labial palpi (Fig. 7, *LP*) lacking unless represented by small, weak, indistinct sclerites near premental setae. Ligula large, membranous, weakly bilobed, anterior margin with numerous fine setae.

Hypopharynx (Fig. 9) membranous, lateral and anterior margins densely setiferous, medial area longitudinally depressed and without setae. Hypopharyngeal rods extending and diverging posteriorly from latero-posterior angles.

Prothorax (Figs. 8, 10, and 13) cylindrical, subrectangular, rounded anteriorly, slightly longer and broader than either the mesothorax or the metathorax; with a large, weakly sclerotized tergite and a weaker smaller sternite; laterally and ventrally with several lobes. Setae normal and arranged as illustrated. No legs or ventral glands present.

Mesothorax and metathorax (Figs. 8, 10, and 13) cylindrical, subrectangular, dorsally with four folds, equal in length, subequal in width; each segment with a pair of ventral glands (Figs. 3 and 10, *VG*), each gland with a protracted duct; legs indicated as small nonfunctional lobes, one on each side of the ventral

glands. Mesothorax with triangular membranous presternum. Laterally on each side of presternum a normal seta, the remaining segmental setae oblanceolate; setae on metathorax all oblanceolate.

Abdominal segments one to eight (Figs. 8, 10, 13, and 14) subrectangular; dorsally with four folds (Figs. 8, 13, and 14) with length ratios of about 2.5, 1, 1, and 1, ventrally each segment with a pair of well developed prolegs (Figs. 3 and 10, *PL*) and a pair of ventral glands (*VG*), basally coalesced, each gland with a protracted duct. Setae oblanceolate with exception of a minute normal seta on each side of ventral glands and one immediately above each spiracle; arrangement of oblanceolate setae as illustrated.

Ninth and tenth abdominal segments (Figs. 8, 10, and 13) shorter and narrower than those of rest of body; ninth with two dorsal folds, tenth entire. Anal opening a subterminal transverse slit in tenth segment.

Proleg (Figs. 3 and 10, *PL*) well developed, long, fleshy, terminating in a hoof-shaped structure to which internally are attached four long, slender muscles (Fig. 3) having their origins dorsally within the corresponding segment; integument papillose proximally and for greater part of length, distally with a smooth, rigid area just before hoof-shaped termination; proximal anterior surface with two oblanceolate setae.

Spiracles (Fig. 13) moderate in size, biforous, openings oval, converging and meeting anteriorly to produce a subcordate appearance, edges thickened; openings completely encircled by weak, brownish-yellow peritreme; spiracle, including peritreme, somewhat pear-shaped.

Discussions.

Tenth Abdominal Segment.

It has been stated and generally accepted that among the Buprestidae the genera *Agrilus* and *Eupristocerus* bear on the tenth abdominal segment a pair of strong, heavily sclerotized, toothed prolongations and that these are "absolutely distinct from any structure possessed by any other member of the family."[2] In view of our present knowledge of the buprestid larvae, this may be true for the later instars, but this belief breaks down upon a study of the first-instar larva of the genus *Buprestis*. In this genus, although the structure disappears in the later instars, the first-instar larvae of at least two species, *rusticorum* and *aurulenta*, possess on the tenth abdominal segments structures similar to those found in *Agrilus* and *Eupristocerus*, differing only by minor modifications. Consequently it is necessary to reject the belief that this structure is peculiar only to *Agrilus* and *Eupristocerus*, and it is to be expected that comparable structures will be found on early or first-instar larvae of other species and probably genera.

[2] Burke, H. E. "Flat-headed Borers Affecting Forest Trees in the United States." U. S. Dept. Agr. Bul. 437, January 16, 1917.

Prolegs and Ventral Glands of Schizopus sallei.

The first-instar larva of *Schizopus sallei* is unique among known coleopterous larvae by the possession of eight pairs of long, slender, well developed prolegs on abdominal segments 1 to 8 and nine pairs of ventral glands on the mesothoracic, metathoracic, and abdominal segments 1 to 7. The description of the prolegs shows that they agree with the accepted conception of prolegs as found on lepidopterous and certain sawfly larvae, but in this case they are much longer in proportion to the body. The fact that they appear on this larva is noteworthy since to date no equally well developed prolegs have been found on any other coleopterous larva. There are, however, lobelike "prolegs" found on abdominal segments 1 to 8 in certain coleopterous larvae such as in the curculionid genus *Cionus*, but these are nothing more than pedal or ambulatory lobes and not prolegs in the sense of the definition as accepted by the lepidopterists. The presence of ventral glands, although their function is unknown, is also worthy of mention since homologous glands have not been found on other coleopterous larvae. To what instar these structures persist is not known since the larvae studied did not survive the first instar. Further studies and collections are necessary to answer this question and to reveal the presence or absence of prolegs and ventral glands in other species of *Schizopus*, or in other species and genera of the tribe Schizopodini.[3]

Notes on the Systematic Position of Schizopus sallei.

At present, according to the generally accepted classification of Leng and others, *Schizopus sallei* is placed in the Buprestidae, tribe Schizopodini; however, some students of the adults of this family doubt the correctness of this classification, believing that the genera constituting the tribe Schizopodini make up a separate and distinct group not belonging with the buprestids. A study of the first-instar larva of *S. sallei* tends to uphold this contention, and if the larva of *sallei* is a typical representative of the genus, then *Schizopus* should not be assigned to the Buprestidae.

The principal distinguishing character of the buprestid larva is the occurrence of well developed dorsal and ventral ambulatory plates in combination with a distinct labrum. Other distinguishing characters are: Spiracles cribriform; head more or less deeply retracted into the prothorax; body of 13 well defined, flattened segments; antenna medium-sized and two-segmented; ocelli usually wanting; labrum rather large, arched and pro-

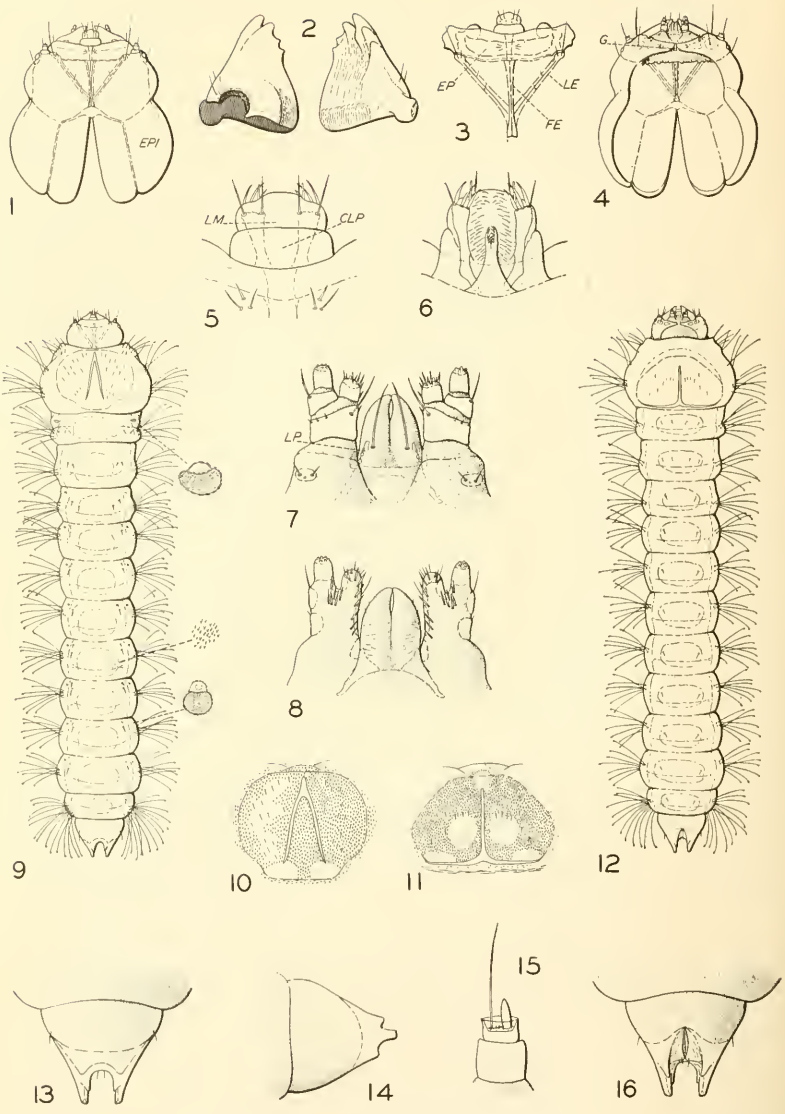
[3] This tribal name, usually spelled Schizopini, should be spelled Schizopodini since the root of *-pus* is *-pod.*

truded; mandibles short, strong, usually toothed and with an inner concavity; maxillary palpi two-segmented; labial palpi minute and unsegmented, almost obsolete; true legs wanting.

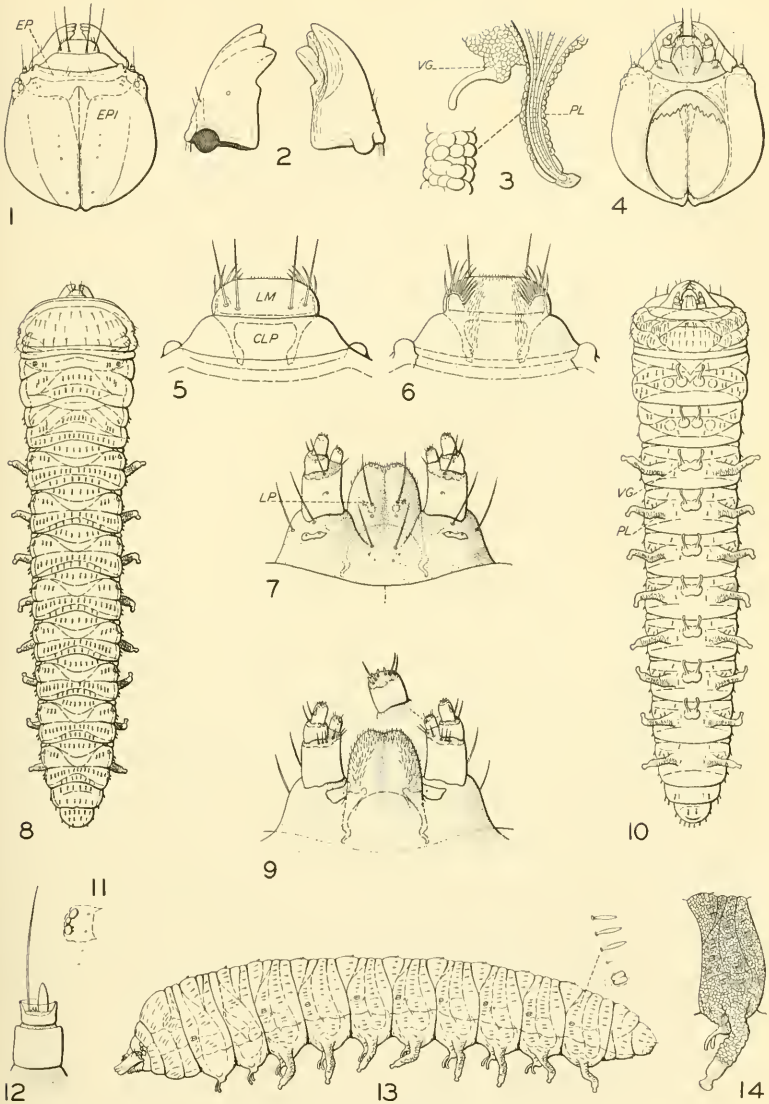
All the above-listed characters are found in the first-instar larvae of *Buprestis rusticorum*, *B. aurulenta*, and other buprestids but not in *Schizopus sallei*. The larva of this species agrees with the buprestid larvae in having the head deeply retracted into the prothorax, a 13-segmented body, a medium-sized and two-segmented antenna very similar to that found in the buprestids, strong toothed mandibles with buccal concavities, two-segmented maxillary palpi, greatly reduced, almost obsolete labial palpi, and the lack of true legs. In these larval characters a close relationship to the buprestids is apparent. It differs by not possessing well developed dorsal and ventral ambulatory sclerites and by having biforous instead of cribriform spiracles. These two characters alone exclude it from the Buprestidae. Furthermore, the shape of the head differs from that found in buprestid larvae, there are three well developed ocelli on each side of the head, and the larva has ventral glands and well developed prolegs. There are no indications of these structures on corresponding larvae of *Buprestis rusticorum* or *B. aurulenta*, nor, in agreement with the previous discussion, have these structures been found on any first-instar buprestid larva.

Whether the characters of the first-instar larva of *Schizopus sallei* change in later instars, or what characters may change, is not known, but it is improbable that the main distinguishing characters radically change since the characters of the first-instar larvae of *Buprestis rusticorum*, *B. aurulenta*, and other buprestids are not unlike those of older larvae.

As it is, the characters possessed by the first-instar larva of the species under discussion indicate that the species, and probably its genus, are improperly classified when placed in the Buprestidae; but these same characters, so unlike those found in other coleopterous families, both with respect to the characters themselves or the combinations of them, make it impossible to place the species in any generally recognized family. Therefore, although the group is closely related to the buprestids, the facts derived from this study furnish further evidence that the family Schizopodidae proposed by Le Conte is warranted. In addition, they suggest that the answers to questions concerning the systematic positions of the genera constituting the tribe Schizopodini may be found in the study of the larvae of these groups.



FIRST STAGE LARVA OF BUPRESTIS RUSTICORUM (KBY.)



FIRST STAGE LARVA OF SCHIZOPUS SALLEI HORN

Explanation of Plate 22.

Buprestis rusticorum (Kby.).

(Drawn by the author.)

Fig. 1. Head, dorsal aspect. *EPI*, epicranial half.
Fig. 2. Left mandible, dorsal and ventral aspect.
Fig. 3. Frons. *EP*, epistoma; *FE*, frontal endocarina; *LE*, lateral endocarina.
Fig. 4. Head, ventral aspect. *G*, gula.
Fig. 5. Clypeus, *CLP;* labrum, *LM*.
Fig. 6. Epipharynx.
Fig. 7. Maxillae and labium, ventral aspect. *LP*, labial palpus.
Fig. 8. Maxillae, labium and hypopharynx, dorsal aspect.
Fig. 9. First-stage larva, dorsal aspect.
Fig. 10. Dorsal ambulatory sclerite of prothorax.
Fig. 11. Ventral ambulatory sclerite of prothorax.
Fig. 12. First-stage larva, ventral aspect.
Fig. 13. Tenth abdominal segment, dorsal aspect.
Fig. 14. Tenth abdominal segment, lateral aspect.
Fig. 15. Antenna.
Fig. 16. Tenth abdominal segment, ventral aspect.

Explanation of Plate 23.

Schizopus sallei Horn.

(Drawn by the author.)

Fig. 1. Head, dorsal aspect. *EPI*, epicranial half.
Fig. 2. Left mandible, dorsal and ventral aspect.
Fig. 3. Proleg, *PL*, dissected to show muscles; ventral glands, *VG*, lateral aspect.
Fig. 4. Head, ventral aspect.
Fig. 5. Clypeus, *CLP*; labrum, *LM*.
Fig. 6. Epipharynx.
Fig. 7. Maxillae and labium, ventral aspect. *LP*, labial palpus.
Fig. 8. First-stage larva, dorsal aspect.
Fig. 9. Maxillae, labium and hypopharynx, dorsal aspect.
Fig. 10. First-stage larva, ventral aspect. *VG*, ventral glands; *PL*, prolegs.
Fig. 11. Ocelli, ocellar area and sensory pores.
Fig. 12. Antenna.
Fig. 13. First-stage larva, lateral aspect.
Fig. 14. Individual abdominal segment.

A NEW SPIDER MITE FROM VIRGINIA (ACARINA: TETRANYCHIDAE).

By E. A. McGregor,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The description of this new species of *Tetranychus* is based upon material which was collected from apple trees, but these mites also developed readily on several varieties of beans.

Tetranychus schoenei, new species.

Female.—Dorsal body setae fairly conspicuous, not arising from tubercles, 26 in number. Body rather widely oval, broadest across hind margin of cephalothorax, averaging 0.391 mm. in length and 0.235 mm. in width.[1] One perfect and one imperfect eye cornea on each side. Mandibular plate relatively broad, rounded anteriorly, at maturity. "Thumb" of palpus about four-fifths as long as its greatest thickness; bearing terminally a "finger" with subparallel sides and sharp terminal point, when viewed laterally; terminal "finger" nearly two-thirds as thick as "thumb" at tip; the dorsal sensilla slender and acute-pointed. Relative lengths of the joints of the foreleg as follows: Coxa, 19; trochanter, 9; femur, 31; patella, 14; tibia, 19; tarsus, 33. Tip of tarsus (female) bearing a claw which is bent strongly downward, and is cleft into three pairs of equal, needlelike spurs. Tarsus of leg I with two duplex setae dorsally, and with four setae proximad of these. The usual four tenent hairs arising from the onychium, a pair on each side of the claw base. The collar trachea of the conventional *Tetranychus* type, in the shape of a U with one long and one short arm.

Male.—Body smaller and narrower than in female, obpyriform; legs proportionately longer. Penis with inner lobe rodlike; basilar lobe seemingly an obtuse prominence; shaft about one-half to two-thirds again as long as its basal thickness, bent abruptly upward about 75° from axis of main shaft, expanding terminally to form the unusually prominent barb whose axial length well exceeds the length of the hook element and is fully one-half the length of the shaft proper; posterior portion of barb produced into an acuminate, ventrally-directed point, resembling the claw of a hammer; anterior portion of barb produced into a strong, rounded boss; axis of barb nearly parallel to that of shaft. Tarsal claw of foreleg with distal element relatively straight, the ventral position (analagous to the deflexed spurs in certain genera) of about equal thickness at base to that of distal spur and appearing to be 3-pointed terminally.

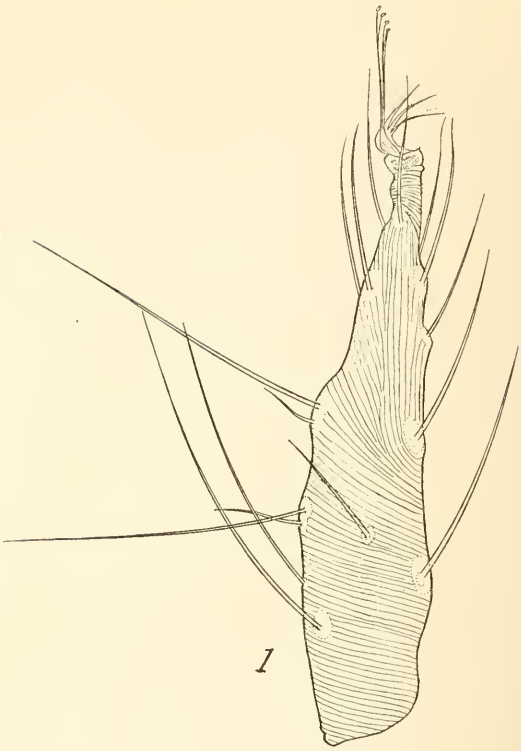
Type slide.—U. S. National Museum No. 1419.

The type material is from Winchester, Va., transferred to greenhouse at Blacksburg, Va., collected by W. J. Schoene.

The presenc species is perhaps closest to *Tetranychus atlanticus* McG. The two species may be distinguished as follows:

[1] Average measurements of a series of individuals.


2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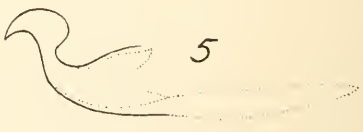
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Tetranychus atlanticus, McG.

Palpus of female with terminal sensilla rotundate terminally; dorsal sensilla unusually thick. Axial length of barb of penis about one-third that of shaft; axis of barb directed somewhat upward posteriorly. Ventral portion of tarsal claw of ♂ leg I much thicker than dorsal spur of claw.

Tetranychus schoenei, n. sp.

Palpus of female with terminal sensilla sharply angled terminally; dorsal sensilla very slender. Axial length of barb of penis fully one-half that of shaft; axis of barb about parallel to that of shaft. Ventral portion of tarsal claw of ♂ leg I about equal in thickness to that of dorsal spur of claw.

Explanation of Plate.

Tetranychus schoeni.

Fig. 1. Tarsus of right leg I of female, viewed from outside.
Fig. 2. Tip of tarsus of leg I of male, viewed laterally.
Fig. 3. Terminal portion of palpus (♀), viewed laterally.
Figs. 4 and 5. Lateral view of penis.
(Fig. 4 from material from bean; fig. 5 from material from apple.)

MINUTES OF THE 522D REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, NOVEMBER 6, 1941.

The 522d regular meeting of the Society was held at 8 P. M., Nov. 6, 1941, in Room 43 of the National Museum. Twenty visitors and 52 members attended. President Ewing called the meeting to order, and Vice-President Cory presided during the latter part of the program.

The following Nominating Committee was appointed by the President: B. A. Porter; F. C. Bishopp; J. S. Wade; S. B. Fracker, Chairman.

The regular program was as follows:

1. The winter survival of insects. Lewis P. Ditman, University of Maryland.

Dr. Ditman pointed out that insects which overwinter may do so in one of three ways, migrate, endure the cold (as the honey bee) or hibernate. The physiological condition of insects which hibernate was the main subject of discussion. Methods were discussed for determining the cold hardiness of insects and results of tests on insects in the active stage (i. e. during the summer) were compared with those on insects in a state of hibernation. It is quite apparent from the results that some insects are remarkably well adapted to withstand cold temperatures, while others succumb at warmer temperatures. (Secretary's abstract.)

2. Electron micrographs of insect cuticle and tracheae, with a discussion of the application of electron microscopy to entomology. A. Glenn Richards, Jr., University of Pennsylvania.

Most of the experimental work discussed was done on the cuticular layer of the pronotum of the cockroach. Sections as thin as one-tenth of a micron were

studied. The presence of minute, spiral pore canals in the cuticle was brought out. Although their occurrence has been known before, it now is possible actually to see them and to compute their diameters and lengths. The fact that the cuticle is in layers was emphasized, while the membranous parts seem more homogeneous. Interesting pictures of tracheae and extremely minute tracheoles of mosquito larvae were shown. Some of the difficulties in the use of the electron microscope were discussed. The material to be studied must be capable of withstanding the conditions of a vacuum and since the stream of electrons is very strong the substance under study must be capable of withstanding their effect. (Secretary's abstract.)

Adjournment at 10.20 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

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NOTES ON TABANIDAE (DIPTERA) FROM PANAMA. III. THE GENUS CHRYSOPS MEIGEN.[1]

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Genus **CHRYSOPS** Meigen.

1803, Illiger's Mag. f. Insectenk., II, p. 267. (Type, *Tabanus caecutiens* Linn.). Kröber, 1925, Konowia, IV, 3–4, pp. 210–375, Pl. 1–5. Bequaert, 1930. The African Republic of Liberia, etc., Vol. II, p. 889.

Heterochrysops Kröber, 1920, Zool. Jahrb., Abt. f. Syst., XLIII, p. 55. Bequaert, 1924, Psyche, XXXI, No. 1, p. 31. (Type *C. flavipes* Meig., 1804.)

Bequaert (l. c. 1930) has given a full generic synonymy, which there seems no necessity to repeat here.

The flies of this genus are generally small black or yellow insects with mottled wings. Spurs are present on the hind tibiae, the vertex bears three well developed ocelli, and the eyes are generally green in life, with purple spots. The antennae are very long, the first two segments together never less than two-thirds as long as the third segment, which is composed of a more or less cylindrical basal part made up of fused annuli, and a terminal flagellum of four movable annuli. The subepaulet bears no macrotrichia, and the anal cell is often open.

Five species have been recorded previously from the Republic of Panama, and three more are added in the present paper. When compared to areas of comparable size and diversity of habitat in North America, this seems a very meagre fauna, but Tropical America as a whole is very poor in species of *Chrysops*. Bequaert in a recent paper (1940) lists five species from Trinidad, three from the Republic of Honduras, and only four from the whole of the West Indies. Kröber (1925) includes but 27 species in the fauna of Brazil, with an area comparable to that of the United States.

[1] Parts I and II of this series appeared in the Revista de Entomologia, *11*, fasc. 3, Dec. 1940 and the Annals of the Entomolological Society of America, 33, No. 4, Dec. 1940.

Of the eight species here included, only one, *C. alleni*, has not been so far taken elsewhere. *C. variegata* occurs throughout the Neotropical region, *C. incisa*, *soror*, and *calogastra* were previously known from South America, while *C. melaena*, *chiriquensis* and *mexicana* have been taken in other Central American republics.

KEY TO FEMALES.

1. Discal cell hyaline, or with a prominent hyaline spot in the middle 2
   Discal cell entirely infuscated 3
2. Antennae much longer than fore femora, the third segment shorter than the first and second together. Cross-band of the wing well developed; apex infuscated. Whole insect predominantly yellowish brown ..... *variegata* de Geer.
   Antennae but little longer than fore femora, the third segment slightly longer than the first and second together. Cross-band obsolete; apex of wing with only costal infuscation. Whole insect blackish grey ..... *alleni* Fairch.
3. Fronto-clypeus with a median pollinose stripe. Apical spot drop shaped; fifth posterior cell fully infuscated ..... *chiriquensis* Fairch.
   Fronto-clypeus entirely shining. Apical spot slender, or filling most of apex of wing. Fifth posterior cell always partly hyaline 4
4. Apical spot consisting of a narrow stripe along the costa, not extending beyond apex of wing 5
   Apical spot filling most of apex of wing, at least to the second posterior cell 6
5. Sides of thorax with a prominent yellow pollinose stripe. Hyaline area in fourth and fifth posterior cells extensive, reaching nearly to the discal cell. A small hyaline spot at the base of the first submarginal cell. First and second abdominal tergites extensively yellowish on sides, no yellow mid-dorsal triangle on the second tergite ..... *incisa* Macq.
   Sides of thorax blackish. Hyaline area in fourth and fifth posterior cells barely reaching the middle of the fourth posterior cell. No hyaline spot in first submarginal cell. Yellow on sides of first two tergites less extensive, and a prominent yellow triangle present on the second tergite ..... *melaena* Hine.
6. Body altogether black, with at most faint indications of mid-dorsal abdominal triangles. Spot on fork of third vein unconnected with cross-band ..... *soror* Kröb.
   At least some yellow markings on abdomen and a spot of yellow tomentum on pleura 7
7. Abdomen with a transverse yellowish white band anteriorly on the second tergite, widening to the full width of the tergite at the sides. This tergite also bears a prominent, narrow, yellow, mid-dorsal triangle; remainder of abdomen black. Spot on fork of third vein may be either connected or unconnected with cross-band ..... *mexicana* Kröb.
   Abdomen as above, but the third to fifth tergites have yellow hind margins. Spot on fork of third vein always connected with cross-band by a narrow spur ..... *calogastra* Schin.

Chrysops melaena Hine. (Fig. 2.)

1925, Occ. Papers Mus. Zool. Univ. Michigan, No. 162, p. 147 (♀; Panama, Costa Rica, Venezuela). Kröber, 1925, Konowia IV, pp. 373–374; 1934, Rev. Ent. IV, p. 228 (=*leucospilus* Wied.). Bequaert, 1931, Journ. N. Y. Ent. Soc. XXXIX, p. 535. Dunn, 1934, Psyche, XLI, No. 3, p. 172 (Chiriqui, Panama) Curran, 1934, Fam. Gen. N. A. Diptera, Pl. 152, fig. 19 (Wing).

Chrysops incisa Kröb., (in part, nec. Macq.) 1925, Konowia, IV, pp. 215, 225, 229 and 344, Pl. 1, fig. 13, Pls. III, IV (♂, ♀).

This seems to be the most abundant species of the genus, at least on the Pacific side of Panama, where it has been taken nearly everywhere collecting has been done, though it appears not to occur above about 2,000 ft. It bites man readily, especially when abundant. Kröber's (1925) record of *leucospila* from Costa Rica probably refers to the present species.

Distribution: Costa Rica, Panama, Venezuela, Colombia (1 ♀, Jazmin, L. H. Dunn).

Panama records. Progresso, Chiriqui, R. P. IV–7 (Holotype and 2 paratypes); Tabernilla, C. Z. VI–14 (Paratype); Arraijan, R. P. I–21–30 (Dunn); Miraflores, C. Z. I–10–30 on horse (Dunn); Summit, C., XII–21–29 on horse (Dunn) Camp Pital, Chiriqui, VII–12 to 20–29, on ears of mule (Dunn); Escobal, V–4–31 (Dunn); Corozal, C. Z. I–21–29 (Curran); Barro Colorado Is., C. Z., V–22–26 (Greene), Jan. 29 (Curran); Paraiso, C. Z., I–10 to II–7–11 (Busck); Argas, R. P., IV–28–11 (Busck); Rio Trinidad, C. Z., V–2–11 (Busck); Gatun, C. Z., VIII–4–23 (Dyar); El Valle, Coclé Prov., XII–8–38, VI–18–39, VII–9–39, XII–10–39, XII–17–39 (Fairchild); Rio Las Lajas, R. P., II–5–39 (Fairchild) Ft. Clayton, C. Z., I–23–39 (Shropshire); Vacamonte Point, R. P., I–23–40 (Fairchild). Paja, R. P., V–11–41 (Fairchild).

Chrysops incisa Macquart. (Fig. 3.)

1845, Mem. Soc. Sci. Lille (1844) p. 176, Pl. IV, figs. 12, 12 a (♀; Temperate Regions of Columbia); 1844 Dipt. Exot., Suppl. I, p. 44, Pl. IV, figs. 12, 12 a. Walker, 1854, List. Dipt. Brit. Mus., V, Suppl. I, p. 285. Schiner, 1868, Reise Novara, Zool., II, Abt. 1, Vol. B, Dipt., p. 104 (♂, ♀). Hunter, 1900 Trans. Amer. Ent. Soc. XXVII, p. 135. Kertész, 1900, Cat. Tab., p. 8. Ricardo, 1901, Ann. Mag. Nat. Hist. (7), VIII, pp. 310, 312 (♂, ♀). Kertész, 1908, Cat. Dipt., III, p. 188. Surcouf, 1921, Gen. Insect., Taban., p. 152. Hine, 1925, Occ. Papers Mus. Zool. Univ. Michigan, No. 162, p. 14. Bequaert, 1932, Journ. N. Y. Ent. Soc. XXXIX (1931), p. 535. (Mexico); 1933, The Peninsula of Yucatan, Carnegie Inst. Pub. No. 431, p 560.

? *Chrysops auroguttata* Kröber, 1930, Zool. Anz., XC, 3–4, p. 71–72, figs. 6–8 (♀; Columbia; Trinidad); 1934, Rev. Ent., IV, 2, p. 225. Bequaert, 1940, Rev. Ent., XI, 1–2, p. 272 (Trinidad); 1940, Bull. Ent. Res., XXX, 4, p. 448.

? *Chrysops auroguttata* var *pallidefemorata* Kröber, 1930, Zool. Anz., XC, 3–4, p. 72, figs. 9–10 (♀; Trinidad); 1934, Rev. Ent., IV, 2, p. 225. Pechuman, 1937, Rev. Ent., VII, 2–3, p. 136 (♀; Panama).

As pointed out by Bequaert (1932), Kröber's *incisa* (1925, Konowia, IV, pp. 215, 225, 229 and 344, Pl. I, fig. B, Pl. III, figs., and Pl. IV, figs., ♂, ♀) seems not to be the species described by Macquart nor the species discussed by Hine (1925), but a mixture of *melaena* Hine and *latifasciata* Bell. Kröber later (1930) described *C. auroguttata* and a var. *pallidefemorata* which agree very closely with Hine's and Bequaert's interpretations of *incisa*, differing only in the absence of a yellow triangle upon the second abdominal tergite. Bequaert (l. c., p. 536) notes that Macquart's figure of his Columbian specimen shows a smaller hyaline area in the fourth and fifth posterior cells than do Central American specimens. It seems highly probable, therefore, that *auroguttata* Kröber is the same as *incisa* Macq., and that *pallidefemorata* Kröber, if really distinct, must be placed as a variety or race of *incisa*.

All the specimens I have seen from Panama and Central America have the hyaline area in the cross-band extensive, nearly touching the discal cell, in this agreeing with *pallidefemorata*. It is apparently not a common species here, being confined to the Atlantic side of the Isthmus.

Distribution: Colombia, ? Trinidad, Panama, Yucatan.

Panama records: Trinidad River, May, 1911, June 1912 (Busck). Mohinga Swamp, Gatun, C. Z. VIII–26–40 (Fairchild).

Chrysops variegata (de Geer). (Fig. 1.)

1776, Mem. pour Servir a l'Hist. des Ins., VI, p. 230, Pl. XXX, figs. 7, 8, (♀, Surinam) (*Tabanus*). Bequaert, 1926, Med. Rep. Hamilton Rice Exped. Amazon, p. 220; 1931, Journ. N. Y. Ent. Soc., XXXIX, pp. 533–535. Kröber, 1934, Rev. Ent. IV, 2, p. 224. (*Heterochrysops*). Bequaert, 1940, Rev. Ent., XI, 1–2, pp. 276–279.

Tabanus costatus Fab., 1794, Ent. Syst., IV, p. 373. Dunn, 1929, Am. Journ. Trop. Med., IX, 6, p. 502. (*Chrysops*) (Medellin, Colombia).

Chrysops vulneratus Rond., 1848, in Baudi and Truquii, Studi Ent., I, p. 104 (Brasil).

Chrysops molestus Guerin, 1835 (nec. Wied. 1828) Icon. Regne Animal Insectes, VII, Pl. XCVII, fig. 3.

Chrysops amazonius Rond., 1863, Arch. Zool, Modena, III, p. 81 (Porto Rico).

Chrysops lynchii Brethes, 1910, An. Mus. Buenos Aires, XIII, p. 474. Kröber 1934, Rev. Ent., IV, 2, p. 224. (*Heterochyrsops*.)

Chrysops subfascipennis Macq., 1855, Dipt. Exot., Suppl. V, p. 35 (Banks of Amazon River).

Chrysops (*Heterochrysops*) *variegata* var. *subfascipennis* Kröber, 1934, Rev. Ent., IV, 2, p. 224.

Chrysops variegata var. *lynchii* Pechuman, 1937, Rev. Ent., VII, 2–3, pp. 140–141.

The synonymy of, and references to, this common and widespread Neotropical species are very extensive. Bequaert (1926,

1931, 1940) and Kröber (1934) give full references, which I see no need to repeat here. As with many abundant and widespread forms, this species shows considerable variation in minor characters, especially in the color of the wings, and aside from those listed above, Kröber (1925, Konowia, IV, p. 235) has described a var. *peruviensis* and a var. *venezuelensis*. I am not in a position to discuss the status of these names for lack of material, but Bequaert (l. c. 1940) has cast considerable doubt on their utility.

I have not found the species to be as abundant as *melaena* in Panama, at least in areas where most of my collecting has been done.

Distribution: Southern Mexico and the West Indies to Chile and Argentina.

Panama records: Escobal, R. P. V–4–31 (Dunn); Summit, C. Z. X–24–29, XII–21–29 (Dunn); France Field, C. Z. XII–27–29 (Dunn) Ft. Clayton, C. Z. I–23–39 (Shropshire); Juan Mina Sta., C. Z. XII–5, 21–38 (Fairchild); La Venta, R. P. I–22–39 (Fairchild); Venado Beach, C. Z. VI–22–39 (Fairchild); Ft. Sherman, C. Z. VII–3–24 (Banks) also specimens in U. S. N. M. from Rio Trinidad, Barro Colorado Is., Gatun, Tabernilla, Mt. Hope, Ft. Davis in the Canal Zone, and Porto Bello, R. P. with dates from April to November.

Chrysops alleni Fairchild.

1939, Proc. Ent. Soc. Washington, XLI, No. 9, pp. 257–258, fig. 1.

This species, quite distinct from anything else in the region, has been taken so far only in brackish mangrove swamps on the Pacific side of the Isthmus. It seems to be most abundant at the end of the dry season in May, but probably flies throughout the year.

Distribution: Pacific coast of Panama.

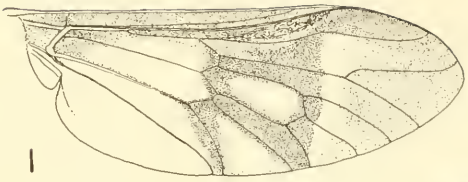
Panama records: Old Panama, R. P. V–1–39, XII–24–39, III–16–40, I–2–41; Matutela Swamp, C. Z. V–20–39; Bejuco, R. P. VI–18–39; Venado Beach, C. Z. X–16–39. Paitilla Point, R. P., VII–7–40.

Chrysops chiriquensis Fairchild.

1939, Proc. Ent. Soc. Washington, XLI, No. 9, p. 259, figs. 2, 3.

Chrysops subcaecutiens Hine, 1925 (nec. Bell., in part), Occ. Papers Mus. Zool. Univ. Michigan, No. 162, p. 20. (Boquete, Chiriqui.)

The large size and median pollinose stripe on the frontoclypeus should serve to distinguish this species from any other in the Panama fauna. Dr. C. B. Philip writes me that he has recently received specimens of this species from the State of Chiapas, Mexico. I have seen Hine's specimens.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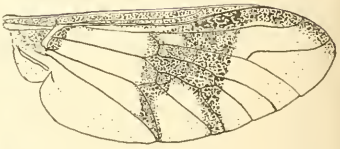
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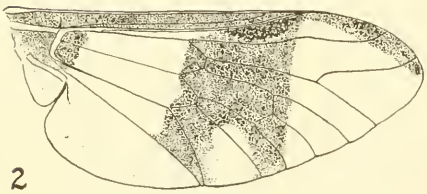
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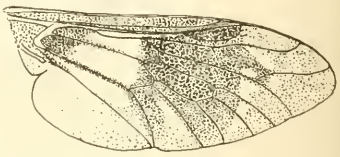
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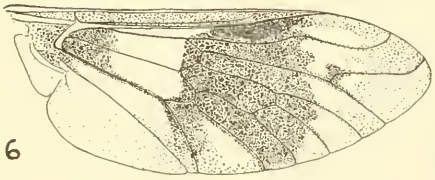
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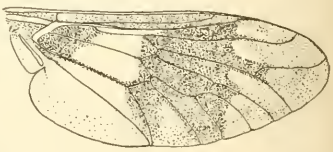
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Distribution: Western Panama to Guatemala and Southern Mexico.

Panama records: Boquete, Chiriqui Prov., R. P., 3–4000 ft. elev., V–7–39. (Fairchild); III–1, 3, 8–23 (Gaige coll., in Hine coll.).

Chrysops calogastra Schiner. (Fig. 4.)

1868, Reise Novara, Zool., II, Abt. I, Vol. B, Dipt. p. 103 (♀; South America). Hunter, 1900, Trans. Amer. Ent. Soc., XXVII, p. 135. Ricardo, 1901, Ann. Mag. Nat. Hist., (7) VIII, p. 310. Kertész, 1900, Cat. Tab., p. 6. Surcouf, 1921, Gen. Insect., Taban., p. 150. Kröber, 1925, Konowia, IV, pp. 214, 222 and 246, Pl. II, (Wing, ♀) Pl. IV (abdomen, ♀); 1934, Rev. Ent., IV, 2, p. 225. Dunn, 1934, Psyche, XLI, No. 3, p. 172.

This and the two following species form what appear to be a rather closely related group. *Calogastra* has yellow transverse bands on all the tergites, and the spot on the furcation of the third vein seems nearly always to be connected with the cross-band, *mexicana* has yellow only on the second tergite, and the spot on the furcation is sometimes connected with the cross-band, though more often not; while *soror* lacks all yellow on the abdomen and the spot on the furcation seems never to be connected with the cross-band. In addition, I have seen a specimen in Dr. Bequaert's collection from British Guiana which is like *calogastra*, except that the spot on the furcation of the third vein is unconnected with the cross-band.

Distribution: Brasil, (Kröber, the Type ?); Columbia, Restrepo, Muzo, and Villeta (in Coll. J. Bequaert); Panama, at least to the Costa Rican border.

Panama records: Camp Pital, Chiriqui, VII–11–29 (Dunn). Cerro Campana, Panama Prov., VI–11–39, VII–2–39. El Valle, Coclé Prov., VII–9–39; XII–10–39. Rio Pequeni, VIII–21–40. Barro Colorado Is., C. Z., V–10–26 (Greene, U. S. N. M.); I–30–29 (Frost, U. S. N. M.). Cano Saddle, Gatun, C. Z., V–16–23 (Shannon, U. S. N. M.).

Chrysops soror Kröber. (Fig. 5.)

1925, Konowia, IV, p. 245, Pl. II, (♀; wing), (Venezuela); 1934, Rev. Ent. IV, 2, p. 229. Lutz, 1928, Est. Zool. Parasit. Venezolanas, p. 56.

This member of the *calogastra* group is the only entirely black species in Panama. It has been taken only at elevations above 2000 ft., and is not very common. Some specimens show a faint greyish indication of mid-dorsal triangles on the second and third tergites. There is a ♀ labelled Trece Aguas, Guatemala 19–IV (Schwarz and Barber) in the Hine Collection.

Distribution: Venezuela, Panama, Guatemala.

Panama records: El Valle, Coclé Prov., XII–8–38; V–20–39; VII–9–39; VI–16–40. Cerro Campana, Panama Prov., VI–11–39. Cerro Azul, Panama Prov., V–17–41.

Chrysops mexicana Kröber. (Figs. 6 and 7.)

Chrysops calogaster var. *mexicana* Kröb., 1925, Konowia, IV, p. 248, Pls. II, IV, ♂, ♀; wing, abdomen) (Volcan Colima, Mexico); 1934, Rev. Ent., IV, 2, p. 225.

In many respects this species is intermediate between *calogastra* and *soror*, but I believe it to be distinct from both. Most of my specimens agree perfectly with Kröber's description and figures, except that the abdomens are always entirely black from the third tergite on. In two specimens, however, the tibiae are all black, the hyaline crescent is reduced to a series of short streaks, and the spot on the fork of the third vein is broadly connected with the cross-band.

Distribution: Mexico (Kröber), Panama.

Panama records: Cerro Campana, Panama Province, VI–11–39, VII–2–39, 2500–3000 ft. El Valle, Coclé Province, VII–9–39, XII–10–39, 2000–2500 ft. Rio Pequeni, VIII–21–40.

Explanation of Figures.

Fig. 1. Chrysops variegata (de Geer).
Fig. 2. C. melaena Hine.
Fig. 3. C. incisa Macq.
Fig. 4. C. calogastra Schin.
Fig. 5. C. soror Kröb.
Fig. 6. C. mexicana Kröb.
Fig. 7. C. mexicana Kröb.
All figures were drawn from female specimens and are all to the same scale.

A NEW CHALCIDOID PARASITE OF THE VETCH BRUCHID.

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A European species of the eulophid genus *Tetrastichus* was introduced into North Carolina in 1939 by the Bureau of Entomology and Plant Quarantine for control of the vetch weevil, *Bruchus brachialis* Fahraeus, and specimens of the parasite were subsequently reared by J. S. Pinckney from host material collected in the release area. The material for the original introduction was collected in the department of Var, France, by H. L. Parker.

The identity of this parasite had not been established at the time of the introduction and has remained in doubt up to the present time. Specimens, said to be part of the originally introduced material, run to *annulatus* Foerster in the key by Kurdjumov (Rev. Russe d'Entom. XIII, p. 251, 1913) to the European species of *Geniocerus* (which I consider to be a synonym of *Tetrastichus*) and seem to agree closely with the short specific description by Foerster. *Tetrastichus annulatus* was originally described from a specimen or specimens collected by Foerster in the alpine region of Switzerland, a region not very far removed, but quite different in elevation from the maritime area of Var. The species is recorded by Dieuzeide (Bul. Soc. Nat. Hist. d'Afrique du Nord, vol. 22, p. 270, 1931) from Algeria as a parasite of the itoniid *Amblardiella tamaricum* (Kieffer), the identification of the parasite having been made by Ch. Ferrière. It seems unlikely that the same species of *Tetrastichus* would be found to attack two such widely different hosts as *Amblardiella tamaricum* and *Bruchus brachialis*.

In the absence of either a detailed description of *annulatus* or authentic specimens for comparison and in view of the uncertainty injected by the different host records and the different altitudes at which the Foerster type and the bruchid parasites were collected it is deemed inadvisable to identify the latter as *Tetrastichus annulatus* despite its apparent close agreement with that species. In order to supply a name for the bruchid parasite it is herewith described as a new species.

The new species resembles *Tetrastichus rapo* (Walk.), but differs by the infuscations on the middle and hind tibiae, by the carina mesad of propodeal spiracle, and by the somewhat longer joints of the funicle.

Tetrastichus bruchivorus, new species.

Tetrastichus sp. Strong, U. S. Dept. Agr. Bur. Ent. and Pl. Quar., Rept. of Chief, p. 89, 1939.

Female.—Length 1.65 mm. Head, thorax, and abdomen metallic green with a slight bluish tinge; scape black, flagellum brownish black; all coxae and femora concolorous with the thorax, the apical one-fourth to one-sixth of femora pale yellow; anterior tibia entirely yellow; intermediate tibia yellow with a fuscous band in the middle; posterior tibia with the basal one-half to two-thirds brownish black, the apex yellow; all tarsi yellow with apical two segments fuscous; wings hyaline, venation fuscous.

Antenna moderately stout; scape subcylindrical; pedicel about one and one-half times as long as thick; single ring joint transverse; first funicular joint a little longer than pedicel and about as thick as pedicel; second funicular joint a little shorter than first; third joint of funicle slightly longer than broad; club distinctly three jointed, subovate, about equal in length to the last two funicu-

lar joints, the apical joint terminating in a short spine. Head transverse, finely lineolate-reticulate; cheek more than half as long as height of eye; ocellocular line equal to about twice long diameter of an ocellus, distinctly shorter than distance between posterior ocelli; eyes bare; mandibles broad, each with three short, blunt teeth, the outer one the most distinct. Thorax ovoid, about two-thirds as long as broad; prothorax short, transverse, rounded in front, finely sculptured; mesoscutum finely lineolate; parapsidal grooves deeply impressed; median longitudinal groove very fine but distinct and complete; prescutum longer than broad, with a single row of hairs along each parapsidal groove; axillae and scutellum sculptured like mesoscutum; scutellum convex, with two pairs of black setae and with the two longitudinal grooves distinct; postscutellum weakly reticulated; propodeum medially about one-third as long as scutellum, weakly reticulately sculptured, with a median longitudinal carina and another very weak carina curving outwardly just mesad of the spiracle, the lateral folds and spiracular sulci absent. Wings extending beyond apex of abdomen; submarginal vein with three to five bristles dorsally; marginal vein about equal to submarginal and slightly more than twice as long as stigmal; marginal cilia short. Abdomen ovate, as long and about as broad as thorax, distinctly reticulately sculptured; ovipositor just reaching apex of abdomen.

Male.—Length 1.5 mm. Like the female in all respects except in the antennae and abdomen. Antenna long and rather stout; scape a little broader than in female, about four times as long as broad; pedicel about one and one-half times as long as broad; one very short ring joint; funicle four jointed, distinctly broader than pedicel; first funicular joint a little longer than pedicel, with a whorl of hairs basally which are about twice the length of the segment; second, third, and fourth joints subequal in length and breadth, each a little longer than first and each with a basal whorl of hairs similar to those on first segment; club distinctly three jointed, a little longer than last two funicular joints, no thicker than funicle; first joint of club with a basal whorl of hairs which are not so long as those on funicular joints; second and third joints with numerous hairs but they do not appear to be arranged in whorls; apical joint terminating in a short spine. Abdomen elliptical, a little shorter than the thorax and distinctly narrower.

Type locality.—Department of Var, France.

Type.—U. S. National Museum No. 55900.

Described from 52 female specimens (1 holotype) reared from *Bruchus brachialis* Fahraeus infesting vetch, collected in the Department of Var, France, by H. L. Parker; 9 females and 1 male (the allotype) reared from *Bruchus ulicis* Mulsant and Rey collected by Parker in the same French department; 14 females taken at quarantine in Philadelphia, Pa., in seeds of vetch originating in Italy and which were infested with *B. ulicis;* and two females reared from *B. brachialis* collected at Statesville, N. C., by J. S. Pinckney.

REPORT OF THE TREASURER FOR THE YEAR 1941.

Receipts.

Cash on hand (Jan. 1, 1941)	$237.81
From members, dues for 1941	497.83
dues in advance	34.39
back dues	105.00
initiation fees	22.00
From subscribers, for subscription to Proceedings	599.75
From authors, for separates and authors' copies	78.75
for illustrations	3.23
From institutions, for authors' separates	99.25
for illustrations	24.41
for entire cost of articles	103.74
From sales of back numbers of Proceedings	101.04
Total receipts	$1,907.20

Expenditures.

To H. L. & J. B. McQueen, Inc., for printing Proceedings (Vol.42, No. 9 and Vol. 43, Nos. 1 to 8) and separates	$1,164.56
To H. L. & J. B. Mcqueen, Inc., for printing programs of meetings 515 to 523, inclusive	24.75
To Southern Engraving Company for engravings	140.17
For stationery	34.10
For stamps	36.06
For shipping charges, including second-class postage and insurance	8.54
For clerical help, Office Corresponding Secretary	40.00
For clerical help, Office of Treasurer	16.00
For rental of safe deposit box at City Bank	3.89
For advertising in Journal of Economic Entomology	2.00
For service charge at Hamilton National Bank	.25
Total expenditures	$1,470.32
Stamps on hand received in lieu of cash	3.80
Cash on hand, Hamilton National Bank	427.08
Cash on hand, undeposited	6.00
	$1,907.20

Publication Fund.

Schwarz donation (principal $1,000.00) invested with the American Building Association—reported 1940	$1,477.52
Dividend for 1940, credited 1941	59.08
Total in Schwarz donation fund	$1,536.60

Knab bequest, invested with Columbia Federal Savings and Loan Association reported 1940	$618.24
Additional interest not recorded in 1940	8.19
Interest 1941	10.96
Deposited 1941	150.00
Covered by personal non-interest bearing note	650.00
Total in Knab bequest fund	$1,437.39
General publication fund in savings account at the Hamilton National Bank, January 1, 1941	641.02
from sale of complete sets	93.60
from sale of No. 1 of Memoirs	34.20
interest from savings account	13.68
Total in general publication fund	$782.50
Total amount of publication fund	$3,756.49

Respectfully submitted,

W. B. Wood,
Treasurer

The Committee on Audit has examined the financial accounts kept by the Treasurer of the Society and found them to be correct for the year 1941, and we, the undersigned members of the Committee, do so certify:

Respectfully submitted, January 8, 1942.

D. J. Caffrey,
L. G. Baumhofer,
Auditing Committee.

REPORT OF THE CORRESPONDING SECRETARY OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON FOR THE YEAR ENDING NOVEMBER 30, 1941.

Correspondence:

Approxiamtely 375 letters were written, of which about 100 went to prospective members or to purchasers of the Society's publications. This type of soliciting appeared to be more effective than other advertising by the Society during 1941.

Reserve Publications:

Statement of the inventory and sales of Proceedings and Reprints:

Proceedings.

1. Copies of Proceedings on hand December, 1940	30,038
2. Copies of Proceedings acquired Dec. 1940—Nov. 1941	489

3. Copies of Proceedings available (total 1 and 2)	30,527
4. Copies of Proceedings sold during the year	226
5. Copies of Proceedings on hand	30,301

Reprints.

1. Reprinted articles on hand December, 1941	477
2. Total copies reprints reported on hand December, 1940	13,790
3. Copies of reprints sold during the year	57
4. Copies of reprints on hand	13,733

Sales of Proceedings and Reserve Reprints.

1. Total number of sales	36
2. Number of complete sets sold	0
3. Orders exceeding $20.00 net value	0
4. Total net value of sales	$105.80

Report on Memoir No. 1:

1. Total copies of Memoir No. 1 printed	300
2. Total copies of Memoir No. 1 disposed of in 1939	66
3. Total copies of Memoir No. 1 sold in 1940	20
4. Total copies of Memoir No. 1 disposed of in 1941	13
5. Total copies of Memoir No. 1 on hand	201

Members and Subscribers:

	1938	*1939*	*1940*	*1941*	*Compared to preceding year*		
					Loss	*Gain*	*Net loss or gain*
Members	240	242	247	254[1]	10[2]	17	plus 7
Subscribers	124	128	134	144[3]	1	11	plus 10

Respectfully submitted,

F. W. Poos,
Corresponding Secretary.

[1] Includes 18 members, in arrears for dues, to whom the Proceedings is not being sent in accordance with Article VI of the By-Laws; also two members do not receive the Proceedings in accordance with the new Article VII of the By-Laws.

[2] Four deaths; 6 resignations.

[3] Includes several subscribers in foreign countries whose status is uncertain on account of war conditions.

MINUTES OF THE 523D REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, DECEMBER 4, 1941.

The 523d regular meeting of the Society was held at 8 P. M., Dec. 4, 1941, in Room 43 of the National Museum. The meeting was called to order by President Ewing, and 37 members and 10 visitors were present. The report of the October meeting was approved as read.

The following were elected to membership in the Society: Charles W. Collins, Bureau of Entomology and Plant Quarantine, Morristown, N. J.

F. H. Lathrop, Maine Agricultural Experiment Station, Orono, Me.

Henry K. Townes, Bureau of Entomology and Plant Quarantine, Washington, D. C.

Reports were given by the following members of the Executive Committee: Corresponding Secretary, F. W. Poos; Treasurer, W. B. Wood; President, H. E. Ewing. The latter called attention to the favorable trend of the Society as indicated by statistics compiled over a five-year period beginning in 1937, showing the number of members, average attendance at meetings, receipts of treasurer and the number of pages published annually in the Proceedings. Siegler inquired about members who are not receiving the Proceedings at present because of failure to pay dues. Poos noted that the Executive Committee had recently voted to set aside 18 copies of each back issue for the sole purpose of filling orders for complete sets of the Proceedings.

The Nominating Committee, through its chairman, S. B. Fracker, presented its recommendations for 1942 officers. Other members of the committee were F. C. Bishopp, B. A. Porter and Joseph S. Wade. The nominees were unanimously elected, as follows:

President	E. N. Cory
First Vice-President	R. W. Harned
Second Vice-President	P. N. Annand
Recording Secretary	A. B. Gurney
Corresponding Secretary	F. M. Wadley
Treasurer	L. G. Baumhofer
Editor	W. R. Walton
Executive Committee	H. E. Ewing
To represent the Society as Vice-President of the Washington Academy of Sciences	Austin H. Clark

Under Notes and Exhibitions of Specimens, F. C. Bishopp reported that Herald R. Cox, of the Rocky Mountain Laboratory, National Institute of Health, Hamilton, Montana, was the recipient of the Theobold Smith Award of the American Association for the Advancement of Science, for his outstanding work on the cultivation of Rickettsiae—the causative organisms of Rocky Mountain spotted fever, Australian and American "Q" fevers, and other diseases. Dr. Cox has shown that these disease organisms can be cultivated readily in chick embryos. The development of this technique not only makes it possible to prepare economical vaccines for these maladies but also provides a useful tool for the study of them. (Author's abstract.)

Dr. Bishopp also spoke as follows regarding a recent tribute to a member of the Society, Lloyd E. Rozeboom:

"Attention is drawn to the signal honor conferred upon one of our members at the November meeting of the American Society of Tropical Medicine, held conjointly with the Southern Medical Association in St. Louis, Mo. This was the Bailey K. Ashford Award in Tropical Medicine of $1,000 and a bronze medal. The presentation was made by Col. J. S. Simmons, M. C., U. S. A., in recognition of Dr. Rozeboom's work on the transmission of malaria by *Anopheles bellator* R. & K. in Trinidad. This abundant species has been suspected of acting as a vector of malaria but its peculiar feeding and biting habits have made actual determination of this most difficult. The mosquito breeds in epiphytic bromeliads which grow high in the Immortelle trees that shade the cocoa trees. It seeks blood at twilight and, contrary to the usual habits of most anophelines, does not remain in houses but returns at once to its sylvan habitat. By collecting specimens on men used as bait, an opportunity was given to examine considerable numbers of them for malaria infection. The 398th specimen examined by Dr. Rozeboom and his associates was found to be infected with a single live oocyst. This when crushed liberated a large number of motile sporozoites.

"This discovery is of much significance at this time because of the abundance of this native mosquito in the tropics which are now being occupied in connection with defense activities. The recognition of the outstanding work of this young medical entomologist is well deserved and I am sure the entire membership of this society joins me in rejoicing in it and extending congratulations."

At the suggestion of S. B. Fracker, a vote of thanks was given to the retiring Treasurer and Corresponding Secretary, W. B. Wood and F. W. Poos. President-Elect Cory presided during the remainder of the meeting.

E. A. Back called attention to the vast number of certain insects which may infest cereal packages, and he exhibited oatmeal containers that had been entered by the confused flour beetle, *Tribolium confusum* Duv., and the lesser grain borer, *Rhizopertha dominica* (F.).

C. T. Greene reported an exhibited larvae of the botfly genus *Gasterophilus* (probably *nasalis* (L.) or a species very closely related). These specimens were sent in by Carlton M. Herman of Los Angeles, Calif., Nov. 19, 1941, with the statement that they were taken from a lion on Oct. 17, 1941, at Gay's Lion Farm, just outside of Los Angeles. This is the first known record of any dipterous larvae being taken from the lion. (Author's abstract.)

F. C. Bishopp reported an interesting case of nasal myiasis which was brought to his attention last July by R. G. Beachley, Health Officer in Arlington County, Va. A woman, while working in her yard, felt a sharp sting—as though by an insect—in her right nostril. This resulted in a profuse watery secretion and some coughing, followed by paroxysms of sneezing and pain which steadily became more violent during the week following the attack. Examination by a nose and throat specialist and by X-ray failed to reveal any foreign object, but, eleven days after the attack, a spiny larva about 6.5 mm. in length was dislodged by sneezing. This was identified by E. F. Knipling as a nearly grown, first-instar larva of the genus Cuterebra (Bishopp No. 30722). During the three days following the expulsion of the larva, a number of hemorrhages—some of which were profuse—occurred. These attacks were followed by complete recovery. Rabbits, chipmunks, squirrels, and field mice were present in the vicinity of the woman's residence. (Author's abstract.)

Gurney noted the presence in the Washington area of a second introduced species of Asiatic mantid, *Tenodera angustipennis* Sauss. For nearly a decade at least, *angustipennis* has occurred here, and now it is submitted for identification by local residents about as often as the better known and closely related *T. sinensis* Sauss., which has been in this country at least 45 years. The two species are distinguished by differences of size, proportion, color of the hind wing and by important distinctions in the egg mass and male terminalia. Notes on *angustipennis* in the United States were first published by F. M. Jones and J. A. G. Rehn in 1933, in separate articles appearing in Entomological News. A native species, *Stagmomantis carolina* (Joh.), also occurs in the vicinity of Washington; the only other mantid occurring so far north in the Eastern States is the introduced *Mantis religiosa* L., of the Palearctic Region, which is established in Western New York, particularly about Rochester.

The regular program was as follows:

1. Insect problems of the Aroostook potato area.

Geddes W. Simpson, Maine Agricultural Experiment Station, Orono, Me.

Dr. Simpson emphasized the importance of the potato crop raised in Aroostook Co., Me., particularly since about one-half of all certified seed potatoes grown in this country are produced there. The various types of insect injury interfering with potato yield and the development of tubers meeting the requirements of certified seed were noted. Viruses constitute the most serious troubles, and the main insect vectors involved are aphids. The peach, buckthorn, potato and foxglove aphids are the four chief species, and their life histories were discussed. The Colorado potato beetle, potato flea beetle, leafhoppers, *Lygus* bugs, white grubs and wireworms were also mentioned. (Secretary's abstract.)

2. The search for new insecticides.

Herbert L. Haller, Bureau of Entomology and Plant Quarantine.

The principal groups of compounds which comprise insecticides are organic and inorganic natural substances, and those prepared synthetically in the laboratory. The organic materials may be of animal origin, such as fish oils and gelatin, or derived from plants, as is true of nicotine, pyrethrum and rotenone. Dr. Haller devoted special attention to this latter group of compounds and explained how the organic chemist cooperates with plant breeders and manufacturers in developing insecticides. He discussed tobacco and the search for a non-water-soluble type of nicotine. Pyrethrum, derris, cube and tephrosia plants were illustrated, and their present importance and principal areas of cultivation described. (Secretary's abstract.)

A non-resident member, W. H. W. Komp of Panama, greeted the Society. Herbert H. J. Nesbitt, of Ottawa, Canada; F. J. Bartlett, of Gulfport, Miss. and Charles F. Doucette, of Sumner, Wash., were introduced and spoke briefly.

Adjournment at 9.50 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

Actual date of publication, January 29, 1942.

ANNOUNCEMENT

Prices for back volumes and single numbers of the Proceedings of the Entomological Society of Washington are as follows until further notice:

Vols. 1–19,	per volume	$2.00
	per number	.50
Vols. 20–41	per volume	4.00
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F. M. WADLEY,
Corresponding Secretary,
Address: Bureau of Entomology and Plant Quarantine,
Washington, D. C.

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THE ENTOMOLOGICAL SOCIETY OF WASHINGTON

ORGANIZED MARCH 12, 1884.

The regular meetings of the Society are held in the National Museum on the first Thursday of each month, from October to June, inclusive, at 8 P. M.

Annual dues for members are $3.00; initiation fee $1.00. Members are entitled to the Proceedings and any manuscript submitted by them is given precedence over any submitted by non-members.

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Editor . . . . . W. R. WALTON
Executive Committee . H. E. EWING, C. F. W. MUESEBECK, R. E. SNODGRASS
Nominated to represent the Society as Vice-President of the Washington Academy of Sciences . . . . . AUSTIN H. CLARK

PROCEEDINGS ENTOMOLOGICAL SOCIETY OF WASHINGTON.

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The Corresponding Secretary and Treasurer should be addressed similarly.

PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 44 FEBRUARY, 1942 No. 2

A NEW PARASITIC MUSCOID FLY FROM TEXAS.[1]

By H. J. REINHARD,
College Station, Texas.

The new species of *Sarcophaga* described below was reared from adult Mantids by Dr. O. P. Breland, who in the following paper presents some biological observations on the same.

Sarcophaga austinana, n. sp.

Similar to *Sarcophaga* (*Mantidophaga*) *stagmomantidis* Towns., but differs in having the cheek grooves and frontal stripe wholly black and the female lacks apical scutellar bristles. The species has the essential characters of Aldrich's Group D (Sarcophaga and Allies, p. 113) and is apparently the first southwestern form to be recorded from a Mantid host.

Male.—Front narrowed before ocellar triangle, 0.157 of head width (average of three: 0.163; 0.161; 0.147); parafrontals cinereous pollinose on black ground color; frontal vitta velvety black, slightly narrowed behind but wider than parafrontal on entire length; inner verticals well developed, outer ones vestigial; ocellars not very strong, proclinate; frontals in a single row, moderately divergent beneath antennal base and descending nearly to level with apex of second segment; face blackish gray pollinose, not deeply impressed, its lateral ridges finely haired on lower two-fifths; vibrissae strong, decussate, near oral margin; antennae black, third segment hardly twice length of second, reaching to lower fourth of face; arista blackish, long plumose to middle and thickened on proximal fourth; parafacial black, gray pollinose, with a double row of hairs along outer margin, inner row larger, almost bristly; cheek cinereous pollinose on black ground color, nearly one-third eye height; proboscis short, stout; palpi black, upturned and slightly thickened beyond middle; eyes bare, descending about to vibrissal level; back of head gray pollinose, clothed with black hairs intermixed with pale pile below middle.

Thorax black, gray pollinose, with the usual three to five black vittae on notum. Chaetotaxy: acrostichal 2, 3; dorsocentral 3, 3; intraalar 2 (none near

[1] Contribution No. 706, Division of Entomology, Texas Agricultural Experiment Station.

suture); supraalar 3; postalar 2; notopleural 4; presutural 2; posthumeral 2; humeral 3; sternopleural 3 (in a row); scutellum with 2 lateral, 1 smaller decussate apical and 1 discal pair well behind middle; infrascutellum recessive; propleura and prosternum bare; calypters subopaque, with a rather uniform blackish tinge.

Abdomen wholly black, gray pollinose, tessellated with a distinct median black vitta; first segment without, second with a pair of median marginals; third with a median marginal pair and 4 or 5 laterals; anal segment with a complete marginal row; hypopygium reddish yellow; first segment small, with a row of 6 to 8 slender bristles on hind margin above; second segment globose but not very large, with numerous erect smallish hairs and two stronger bristles near middle behind; forceps yellow, rather short and uniformly curved forward, terminating in a sharp point, hind side with a small but distinct barblike projection slightly beyond the inward basal curvature; viewed from behind the forceps are thin, divided but hardly at all divergent apically, the inner margin of each forcep is slightly raised to form a sharp median keel; accessory plate yellow, slender and curved backward against forceps; both claspers well developed, hind pair strongly hooked at tip, the anterior somewhat shorter and thicker with an obliquely rounded tip; penis wholly shining black, jointed near middle, distal segment slightly enlarged bearing a blackish pale-margined earlike lobe on each side at apex; fifth sternite black, with a broad V-shaped apical incision, lobes clothed with fine hairs and pale pubescence along inner margin.

Legs black; middle femur with short comb; middle tibia with two anterodorsal bristles; hind tibia not villous; claws and pulvilli elongated, latter considerably infuscated.

Wings hyaline but with an apparent blackish tinge basad of small cross vein; first vein with longish coarse hairs on middle part, third setulose almost to small cross vein; apical cell open far before wing tip; costal spine strong; epaulets black.

Female.—Front at vertex 0.292 of head width (average of three: 0.278; 0.301; 0.297), widening gradually downward to antennal base; two pairs of proclinate orbitals and outer verticals developed; apical scutellars absent; abdomen truncate at apex as viewed from above; median marginals on second segment weak and usually depressed; genital segment black, the apical margin beset with a row of slender black hairs; fifth sternite black, dusted with gray pollen, the sixth terminating in a reddish yellow chitinized larvipositor, which is bowed forward, grooved behind and tapers to a blunt tip; claws and pulvilli short.

Length: Male, 8–9 mm.; female, 6.5–7 mm.

Holotype: Male, Austin, Texas, October 13, 1941 (O. P. Breland). Allotype: Female same data as type. Paratypes: two males and six females same data as type, one male and four females, San Marcos, Texas, October 11, 1941 (O. P. Breland). Holotype and Allotype in U. S. National Museum; six paratypes in my collection, the remainder returned to Dr. O. P. Breland.

DIPTEROUS PARASITES OF ADULT MANTIDS (MANTIDAE; SARCOPHAGIDAE).

By Osmond P. Breland,
The University of Texas.

Adult mantids appear to be singularly free of parasites, although several species of insects attack their egg cases (Breland 1941a). During the past several years, the writer has kept dozens of mantids in the laboratory, and, with two exceptions, has not found any parasites that attack them. The mantids that were exceptions were both grey females of *Stagmomantis carolina* (Joh.), which had been collected by students and brought into the laboratory. One specimen was collected by Alvin Flury 2 miles north of San Marcos, Texas, September 27, 1941. The other insect was collected by Jack Dobson, a graduate student, at Austin, Texas, October 3, 1941. From each of these mantids, parasites were bred that are described as a new species (*Sarcophaga austinana*) by Dr. H. J. Reinhard in the article preceding this paper.

Before discussing the biology of this parasite, it might be well to point out briefly a few previous reports of dipterous parasites having been bred from mantids. So far as the writer could determine, there have been made only a very few of such reports.

The first publication of such rearings that the writer has been able to find is that of Riley (1875: 180). He states that he found a female of "the common Carolina Mantis" (presumably *S. carolina*) with the abdomen partly decomposed, and filled with sarcophagid larvae. The mantid was collected in October, and the parasitic larvae stayed in the ground until the next July, at which time they emerged as adults. Riley determined these insects as *Sarcophaga carnaria* var. *mantivora*, and stated that size was the only difference between his insects and typical *S. carnaria*. He intimated that his specimens were considerably smaller in size than typical *S. carnaria*. Riley did not postulate how these parasites had gained access to the body of the mantid, although he states that *S. carnaria* should probably be considered as a scavenger of grasshoppers rather than a true parasite, since it is seemingly attracted more often to weakened insects, or those that were already dead.

Gahan (1915) reported the breeding of 3 sarcophagids from a female of *S. carolina*. The mantid when collected had a wound in its side so that Gahan states that it was not known whether this was true parasitism, or whether the mantid had become maggot infested after receiving a previous wound. This species was determined at that time as *Sarcophaga* (*Helicobia*) *helicis*, but was later described as a new genus and species, *Mantidophaga stagmomantidis*, by Townsend (1918). Busck (Proc. Ent.

Soc. Wash. 17: 24–25), in discussing this paper by Gahan, suggested that perhaps the mantid had become accidentally parasitized by eating sarcophagid larvae which had passed uninjured through its mouth parts. He further stated that he had seen an adult mantid (*P. sinensis*) eat mature sarcophagid larvae that had been squeezed by the mantid from a gravid fly, and that later this same mantid was found to be parasitized by sarcophagid larvae. The parasites, however, were not reared to maturity, so that there is no positive guarantee that they were the same species as the insects that were eaten, or that they actually entered the body of the mantid by this method.

Branch (1920) likewise discovered a female *S. carolina* with a wound in its side, and bred one specimen of *S. setigera* from its body. Again the true nature of the association was not established.

It is believed that the following observations relative to the present rearings should be of interest.

Both specimens when brought into the laboratory appeared normal, and it is believed that if any wounds had been present they would have been noticed. The insects' abdomens were distended as though with eggs, and their reactions were normal except that they did not take food. Their failure to take food was not unusual, however, since females on the verge of egg deposition will quite frequently disregard introduced insects (Breland 1941b).

Several days after the mantids had been placed in the laboratory (4 days in one case, 5 in the other) dipterous larvae began emerging from the abdomens of the mantids. More detailed observations were made on the insect from San Marcos, so that the following biological notes apply specifically to the parasites from this insect. From the single female mantid, 16 dipterous larvae emerged and crawled about the cage looking for a place to pupate. These larvae averaged 8 mm. in length in the unexpanded condition. Several of the larvae were placed in a finger bowl filled with dirt, while the others were put in dampened strips of toweling paper for additional observation. Those in the toweling paper assembled in a group under the strips, and within 36 hours all had formed puparia. Nine days after forming puparia, adult flies began emerging from both containers.

The female mantid was still alive after the emergence of the parasitic larvae, but was indeed quite feeble. Examination of this insect revealed that the larvae had emerged from between tergites 4 and 5, and 5 and 6, while there were no other wounds on the body. Dissection revealed that most of the inside of the abdomen consisted of a mass of unrecognizable material. A few mature eggs, part of the digestive tract, and the fairly complete nerve cord were all that could be identified with certainty.

The mantid from Austin yielded 21 larvae, and these started

emerging as adults 9 days after they had been placed in dirt for pupation.

It seems possible that in nature the parasites would not have emerged as adults until the following spring or summer, since the laboratory temperature was somewhat more constant and warmer than the outside temperature. This fact plus other abnormal laboratory conditions may have accounted for the unsatisfactory results of the experiments with the living insects.

For several consecutive days, the adult flies were placed in cages with adult mantids, and their reactions were carefully recorded. So far as could be determined, the flies wholly ignored the mantids, but some of the mantids consumed several of the adult flies. Those mantids that were placed with the flies were carefully watched until they themselves died, but no signs of parasitism developed in any of these insects. The experiments were continued until all of the flies that had not fallen prey to the mantids had died.

The reaction of one mantid to the flies was of particular interest. This insect appeared frightened by the buzzing of the flies, and while in the cage with them would either stay in one corner or move cautiously from one place to another. When the flies approached it would strike at them spasmodically—not at all like the usual mantid trying to catch food. During the time this mantid was with the flies, it managed to catch several. It would then take a bite or so from its victim, and then violently discard it as though it were not palatable. This particular insect did not completely consume a single fly, although it killed and mutilated several. Other mantids were not frightened by the flies, but ate with relish all that they could catch.

Although these observations do not completely solve the problems connected with the relationship between these two species of insects, it is believed that certain facts are suggestive. It is believed that the larvae were true parasites, because of the large number present, and since a large wound in the body of the mantid would probably have been noticed. The possibility is also suggested that the wounds reported in the bodies of the mantids by Gahan (1915) and Branch (1920) were caused by the previous emergence of some of the dipterous larvae before the mantids were discovered. This is supported by the fact that only a single larva was discovered in one instance and three in the other. Since, however, the species reported by both these authors were different from the present parasites, this may not have been the case.

There is no direct evidence as to how the larvae of the present parasite may have gained entrance into the bodies of the mantids. While it seems possible that one or perhaps a few larvae might get past the mouth parts uninjured as suggested by Busck, which has been mentioned previously, it does not seem

possible that such a large number as recovered by the writer could have done so. This possibility, however, should not be overlooked.

The other possibility is that the female parasite larviposited on the body of the mantid as does *S. kellyi* and other species when parasitizing grasshoppers. Neither of these two possibilities is supported by the experiments that were performed with the mantids and the adult parasites, but it is possible that nymphs are attacked, or that laboratory conditions kept the parasites from reacting normally. Although a female fly might have some difficulty in approaching closely to an adult or nymphal mantid, this could be accomplished while the mantid was eating another insect.

Until additional data are forthcoming, the writer is inclined to regard the present cases as instances of true parasitism, but accidental in the sense that the mantid is probably not the usual host for the parasite. If, however, additional investigation should indicate that the parasite attacks mantids more heavily in this or other localities, the present interpretation would probably have to be modified or revised.

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THREE NEW SYNTORMON (DIPTERA: DOLICHOPODIDAE) FROM WESTERN UNITED STATES.[1]

By F. C. Harmston and G. F. Knowlton.[2]

The following report deals with three apparently new species of *Syntormon* (Dolichopodidae, Diptera). Like nearly all *Syn-*

[1] Contribution from the Department of Entomology, Utah Agricultural Experiment Station.

[2] Graduate assistant and research associate professor of entomology, respectively.

tormon males, the three species here described have the posterior basitarsi somewhat modified by the presence of a prominent sinuous bristle upon the plantar surface.

Syntormon kennedyi, n. sp.[3]

Male.—Length, 3 mm.; of wing, 3.2 mm. Face moderately wide on upper portion, narrow below, silvery pollinose. Front metallic blue-green, the reflections near the vertex coppery. Antennae (fig. 4) black; third joint broad at base, tapering to a sharp point, densely pubescent; arista about same length as third joint, sub-apical. Orbital cilia white, a few of the upper cilia black.

Dorsum of thorax bronze, the extreme upper lateral margins with a greenish luster; pleurae greenish, thickly dusted with white pollen, the posterior edge yellow. Dorsum of abdomen black with bronze reflections; second and third segments broadly yellow on lateral margins; venter of four basal segments yellow; posterior edge of first segment with long black hairs on the dorsum, the hairs along lateral portion yellowish; otherwise the abdomen is clothed with short black hairs. Hypopygium embedded, the outer appendages small, pale, fringed with yellowish cilia.

Coxae, femora and tibiae yellow, the posterior tibiae thickened and blackened on the apical fifth. Coxae with delicate pale cilia on anterior surfaces, the bristles at apex brownish; posterior coxae with a strong black bristle on outer surface. Middle femora with a row of short, sharp black bristles along lower edge, becoming shorter toward the apex; fore tibiae with a dense row of short, but conspicuous, bristles along the inner anterior surface. Fore tarsi blackened from the tip of first joint; middle tarsi (fig. 7) with third and fourth segments conspicuously compressed, fifth joint plain, tarsi black beyond the middle of the second joint; posterior tarsi (fig. 11) black from near base of second joint, the first and second joints brown, the basitarsi somewhat flattened on lower surface and bearing a conspicuous bisinuate bristle near the tip, this bristle being about ⅔ the length of basitarsus. Joints of fore tarsi as 12–5–4–3–3; of middle tarsi as 14–5–5–4–3; of hind tarsi as 8–7–6–5–3. Halteres pale yellow; calypters yellow with narrow black margin, their cilia pale.

Wings (fig. 3) grayish hyaline, broadest opposite the cross-vein; anal angle not prominent, evenly tapered toward the base of wing.

Described from two males, both taken at Cameron Pass, Colorado, August 18, 1940, by G. F. Knowlton. Holotype deposited in the U. S. National Museum; paratype in the insect collection of the Utah Agricultural Experiment Station.

Taxonomy: Syntormon kennedyi, n. sp., belongs in the group of closely related species which includes *palmaris* Lw. and *utahensis*, n. sp. In *palmaris* Lw. (fig. 9) the third and fourth joints of middle tarsi are greatly flattened, the second joint is entirely white, whereas in *kennedyi* the third and fourth joints of middle tarsi are noticeably, but not greatly, flattened and the second

[3] Named in honor of Dr. C. H. Kennedy, professor of entomology at Ohio State University.

joint is blackened on the apical half. In *utahensis*, n. sp., the last four joints of middle tarsi are greatly flattened dorsoventrally, the second joint is entirely white and equal in length to the third and fourth joints combined. *Syntormon utahensis* is the only one of the above three species which has the posterior tibiae wholly yellow.

Syntormon utahensis, n. sp.

Male.—Length, 3 mm.; of wing, 2.6 mm. Face moderately wide on upper portion, narrowed below, silvery pollinose. Front metallic, blue, greenish above base of antennae. Antennae (fig. 1) black; third joint pubescent, obliquely truncate and pointed at tip; arista sub-apical, slightly longer than the third joint. Orbital cilia white, the upper cilia are black and descend nearly one-half the eye height.

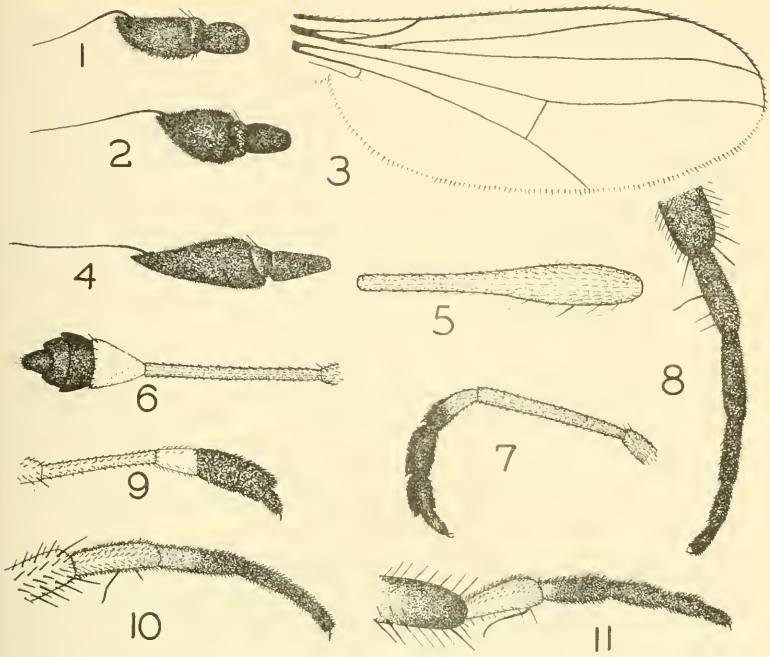
Dorsum of thorax dull metallic green; pleurae greenish, dusted with white pollen, the posterior margin yellow. Dorsum of abdomen black with bronze reflections; lateral and ventral portions of four basal segments yellow. Hypopygium embedded, without evident outer appendages.

Coxae, femora and tibiae wholly yellow. Fore coxae with minute pale hairs on anterior surfaces and the usual black bristles at tips. Middle femora (fig. 5) with a series of about 6 conspicuous black bristles along lower edge; fore tibiae with a dense row of short, sharp black bristles along the inner anterior surface. Fore tarsi blackened from the tip of second joint. First joint of middle tarsi (fig. 6) long, stalk-like; second joint flattened, white; last three segments compressed, velvety-black, the latter, together with the second joint form an elongate-oval tip to the middle tarsi. Posterior tarsi blackened from the middle of second segment, the basal half of the second segment and the first segment are brown, the latter (fig. 10) bears a conspicuous, sinuous bristle on the lower edge near the middle and a shorter, straight bristle slightly beyond the middle. Joints of fore tarsi as 11–5–3–2½–2½; of middle tarsi as 16–5–3–3–2; of posterior tarsi as 9–9–5–4–3. Halteres pale yellow; calypters yellow with narrow black apical margin, and cilia pale.

Wings grayish hyaline, broadest opposite the tip of fifth vein; anal angle evenly rounded, prominent.

Described from one male taken at Marysvale, Utah, June 20, 1940, by G. F. Knowlton and F. C. Harmston. Holotype deposited in the U. S. National Museum.

Taxonomy; Syntormon utahensis, n. sp., is readily distinguished from other species of the genus by having the last four segments of the middle tarsi greatly compressed dorso-ventrally and in possessing wholly yellow posterior tibiae. *Syntormon palmaris* Lw. and *S. kennedyi*, n. sp., might be confused with *utahensis* but they differ in having the third and fourth joints of middle tarsi laterally compressed and the posterior tibiae are blackened at the apices.



Syntormon utahensis, n. sp., male 1, 5–6, 10. *S.oregonensis*, n. sp., male, 2, 8. *S. kennedyi*, n. sp., male, 3–4, 7, 11. *S. palmaris* Loew, male, 9.

Syntormon oregonensis, n. sp.

Male.—Length 3.2 mm.; of wing 3.5 mm. Face moderately wide, silvery pollinose. Front metallic green. Antennae (fig. 2) black; third joint slightly longer than wide, evenly rounded below; arista nearly apical, approximately twice the length of third joint. Lower orbital cilia white; upper cilia black, descend about one-third the eye height.

Dorsum of thorax metallic green; pleurae greenish with thick white pollen. Abdomen wholly dark metallic green, the dorsum with deep bronze reflections. Hypopygium embedded.

Fore coxae yellow, the anterior surfaces with conspicuous white hairs; middle and hind coxae black. Femora yellow, the posterior pair blackened on apical third. Fore and middle tibiae yellow; posterior tibiae black, gradually thickened from beyond the basal third, the outer surface clothed with conspicuous black hairs and bristles. Fore tarsi blackened from the tip of first joint; middle and hind tarsi wholly black, the former of plain structure; posterior basitarsi (fig. 8) with a prominent sinuous bristle on the lower surface near the middle, and two shorter, straight bristles slightly beyond the middle. Joints of fore tarsi as 10–5–5–3–3; of middle tarsi as 12–5–5–4–3; of posterior tarsi as 8–8–6–5–4. Calypters and halteres yellow, the former with narrow black apical margin and pale cilia.

Wings grayish hyaline; anal angle moderately prominent, evenly rounded.

Described from one male collected at Portland, Oregon, September 5, 1940, by F. C. and V. H. Harmston. Holotype deposited in the U. S. National Museum.

Taxonomy: Syntormon oregonensis, n. sp., is readily distinguished from other described species of the genus by the wholly black posterior tibiae together with the yellow fore and middle femora; no other known species of *Syntormon* occurring in North America has the above combination of leg colors. It is much like *affinis* Wheeler in general appearance, but in that species the fore coxae are wholly darkened and the posterior tibiae are blackened only on the apical third.

THE TAXONOMIC STATUS OF THE SO-CALLED "COMMON RED SPIDER."

By E. A. McGregor,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

ABSTRACT

For many years the term "common red spider" has been applied to what was believed to be a single, widespread species of spinning mite of the genus *Tetranychus*. The scientific name *Tetranychus telarius* (L.) has been most commonly applied to this presumably single species. From the information now available it is indicated that the species *T. telarius* (L.) is not present in the United States and that the term "common red spider" has been applied indiscriminately to two species, *T. althaeae* Von Hanst. and *T. bimaculatus* Harv.

In 1758 Linnaeus [1] described a mite from the linden tree in Europe under the name *Acarus telarius*. The species was later referred to the genus *Tetranychus*, although Linnaeus' description was so vague that it might have applied to almost any spinning mite, and it would be impossible to establish the identity of *telarius* with reasonable certainty if it were not for the fact that Linnaeus recorded the linden tree as its natural host.

In 1901 Von Hanstein [2] described a mite (*Tetranychus althaeae*) from hollyhock in Europe. In addition to Von Hanstein, Tragardh [3] and Zacher [4] showed that *T. althaeae* is very distinct from *T. telarius*. The author has studied named specimens of these mites, sent to him by Zacher and others, and finds them to be distinct, one from the other.

With the establishment of the morphological differences between *Tetranychus telarius* and *T. althaeae*, observations were

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[1] Syst. Nat. (ed. 10), vol. 1, 1758, p. 616.
[2] Ztschr. f. Wiss. Zool., vol. 70, 1901, p. 74, pl. 6, figs. 1, 2, 4, 5.
[3] [Sweden] Centralanst. för Försöksv. på Jordbruksområdet, Meddel. 109, No. 20, 1915, pp. 42, 43, figs. 19, 20.
[4] K. Biol. Anst. f. Land u. Forstw., Mitt., No. 14, 1913, pp. 39–40.

recorded as to the host plants on which they occurred in Europe. The former was found to occur chiefly on linden and maple; the latter, on hollyhock, violet, garden beans, hops, and many annual plants in greenhouses.

In the course of the routine work of identifying spinning mites, the writer has accumulated data on the species occurring throughout the United States. The "linden mite," *Tetranychus telarius* (L.) (as accepted by Zacher, Von Hanstein, and Tragardh), has never been identified from America. A spinning mite has frequently been received from various parts of the Unites States and from Canada and Hawaii which appears to be identical with *T. althaeae* Von Hanst.

In addition to *Tetranychus althaeae*, a mite is often received from many points in the United States which is closely related to it. This mite, *T. bimaculatus* Harv., was described by Harvey [5] in 1893 from a variety of cultivated plants at Orono, Maine. The writer has examined named specimes of *bimaculatus* collected by Harvey at the type locality (Orono, Maine). In addition, he has studied material from Orono recently received from Dr. F. H. Lathrop. Although, as above stated, this mite is very closely related to *T. althaeae*, it appears to differ consistently in the form of the penis and in the structure of the tarsal appendages of leg I of the male. Therefore it is believed that Harvey's name (*T. bimaculatus*) is a valid one.

Actually it is difficult to say whether *Tetranychus althaeae* or *T. bimaculatus* is the more common species in the United States. Both these mites have been identified from numerous localities in many parts of the United States, and occasionally from Canada. Of the lots of these two species in the writer's collection, 63 percent are of *bimaculatus* and 37 percent are of *althaeae*. These figures should not be taken too seriously, however, since many lots of mites examined were not retained by the writer.

In the case of several American mites of the genus *Tetranychus*, the female individuals are so alike that no means of identifying them specifically has yet been discovered. This has led to much confusion in the way of incorrect citations of species in the literature, especially since female specimens were usually sent to specialists for study. Since access to male spinning mites is necessary for accurate identifications, and since the male structure has been known and employed only in recent years, it follows that the earlier references in the literature can carry little weight as to the species concerned. Color variations due to differences in host plants have also been a factor adding to the confusion.

When the foregoing facts are considered, it would seem indicated that published references to the so-called "common red

[5] Maine Agr. Expt. Sta. Ann. Rpt. for 1892, pub. 1893, p. 133, pl. 3, figs. 1–4.

spider" can be of little assistance in determining which species has been most commonly reported in the United States.

Finally, it may be repeated that the writer agrees with several leading acaridologists of Europe that *Tetranychus* (*Eotetranychus*) *telarius* (L.) of Europe cannot be identical with the American mite known commonly under *telarius* and *bimaculatus*.

In Plate 2 are shown the differences in the structure of the penis and tarsal appendages as between *Tetranychus telarius*, *T. althaeae*, and *T. bimaculatus*. Briefly, these differences may be presented as follows:

Tetranychus telarius (L.).

Penis.—Basilar lobe a mere obtuse-angled prominence, shaft gradually attenuated, ending in a thin tip without barb, curving very slightly upward. *Tip of tarsus:* Distal element (corresponding to the main claw) straight, relatively weak, the proximal portion (analogous to the deflexed spurs in certain genera) almost three times as thick at base as distal spur, split nearly two-thirds its length into six subequal, distinct spurs, these in two series of three each.

Tetranychus althaeae Von Hanst.

Penis.—Basilar lobe approximately right-angled, shaft about five times as thick proximally as thickness of hook, which is bent upward about 90 degrees from axis of shaft, hook terminating in a conspicuous barb which bears an acute tip both anteriorly and posteriorly. *Tip of tarsus:* Distal element (corresponding to the main claw) straight and relatively weak, the proximal portion little more than twice as thick at base as distal spur, split for a short distance into six closely appressed spurs which are graduated in length, the ventralmost pair the longest, these proximal spurs in two series of three each.

Tetranychus bimaculatus Harv.

Penis.—Basilar lobe a narrowly rounded boss, directed upward and backward, shape of shaft and hook similar to that of *althaeae*, but with all parts relatively smaller, hook terminating in a small barb which bears an acute tip anteriorly, but having a barely discernible boss posteriorly. *Tip of tarsus:* Distal claw element much like that of *althaeae*, the proximal portion about three times as thick at base as distal spur, and comprising mainly the two ventralmost paired spurs, the other four spurs barely discernible.

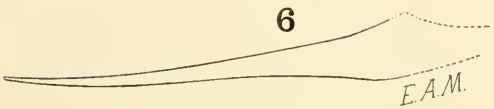










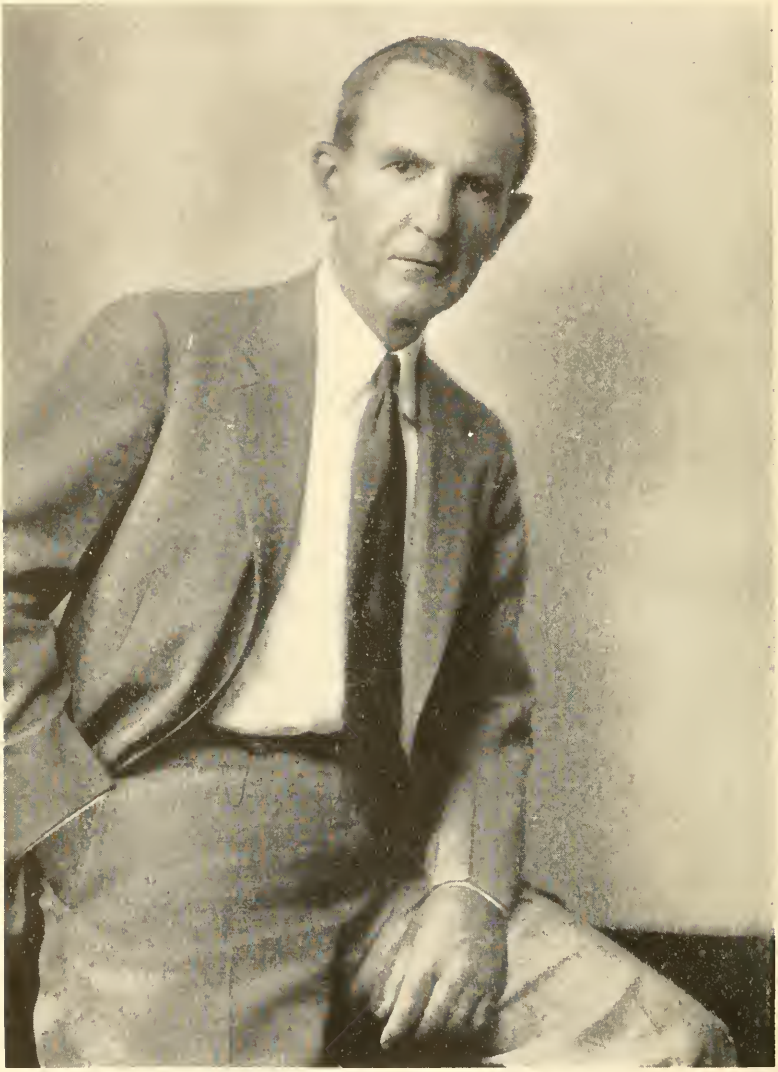


EXPLANATION OF PLATE.

Tetranychus bimaculatus, *T. althaeae*, *and T. telarius.*

Figs. 1 and 2. Tip of tarsus of ♂ leg I and penis, respectively, of *T. bimaculatus.*
Figs. 3 and 4. Tip of tarsus of ♂ leg I and penis, respectively, of *T. althaeae.*
Figs. 5 and 6. Tip of tarsus of ♂ leg I and penis, respectively, of *T. telarius.*

(All figures drawn with aid of camera lucida. Enlargement of Figs. 2 and 4 is identical.)



JESSE LEE WEBB

JESSE LEE WEBB.

1878–1942.

The interesting and varied entomological career of Jesse Lee Webb was brought to a close when he was called by death on January 20, 1942.

One of his outstanding characteristics was his willingness to encourage and assist younger entomologists. He was also adept at popularizing entomology as exemplified by his "Cotton or Weevils," issued as Miscellaneous Publication No. 35 of the United States Department of Agriculture in collaboration with F. A. Merrill. This publication was referred to by a leading editor of the Department as the best primer on insects he had read.

Mr. Webb was born at Bloomington, Illinois, April 9, 1878. At the age of 5 his family moved to Rippey, Iowa, where he received his early education. He entered Washington State College in 1895 and received the B. S. degree there in 1900. In the fall of 1901 he was employed as a student assistant in the then Bureau of Forestry and worked under the tutelage of Dr. A. D. Hopkins, who was then Entomologist of the West Virginia State University. Mr. Webb received the M. S. degree from that institution in 1902.

On July 1, 1902, Dr. Hopkins was placed in charge of the Forest Insect Investigations of the then Division of Entomology, and Mr. Webb continued to work with him until May, 1903.

His first field assignment was for work on forest insects in the Black Hills of South Dakota during the summer of 1902.

In the winter of 1902 the organization of the Section of Forest Insect Investigations was completed on a regional basis. Mr. Webb, who had been made Assistant Forest Expert, was assigned to the Rocky Mountain States, Dr. H. E. Burke to the Pacific States, Mr. W. F. Fiske to the Southern States, and Dr. Hopkins to the Central, Atlantic, and New England States. The taxonomic and biologic work was also divided among these men, Mr. Webb taking the roundheaded borers, Dr. Burke the flatheaded borers, Mr. Fiske the predators and parasites of forest insects, and Dr. Hopkins the bark weevils and bark beetles.

In May, 1903, Mr. Webb received an appointment as Entomologist under the Philippine Insular Government for the investigation of forest insect problems. He resigned on August 31 of that year and returned to New York via the Suez Canal.

Immediately after his return he was appointed to continue laboratory and field research on forest insects under Dr. Hopkins' direction until 1912. These investigations were conducted in a number of western and southern States and in Washington,

D. C., and resulted in the publication of several taxonomic, ecologic and popular articles.

Upon being transferred to the Division of Southern Field Crop Insect Investigation February 1, 1912, Mr. Webb took up studies of insects injurious to growing rice in Arkansas and Louisiana. The results were published in Farmers' Bulletin 1086. The summer of 1914 was spent in Florida investigating control of the tobacco bud worm. Some time was devoted to boll weevil investigations at Tallulah, Louisiana, during the summer of 1915, and later to tests of chemicals for the control of house flies in manure with headquarters at Baton Rouge, Louisiana. The biology of the cluster fly, *Pollenia rudis* Fab., a parasite of earthworms, was worked out during 1916, and in August of that year he was assigned to investigate the horse fly problem in the irrigated Antelope Valley of Nevada and California. Results of these studies were published jointly with R. W. Wells in Bulletin 1218 of the United States Department of Agriculture.

During subsequent years he collaborated with the writer in a series of annual reviews of mosquito work throughout the world which were published in the Proceedings of the New Jersey Mosquito Extermination Association. His more important contributions to entomological literature totaled 18 bulletins and articles.

In March, 1919, Mr. Webb was made assistant leader of the Division of Southern Field Crop Insect Investigations. During the several succeeding years he served as "Acting in Charge" of the Division while Dr. W. D. Hunter, Chief of the Division, spent most of the time directing the pink bollworm eradication efforts in Texas and Louisiana. On July 1, 1926, the Division of Southern Field Crop Insect Investigations was broken up, and Mr. Webb continued in charge of the Washington office of the Cotton Insect Division until 1927, when the Division of Insects Affecting Man and Animals was created, and he became assistant chief of that Division, which position he held until 1935. Since that time he has been a member of the staff of that Division of the Bureau of Entomology and Plant Quarantine.

Mr. Webb was a member of the American Association for the Advancement of Science, the American Association of Economic Entomologists, and the Entomological Society of Washington. He was a member of and did active work in the Columbia Heights Christian Church, and for many years a member of its choir.

In 1904 Mr. Webb was married to Florence Evans, and he is survived by his widow and only son, Delmar Evans Webb.

Many will miss the helpful words and friendly smile of this loyal, Christian gentleman.—F. C. Bishopp.

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OBITUARY.

ALONZO CLAYTON DAVIS (1901–1942).

Alonzo C. Davis, Assistant Entomologist of the Division of Truck Crop and Garden Insect Investigations, stationed at Beltsville, Maryland, died suddenly on Sunday, January 4, 1942. Mr. Davis was born in Honolulu, T. H., on March 4, 1901, and was the son of Harry C. and Harriett O'Connell Davis. He is survived by his wife, the former Mary Elizabeth DeVries-Van Doesburgh, and four children: Alice 12, Harry 10, Henry 2 and Virginia Ann 2½ months. Mr. Davis attended the University of California, receiving the degree of B. A. in 1926 and of M. A. in 1927.

His first assignment in the Bureau of Entomology and Plant Quarantine was an appointment as agent on pepper weevil investigations conducted in southern California in cooperation with the University of California. On June 1, 1931, he received an appointment as Assistant Entomologist and assigned to mushroom insect investigations at Arlington, Virginia, later being transferred to Beltsville, Maryland.

While still very young he became intensely interested in natural history, especially in Coleoptera and insect fauna of the desert and also of the rodent habitats. At the age of 13, he started collecting beetles and at 15 he published the first of a series of a dozen or more articles on Coleoptera. The late Dr. H. C. Fall was one of his teachers at the Pasadena High School, California, and it was through this association that he became so interested in Coleoptera. This influence continued throughout his entire life and he sent much of his material to Dr. Fall for determination or verification.

Early in his career he was a very active collector but later his duties in connection with the economic phases of the mushroom insect project and other interests gave him little opportunity to work with his hobby. While he collected Coleoptera in general, members of the Scarabaeid genus Pleocoma held his interest, resulting in a revision of the genus in 1934–35. Other groups of beetles which were of special interest were: Cicindelidae, Coccinellidae, Acmaeodera (Buprestidae), and the Rhynchophora. At the time of his death he had in manuscript

form a nearly complete paper on a revision of the Ophryastini (weevils), based mainly on material in the National Museum, and his co-workers plan to complete and publish this paper.

Mr. Davis also published articles on other subjects of natural interest, including Orthoptera, Isoptera, faunas of Neotoma nests and Citellus burrows. In his official work with the Bureau, he specialized on the biology and control of mites and mushroom flies. To Mr. Davis and his co-workers in chemistry must go the credit for developing and refining a method of mushroom house fumigation with sulfur, which saves material and practically eliminates the fire hazard.

Another hobby of recent years was rifle and pistol-shooting with muzzle-loading guns reminiscent of early American history. Being a charter member of the Department of Agriculture Rifle and Pistol Club, which he helped to organize and continued to promote until his death, he participated in the Club's rifle and pistol matches, using his out-moded muzzle-loaders in favorable competition with members shooting with the up-to-date types.

He was well-liked by all his associates and his pleasing personality and keen sense of humor will be missed by his companions on the range and in the laboratory. He also served two enlistments in the California National Guard, the first in Company H, 160th Infantry, and the second in Company D, 159th Infantry.

Mr. Davis had a genius for developing gadgets and equipment which he used in his research work. He was fond of wearing his kilts and playing the bagpipes in his Scottish clan affiliations.

Mr. Davis's service was characterized by a sincere devotion to duty and an inherent desire to do a thorough job of whatever he undertook. While his career was short, he left behind him an excellent record not only in the Bureau but with the mushroom industry, for he worked very closely with the representatives of this line of work.

Mr. Davis was an active member of the American Association of Economic Entomologists, the Pacific Coast Entomological Society, the Brooklyn Entomological Society, the Entomological Society of America, and the Entomological Society of Washington.

The Writings of Mr. Davis are as Follows:

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Insect collecting on a mountain trail. Lorquinia, 2:3, 17–18.

1918. Notes on *Pleocoma* II. Bull. Brook, Ent. Soc., 13:5, 116–117.

1924. Larva and pupa of *Desmocerus californicus* Horn. (with J. A. Comstock.) Bull. So. Cal. Acad. Sci., 22: pt. 6, 179–181.

1925. *Neoclytus carus* and *modestus*. Pan-Pac. Ent., 1:4, 169.

1925. *Pleocoma behrensi*. Bull. Brook. Ent. Soc., 1:3, 110.

1926. Habits of *Cymatodera decipiens* Fall. Pan-Pac. Ent., 2:3, 126.
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A luminous *Zarhipis* (Coleoptera). Pan-Pac. Ent., 2:4, 210.

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1928. Southern California collecting notes. Pan-Pac. Ent., 4:4, 183.
A note on the parasitism of *Hippodamia*. Pan-Pac. Ent., 4:4, 184.
Desmocerus californicus Horn. Pan-Pac. Ent., 4:4, 191.
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Notes on some insects found in the burrows of the California ground squirrel in Orange County, California. (with K. D. Sloop.) Bull. Brook. Ent. Soc., 29:2, 79–83.
The pepper weevil. (with J. C. Elmore and R. E. Campbell). U. S. D. A. Tech. Bull. 447, 27 pp.
The Coleoptera of Santa Cruz Island, California. (with H. C. Fall.) Can. Ent., 66:6, 143–144.
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Sulphur fumigation of mushroom houses. (with H. D. Young.) Jour. Econ. Ent., 27:2, 518–525.
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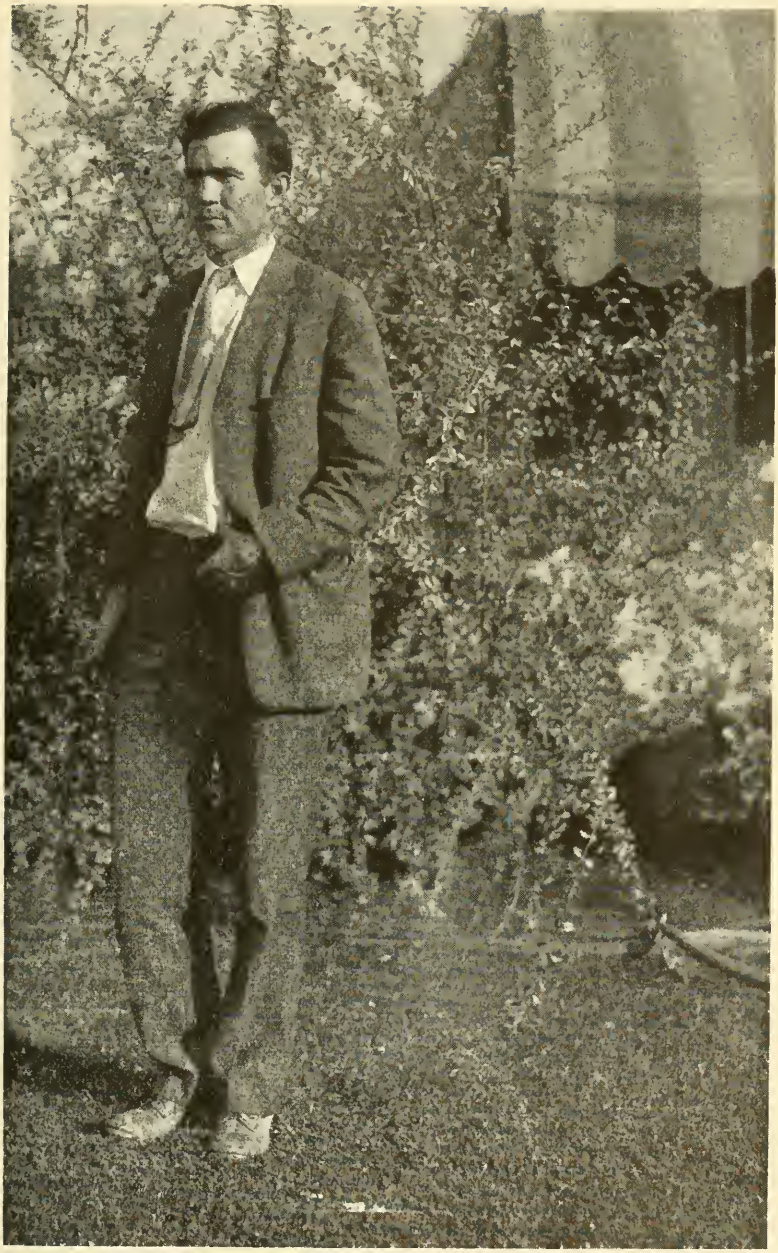
—— California buckeye as an ant poison. (In press.)

C. A. Weigel.
L. J. Bottimer.
L. L. Buchanan.



ALONZO CLAYTON DAVIS

A NEW SPECIES OF HIPPODAMIA FROM MEXICO (COLEOPTERA, COCCINELLIDAE).

By P. H. Timberlake,

University of California Citrus Experiment Station, Riverside, California.

Hippodamia koebelei, n. sp.

Hippodamia convergens, var., Gorham, 1891, Biol. Centr. Amer. 7, p. 153, pl. 8, fig. 24 (at least in part).

Exactly resembling in size and coloration the immaculate variety of *Hippodamia convergens* and hitherto confused with it, but easily distinguished in the male sex by the dilated front and middle basitarsi. The female is hardly distinguishable except by the more or less uncertain character of having the pale border of the pronotum narrower and more even throughout.

Head black, the outer surface of mandibles and a transverse band on frons between the eyes, yellowish white. The frontal band dilated into a triangle or oval at middle and sometimes dilated also at each end. Pronotum black, with the anterior and lateral margins, rather narrowly and evenly, and two convergent marks on the disk, yellowish white. Elytra flavous or red, with a small yellowish white mark on each side of the scutellum at the base, and usually not marked otherwise except by a linear sutural spot at scutellum, which is black. In one specimen there is a small rather nubilous black dot on the disk just behind the middle and at inner third. Under surface of the body and the legs black, the mes- and metepimera white. Antennae testaceous brown, becoming darker at apex. Pronotum and elytra very finely and obscurely punctured as in *convergens*.

Length of ♂, 5.0–6.5 mm.; of ♀, 6.0–6.9 mm.

Median lobe of tegmen (male aedeagus) triangular, tapering from base to apex, subdepressed, rather abruptly bent downward at an angle of about 45° at a point slightly beyond the middle, and with a low, rounded subcarinate crest on each side at the angulation, the surface between the crests concave or grooved. Paramera rather broad, with a narrow laminate inflexed margin on the dorsal edge. The ventral edge somewhat expanding from the beginning of second fifth of the length and beyond this point also densely ciliate. Sipho much as in *H. sinuata*, but besides the paired subapical flaps, there are two rod-like dorsal filaments, which are about as long as the flaps, strongly divergent, and well chitinized, but ending in a somewhat expanded membranous part.

Described from 5♂, 1♀ (holotype ♂, allotype and paratypes), Mexico City, May 22 and 27, 1922 (E. G. Smythe); 1♂ (paratype), Mexico City (O. W. Barrett); 1♂ (paratype) Oaxaca, Mexico (L. O. Howard); 1♂ (paratype), Las Vigas, Mexico (Hoege); 1♀)paratype(Mt. Diabola, Puebla, Mexico, July 29, 1901 (R. H. Hay); 1♀ (paratype) Durango, Durango, Mexico (F. C. Bishopp); and 1♂, 1♀ (paratypes) Mexico (Koebele, No. 1687). "Common on pine and fir trees, base of Popocatepetl, Mex., May 1897, and feeding upon aphis."

Types in U. S. National Museum, Cat. No. 55902, except the last female recorded above which belongs to the Koebele collection.

NEW DORYLINE, CERAPACHYINE AND PONERINE ANTS FROM THE IMATONG MOUNTAINS, ANGLO-EGYPTIAN SUDAN.[1]

By Neal A. Weber,

University of North Dakota, Grand Forks, North Dakota.

The following species of the subfamilies Dorylinae, Cerapachyinae and Ponerinae were the new species of their genera in a collection of about 125 species of ants which I made in the Imatong Mountains, Anglo-Egyptian Sudan, in 1939. The southern foothills of these mountains cross Latitude 4° North into the Uganda frontier and extend east from Longitude 32° 30′ East. The ants are described at the present time in order to use their names in an ecological study of plant zones and animals in these mountains.[2] The biology and relationships of the ants are treated in that study. The species described below have affinities mostly with the West African rain forest and the East African scrub plains faunas but there is a South African element (*Opthalmopone*) and a species (*Anochetus sudanicus*) with Mediterranean affinities.

In the present paper a measurement introduced in 1938[3] and generally used since then by the author is added as a complement to the total length measurement of common usage. This latter is often inaccurately made because of the variable extension of the gastric segments and the contorted position in which dead ants are found or measured. The present measurement may be called the thoracic length and is taken in a straight line from the anterior pronotal margin to the apex of the episternal angles. It is the longest measurement which can be made of a rigid structure in ants and hence minimizes the per cent of error.

AENICTUS.

Aenictus mentu, sp. nov.

(Fig. 2.)

Worker.—Extended length 1.7–2.5 mm. (of thorax, excluding collar or neck, 0.50–0.77 mm.).

Worker maxima.—Head strictly in front view, excluding mandibles, 1.05

[1] The identification of the ants of this collection was facilitated by grants from the American Academy of Arts and Sciences and the American Philosophical Society. I am also indebted to the authorities of the British Museum (Natural History), Museum of Comparative Zoology, American Museum of Natural History and United States National Museum for courtesies extended on my visits to these institutions.

[2] Weber, N. A. 1941. Plant zones and the ecology of animals, chiefly ants, on Central African mountains. Year Book, Amer. Phil. Soc., 1940, pp. 271–272 (Summary).

[3] Weber, N. A., 1938. The biology of the fungus-growing ants. Part IV. Additional new forms. *Revista Ent.* 9:155 (footnote), fig. 17 (p. 171).

times longer than wide; occipital margin transversely truncate, sides feebly convex and reaching widest distance apart at a level opposite the clavate part of antennal scape; anterior clypeal margin transverse but interrupted by the convex anterior carinate portion of each antennal scrobe; eyeless; mandibles small, stout, convex, with a long, acutely pointed apical tooth and three denticles of variable development; antennal scapes clavate, bent near the middle and extending posteriorly slightly past mid-line of head. 2d funicular joint longer than broad, 3d–7th gradually increasing in comparative breadth to distinctly broader than long. Dorsal part of thorax from above about 2.84 times longer than broad when excluding collar or neck, broadest through pronotum whose sides are feebly convex; in side view flat on top except for gentle and feeble impression in mesoëpinotal region; epinotal declivity a rounded obtuse angle. Petiole from above rectangular, about 1.56 times longer than broad; in side view with evenly convex dorsum. Postpetiole from above ovate, as broad as long; in side view flat on top. Gaster ovate. Legs short, femora incrassate. Smooth and shining, epinotum and anterior part of petiole shallowly punctate. Pilosity of short, moderately abundant yellow hairs mostly reclinate and directed backwards. Pale ferruginous, minima workers yellow.

Of the habitus of *rotundatus* Mayr but differing especially in petiolar proportions. Described from one colony (No. 1436) which I took in the Imatong Mts., A.–E. Sudan, August 4 at an elevation of about 4,200 feet. The ants were in a termite nest (*Amitermes* (*A.*) *evuncifer* Silv.). This army ant is dedicated to the Egyptian war god, Mentu, whose influence is at the present time widespread.

CERAPACHYS.

Cerapachys (C.) pigra, sp. nov.

(Fig. 11.)

Worker.—Extended length, including mandibles, 4.4–4.8 mm. (of thorax 1.4 mm.). Head strictly in front view excluding mandibles, slightly longer than broad, occipital margin feebly convex, sides more strongly convex and attaining greatest width apart back of eyes, anterior clypeal margin evenly convex; frontal carinae extended feebly backwards to a level with the eyes; antennal scrobes bordered laterally by a low rounded carina terminating anteriorly as a blunt tooth; eyes situated slightly in front of middle, feeble convex, 0.19 mm. in diameter; mandibles stout, trigonal, without distinct denticles on biting margins; antennal scapes clavate, extending back of eyes; funicular joints 2–10 strongly tranverse, terminal joint 0.18 x 0.45 mm. Dorsal surface of thorax from above rectangular, 0.60 x 1.12 mm., thickest through epinotum; epinotal declivity bordered laterally and dorsally by a feeble, rounded carina between which the surface is smooth and flat. Petiole from above broader than long, sides convex, converging anteriorly, 0.51 x 0.62 mm. Postpetiole from above broader than long, sides convex, converging anteriorly, 0.58 x 0.79 mm. Gaster ovate, 1st segment slightly broader than long. Legs moderately short.

Shining, with coarse shallow, setigerous punctations which are largest on the pedicel, and very fine, shallow punctations visible under higher magnification. Hairs sparse but covering the body evenly, yellowish, appressed. Black, appendages dark brown.

Described from workers of one colony (No. 1374) which I took in the Imatong Mts., A.–E. Sudan, July 31 at an elevation of about 3,800 feet. The ants were traveling in an irregular file two or three abreast over stony ground.

Cerapachys (C.) sudanensis, sp. nov.

(Figs. 1 and 12.)

Worker.—Extended length with mandibles 2.8–3.8 mm. (of thorax 0.78–0.90 mm.) Head strictly in front view, excluding mandibles, 1 1/6 times longer than broad, occipital margin transverse, sides feebly convex, anterior clypeal margin transverse except where notched between projecting frontal carinae; antennal scrobes bordered laterally by a low, convex lateral carina which is rounded and terminates anteriorly as a blunt tooth; eyes feebly convex, situated slightly back of middle of head, about 0.14 mm. in diameter; mandible stout, trigonal, without distinct denticles; antennal scapes stout, clavate, extending to a level with the posterior margin of the eyes; joints 2–8 of funiculus strongly transverse, 9th joint much larger than preceding, terminal joint 0.17 x 0.36 mm. Thorax in side view feebly convex in front, from above broadest through epinotum where slightly convex laterally; epinotal declivity bordered laterally and dorsally by a low carina between which the surface is smooth and flat. Dorsal surface of petiole about 1.4 times broader than long, sides feebly convex, posterior margin produced medially as a slight convex lobe. Postpetiole from above about 1.4 times broader than petiole and about 1.4 times broader than long. 1st gastric segment slightly longer than broad. Legs moderately short. Shining, covered uniformly with setigerous punctations which are coarsest on pedicel. Uniformly covered with moderately abundant reclinate, fine, yellowish hairs. Black, appendages brown, becoming paler distally.

Described from workers of one colony (No. 1363) which I took in the Imatong Mts., A.–E. Sudan, at an elevation of about 6,000 feet. The ants were traveling in single file to a hole.

OPTHALMOPONE.

Opthalmopone berthoudi Forel, **pubescens,** ssp. nov.

Worker.—Extended length with mandibles 11.8 mm. (of thorax including collar or neck 4.33 mm.). Differing from Victoria Falls, S. Rhodesia workers of the typical form chiefly as follows: eyes slightly smaller (0.75 mm. diameter), longitudinal medial impression of epinotal basal surface less distinct, posterior margin of petiolar node distinctly less carinate, more rounded; appressed pubescence of body distinctly more abundant, the pubescence extending to the head and pronotum.

Holotype: One worker (No. 1297) which I took July 23 at an elevation of 2,800 ft. on the plains at the east base of the Imatong Mts., A.–E. Sudan.

EUPONERA.

Euponera (Mesoponera) dentis, sp. nov.

(Fig. 9.)

Dealate Female.—Extended length including mandibles 5.2 mm. (of thorax 1.7 mm.). Head, excluding mandibles, 1 1/7 times longer than broad, occipital margin transverse, sides slightly convex, widest apart back of eyes, anterior clypeal margin feebly convex, clypeus with a rounded medial carina which terminates anteriorly above the anterior clypeal margin as a distinct tooth or rounded angle, continuing posteriorly from the clypeal carina is a distinct line between the frontal carinae which ends in front of the median ocellus as a groove; frontal carina short, ending at a level just posterior to the eyes; eyes feebly convex, situated less than their diameters from the mandibular insertions, 0.21 mm. in greatest diameter; mandibles trigonal, with 8 irregular teeth and a suggestion of a 9th, the apical tooth being long and acute, the others much smaller; antennal scapes not quite reaching occipital angles; funicular joints 2–4 about as broad as long, 5–8 broader than long. Epinotal declivity not angulate, rounded and marginate on sides. Petiolar node cuneate, anteroposteriorly compressed above, anterior face convex from above, posterior face flat. Gaster short, dorsum of 1st segment shorter than 2d. Legs moderately short and slender. Finely and densely punctate, gaster sub-lucid, mandibles smooth and shining. Covered uniformly with a thick, short, appressed yellowish pubescence and sparse, longer upright yellowish hairs most numerous on gaster. Dark brown, appendages paler.

Holotype: One dealate female (No. 1452) which I took in the Lotti Forest of the Imatong Mts., A.–E. Sudan August 5. This species has a petiolar node like *ingesta* Wheeler but thinner at apex. The apical mandibular tooth is much longer.

Euponera (Mesoponera) flavopilosa, sp. nov.

(Fig. 10.)

Dealate Female.—Extended length including mandibles 6–7 mm. (of thorax 2.3 mm.). Head, excluding mandibles, rectangular in front view, 1 1/6 times longer than broad; occipital margin transverse, feebly impressed medially; sides subparallel, feebly convex back of eyes; anterior clypeal margin sinuate in front with a median tooth; frontal carinae feeble, extending to a level with the middle of the eyes; median frontal groove continued posteriorly to the median ocellus pit; eyes feebly convex, 0.29 mm. in greatest diameter; mandibles long, narrow and trigonal with a long acute apical tooth and about 11 denticles; antennal scapes slender, exceeding occipital corners by their distal diameters; all funicular joints distinctly longer than broad. Epinotal declivity plane, not marginate, feebly impressed dorsally. Petiolar node cuneate, high and narrow, twice as high as thick at base in side view, anterior surface feebly convex,

posterior surface plane, dorsal surface convex. Gaster small, 1st segment wider than long and distinctly longer than 2d segment. Legs moderately short and slender. Shining, finely punctate, mandibles feebly striate. Pubescence reclinate, abundant on head, thinner elsewhere. Pilosity of yellow hairs comparatively numerous on petiole and gaster, more scanty on head and thorax. Dark brown, appendages paler.

Holotype: One female (No. 1439) which I took in the Lotti Forest of the Imatong Mts., A.–E. Sudan August 5.

PONERA.

Ponera coarctata (Latr.), **imatongica,** ssp. nov.

(Fig. 3.)

Worker.—Length extended 2.7–2.8 mm. (of thorax 0.8 mm.). Head in front view, excluding mandibles, 1.2 times longer than broad, occipital margin feebly impressed, sides and anterior clypeal margin moderately convex, frontal lobes small, convex, frontal carinae shorter than the lobes and divided by a short, deep groove; eyes minute, hardly to be distinguished from a punctation; mandibles elongate, trigonal, with about 8 denticles of irregular development and a longer, acute apical tooth; antennal scapes failing to reach occipital corners by a distance about equal to their distal diameters. Thorax from above thickest through pronotum, the latter being evenly convex laterally and anteriorly, epinotal sides subparallel, epinotal declivity with sides marginate. Petiolar node from above evenly convex anteriorly, sides convex, posterior margin feebly concave. 1st gastric segment from above broader than long. 2d segment longer than 1st. Legs moderately long and slender.

Shining, finely and densely punctate. Pilosity of abundant, fine, reclinate short hairs which do not obscure sculpturing. Yellowish brown, head darker.

Described from workers (No. 1313, 1387, 1390) taken by myself July 25 and August 1 at elevations of 6,100–6,800 feet in the Imatong Mts., A.–E. Sudan.

Ponera mesoëpinotalis, sp. nov.

(Fig. 4.)

Worker.—Length extended 3 mm. (of thorax 0.9 mm.). Head in front view, excluding mandibles, 1.2 times longer than broad, occipital margin distinctly impressed, sides feebly convex, anterior clypeal margin projecting in a distinct angle; frontal lobes small, convex, frontal carinae shorter than lobes, frontal groove extends between these to gradually disappear near the occipital margin; eyes distinct, situated close to the mandibular insertions, 0.03 mm. in diameter; mandibles comparatively short and with several denticles on the cutting surface; antennal scapes failing to reach occipital corners by a distance about equal to their distal diameters. Thorax from above broadest through pronotum, the latter convex laterally and anteriorly, concave behind, suture being distinct dorsally. Petiolar node from above with evenly convex sides and anteriorly, plane posteriorly, the corners rounded. 1st gastric segment from above

1¼ times broader than long, 1st and 2d segments co-equal in length. Legs of moderate proportions.

Shining, finely punctate. Pilosity of moderately abundant appressed to reclinate fine short hairs and scattered longer and upright hairs most numerous on gaster posteriorly. Bright brown, appendages yellow brown.

Holotype: One worker (No. 1395) taken by myself August 2 at an elevation of about 6,400 feet in the Imatong Mts., A.–E. Sudan. The distinct mesoëpinotal impression separates the species easily from the other Imatong *Ponera*.

Ponera muscicola, sp. nov.

(Fig. 13.)

Female (*Dealate*).—Length extended about 3.2 mm. (of thorax 0.9 mm.). Head in front view 1¼ times longer than broad, occipital margin faintly impressed, corners rounded, sides subparallel, anterior clypeal margin angulate in middle; frontal lobes short, frontal carinae shorter, frontal groove extending to the anterior ocellus and posterior to the carinae deepened as an infuscated pit; eyes situated in front of middle of head, laterally placed and feebly convex, 0.14 mm. in diameter; mandibles trigonal with 9 or 10 irregular denticles and a longer, acute apical tooth; antennal scapes nearly reaching occipital corners. Thorax from above with sides convex, pronotum anteriorly convex, epinotal declivity plane. Petiolar node from above antero-posteriorly compressed, anterior surface convex, posterior margin but faintly convex. 1st gastric segment from above slightly broader than long, slightly shorter than 2d segment. Legs of moderate proportions.

Shining, finely punctate. Pilosity of abundant fine, short reclinate hairs becoming longer and coarser on posterior gastric segments. Bright yellowish brown, head darker.

Holotype: One female (No. 1313) taken by myself July 25 at an elevation of about 7,200 feet in the Imatong Mts., A.–E. Sudan. The ant was in wet moss in the cavity of a tree.

Ponera lotti, sp. nov.

(Fig. 5.)

Worker.—Length extended 2.6 mm. (of thorax 0.8 mm.). Head in front view ovate except for truncate occipital margin; excluding mandibles nearly 1 2/5 times longer than broad, occipital margin distinctly impressed, sides markedly convex, anterior clypeal margin projecting in a blunt tooth; frontal lobes short, convex, carinae shorter, frontal groove distinct, ending near middle of head; eyes minute, apparently of a single facet, about 0.03 mm. in diameter, situated near mandibular insertions; mandibles stout, trigonal with a cutting surface with about 6–11 rudimentary denticles, the two or three most distal being most distinct, and a distinct, acute apical tooth; antennal scapes exceeding the occipital margin slightly. Thorax from above with convex pronotal sides, the pronotum being over 1½ times thicker than the epinotum, the latter with

rounded but marginate sides. Petiolar node from above strongly compressed antero-posteriorly. 1st gastric segment from above about 1.4 times broader than long. Legs moderately long and slender.

Shining, microscopically, and finely punctate. Pilosity a short, fine, appressed pubescence not obscuring sculpture. Dark brown, appendages a yellower brown.

Described from several workers (Nos. 1442, 1448) taken by myself August 5 in the Lotti Forest on the west slopes of the Imatong Mts., A.–E. Sudan.

Ponera ambigua, sp. nov.

(Fig. 6.)

Worker.—Length extended about 2.5 mm. (of thorax 0.75 mm.). Head in front view, excluding mandibles, 1.1 times longer than broad and rectangular with rounded corners, occipital margin impressed, sides subparallel, feebly convex, anterior clypeal margin feebly convex; frontal lobes short, convex, carinae vestigial, frontal groove deep and distinct to middle of head from which it continues faintly to occiput; eyes vestigial, in front of middle of head; mandibles elongate, trigonal, with 8 denticles of irregular development of which two are distinct, and a long, acute apical tooth; antennal scape extends approximately to a level with the occipital corners; terminal funicular joint compressed and apically blunt, 0.08 x 0.24 mm., joints 8–10 squarish. Thorax with epinotum lowered and laterally compressed as in *Euponera;* from above the pro- and mesonotum appear ovate in outline, the pronotum being broader than long and with all sides strongly convex except for concave surface joining mesonotum; mesoëpinotal impression distinct on sides. Petiolar node from above with convex anterior surface and plane posteriorly. 1st gastric segment from above broader than long, narrowed anteriorly, 2d segment larger. Legs of moderate proportions.

Shining, finely punctate. Pilosity of abundant short, fine, reclinate hairs and sparse, upright, longer hairs chiefly on terminal gastric segments. Pale brownish yellow.

Holotype: One worker (No. 1452) taken by myself in the Lotti Forest on the west slopes of the Imatong Mts., A.–E. Sudan August 5. The thorax of this ant is like that of many *Euponera* species yet it has but one well-developed tibial spur on the middle and hind legs.

LEPTOGENYS.

Leptogenys (L.) maxillosa (F. Smith), **sericeus,** ssp. nov.

Worker.—Length extended 7.3–7.6 mm. (of thorax 2.4–2.5 mm.). Differing from the typical form found in Africa, Mauritius, Guam, etc., from the variety *vinsonnella* (Dufour) of the Seychelles and from the variety *falcata* Roger of

Cuba in somewhat larger size but especially in its distinctively longer and denser appressed pubscence which gives it a silky sheen.

Cotypes: Workers from one colony (No. 1377) taken by myself at an elevation of about 4,100 feet on the east slope of the Imatong Mts., A.-E. Sudan July 31.

Leptogenys (Leptogenys) africanus, sp. nov.

(Fig. 8.)

Worker.—Length extended 9.5 mm. (of thorax 2.9–3.0 mm.). Head in front view, excluding mandibles, 1.1 times longer than broad, occipital margin slightly concave, sides feebly convex and diverging to the mandibles, clypeus with a median carina, anterior clypeal margin sinuate and produced medially as a rounded tooth, the latter margined with a few thin spine-like hairs; frontal lobes short, convex, frontal carinae subparallel and extending to a level with the eyes, separated by a groove; eyes large, convex, situated closer to the mandibular insertions than their diameters; mandibles long, falcate, narrow, terminating apically as a single tooth; antennal scapes narrow, long, surpassing occipital corners by over a third their length; all funicular joints longer than broad, joints 2–4 more than twice as long as broad. Mesonotum from above bordered anteriorly and posteriorly by distinct sutures; epinotal declivity plane, not marginate. Petiole from above trapezoidal, wider behind than in front and terminating posteriorly in a long tooth. 1st gastric segment from above over 1½ times broader than long, shorter than 2d segment. Legs moderately long and slender.

Head, thorax and petiole coarsely vermiculate-rugose, becoming reticulate on the petiole, entire body finely punctate in addition. Covered fairly uniformly with upright yellowish hairs. Black, appendages becoming dark brown distally.

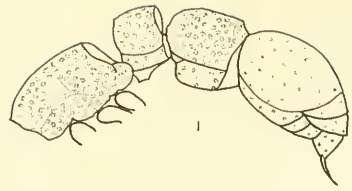
Described from workers of a colony (No. 1452) and strays nearby collected by myself in the Lotti Forest on the west slopes of the Imatong Mts., A.-E. Sudan August 5. This species is noteworthy because of its toothed petiole and coarse sculpture. It may for this be better placed in the Australian subgenus *Odontopelta*. The mandibles and clypeus, however, are those of the typical subgenus.

ANOCHETUS.

Anochetus sudanicus, sp. nov.

(Fig. 7.)

Worker.—Length extended 6.9 mm. (of thorax 2.14 mm.). Head, excluding mandibles, 1 1/6 longer from anterior clypeal margin to occipital angles than broad at eye level; antennal scapes slender, outwardly curved, slightly exceeding occipital angles; mandibles with two large apical teeth and a short third which springs from the base of the lowest tooth. Thorax from above with convex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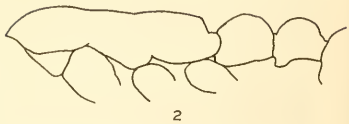
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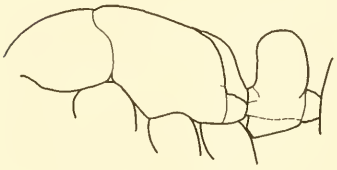
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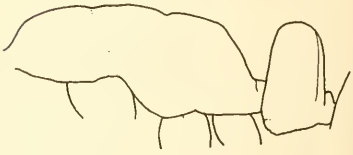
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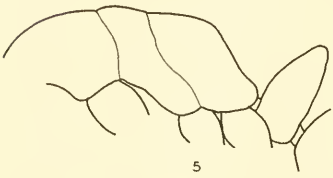
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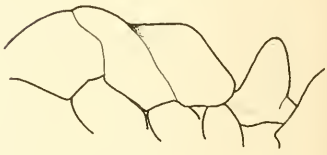
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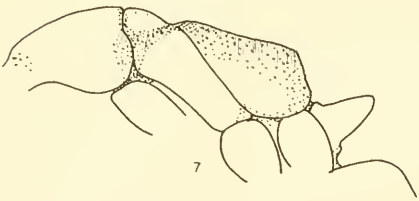
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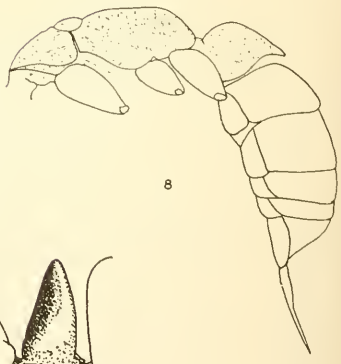
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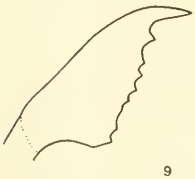
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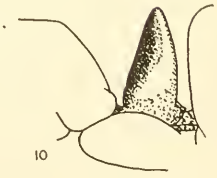
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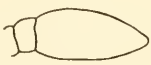
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pronotal and subparallel epinotal sides, the former about 1 2/3 times broader than latter; epinotal declivity faintly impressed medially. Petiolar node from above convex anteriorly, plane posteriorly. 1st gastric segment from above slightly longer than broad and longer than 2d. Legs of moderate proportions.

Shining, striae of front part of head extending to middle; basal and declivous surfaces of epinotum transversely and densely carinate, mesonotum with shallow, transverse striae. Pilosity of sparse, fine, yellowish appressed to reclinate hairs and a few long, upright hairs. Brownish yellow, front of head and gaster infuscated.

Holotype: One worker (No. 1366) taken by myself at the Lango village of Longoforok at the east base of the Imatong Mts., A.-E. Sudan July 29.

This species is close to *A. ghilianii* Spinola of the Mediterranean but differs in having shorter mandibular apical teeth, more slender funicular joints, more angulate epinotum, less circular petiolar node of petiole when viewed from above, more regular and distinct mesonotal striae, coarser epinotal carinae and fewer hairs. It has probably migrated up the Nile valley from the Mediterranean.

Explanation of Plate.

Fig. 1. *Cerapachys* (*C.*) *sudanensis*, sp. nov. Worker thorax and abdomen in side view.
Fig. 2. *Aenictus mentu*, sp. nov. Worker thorax and petiole in side view.
Fig. 3. *Ponera coarctata imatongica*, ssp. nov. Worker thorax and petiole in side view.
Fig. 4. *Ponera mesoëpinotalis*, sp. nov. Worker thorax and petiole in side view.
Fig. 5. *Ponera lotti*, sp. nov. Worker thorax and petiole in side view.
Fig. 6. *Ponera ambigua*, sp. nov. Worker thorax and petiole in side view.
Fig. 7. *Anochetus sudanica*, sp. nov. Worker thorax and petiole in side view.
Fig. 8. *Leptogenys* (*L.*) *africana*, sp. nov. Worker thorax and abdomen in side view.
Fig. 9. *Euponera* (*Mesoponera*) *dentis*, sp. nov. Female mandible.
Fig. 10. *Euponera* (*Mesoponera*) *flavopilosa*, sp. nov. Female petiole in side view.
Fig. 11. *Cerapachys* (*C.*) *pigra*, sp. nov. Worker antenna, terminal segments.
Fig. 12. *Cerapachys* (*C.*) *sudanensis*, sp. nov. Worker antenna, terminal segments.
Fig. 13. *Ponera muscicola*, sp. nov. Female petiole in side view.

XYLOCOMESUS THATCHER A CURCULIONID.

By L. L. Buchanan,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The following note is in explanation of the unfamiliar combination *Rhyncolus knowltoni* (Thatcher) new combination) which the writer has used several times in recent unpublished identification reports.

In the Proceedings of the Utah Academy of Sciences, Arts and Letters, volume XVII, 1940, pages 89 to 91, Mr. T. O. Thatcher erected the new genus *Xylocomesus* and described in it two new species, *cercocarpus* from Nevada and *knowltoni* from Utah. The genus was placed in the Scolytidae. Mr. Thatcher has very generously deposited in the United States National Museum the holotype, as well as paratypes, of each species. Examination of this material shows that both *X. cercocarpus* and *X. knowltoni* are congeneric with such curculionids as *Rhyncolus sprctus* Csy., *R. dorsalis* Lec., etc., and therefore that *Xylocomesus* should be transferred from the Scolytidae to the subfamily Cossoninae of the Curculionidae, where for the present it had best be treated as a synonym of *Rhyncolus* Germar (new synonymy).

A NEW PSYCHOPHORA FROM THE HUDSON BAY REGION (LEPIDOPTERA: GEOMETRIDAE).

By Carl Heinrich.

The following description originally formed part of a paper prepared for the Carnegie Museum and dealing with Heterocera collected on Southampton Island and the shores of Hudson Bay by Dr. George Sutton. The Southampton records were published in 1935 (Mem. Carnegie Museum, vol. 12, part 2, Section 5, pp. 27–29) but records other than these from Southampton were omitted. A description is offered now because a name is wanted for the species.

Psychophora suttoni, new species.

Male.—Wings dull, pale smoky brown, concolorous. Forewing with normal markings obsolete, indicated only by two or three obscure dark spots on costa and very faint indication of discal spot at end of cell. Hind wing with discal dot more pronounced; median, angulate, transverse line barely discernible; subterminal dark line rather well marked; obscure dark blotches on termen at ends of veins. Cilia of both wings paler than ground color and with an obscure dark streak extending from end of each vein. Under side of wings paler; with whitish scales in post-median areas throwing into faint relief the normal broad dark median transverse band; darker ground color along termen of forewing

broken into blotches by paler scales along veins; hind wing with a narrow dark line along termen; subterminal lines on both fore and hind wings irregularly dentate and rather broadly suffused.

Alar expanse 36 mm.

Genitalia similar to those of *sabini* Kirby but without the short flattened thorn-like subcostal spur on the harpe of the latter species.

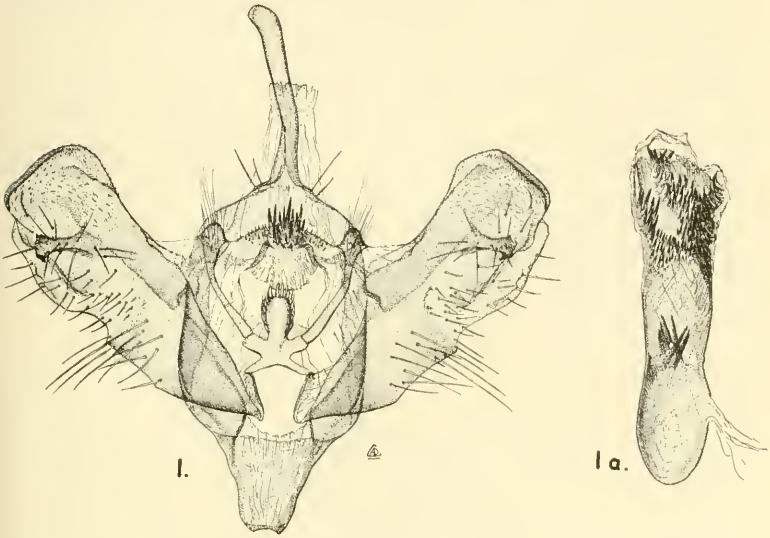


Fig. 1. *Psychophora suttoni*, new species. Male genitalia with aedeagus removed; a1, aedeagus.

Type.—In Carnegie Museum, Pittsburgh.

Type locality.—Little Cape Jones River, east coast of Hudson Bay.

Described from male type collected by Dr. G. M. Sutton, July 18, 1926, and named after the collector.

I have also before me a male from Laggan, Alberta ("19-vii-24, F. H. W. Dodd") and originally in the Barnes collection. In this specimen there is much more pale scaling on the wings, the hind wing is somewhat paler than forewing, the normal dark median band is faintly indicated on forewing, the discal spots are pronounced, there is a row of large terminal spots along termen of forewing similar to those on the under side of the forewing of the type, and only the faintest indication of a subterminal line on hind wing.

P. suttoni is evidently closely allied to *phocata* Möschler from Labrador, but is considerably larger and not nearly so well marked.

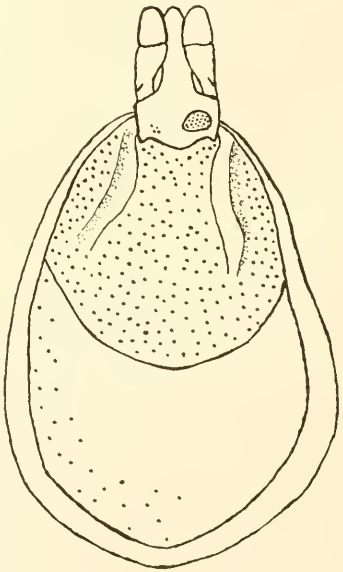
GYNANDROMORPHISM IN IXODES DENTATUS MARX.[1]

By Carroll N. Smith,

Division of Insects Affecting Man and Animals, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture.

Although gynandromorphism is apparently encountered less often among ticks than among insects, cases have been reported by Brumpt (1934, p. 98), Joan (1916, p. 421), and Schulze (1933, p. 427; 1936, p. 83; 1937, p. 160).

In the course of rearing experiments at Vineyard Haven, Mass., a gynandromorph of *Ixodes dentatus* Marx appeared in a group of 11 normal males and 13 normal females. The molting period was 94 days, while that of normal ticks in the same lot ranged from 92 to 134 days. In view of the small number of cases of this type on record it seems desirable to describe the specimen in some detail. A drawing of the dorsal aspect is presented in Figure 1.



[1] A portion of a thesis submitted to the Graduate Council of the George Washington University in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

The capitulum, predominantly like that of the male in contour, is twisted out of line toward the left. The posterior margin of the basis capituli is more convex than in either sex. The right side of the basis capituli bears a porose area identical with that of a normal female, while on the left side there are a few pits. The palpi and hypostome are typical of the male.

In the dorsal aspect, the anterior portion of the body is covered by a heavily sclerotized scutum, characteristic of the female. The posterior portion of the body, which is unsclerotized in the female and covered by the heavily sclerotized scutum in the male, is very lightly sclerotized along the left border, representing an intermediate condition, and shows a pronounced bulge on the right side. The scutum is asymmetrical, extending farther posteriorly on the right side than on the left. The cervical grooves are more like those of the male in contour, but are longer and asymmetrical. Lateral carinae, which are completely absent in the male, are present but much less distinct than in the female, and do not agree with those of the female in contour, as they run more or less parallel to the cervical grooves except for the extreme posterior end of that on the right, which converges with the cervical groove as in the female.

In the ventral aspect the specimen is almost identical with the normal male, only the anal and adanal plates showing any variation. There is only a suggestion of sclerotization of the anal plate, and the adanal plates are incompletely sclerotized on the median sides. The median and pregenital plates and the area around the spiracles are sclerotized as in a normal male. The genital opening resembles that of the male. The ventral aspect of the basic capituli is like that of the male, there being no indication of the prominent auriculae of the female on either side, and the palpi and hypostome are typically male.

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THE SYNONYMY OF IDIOGRAMMA FOERSTER (HYMENOPTERA: ICHNEUMONIDAE).

By R. A. Cushman,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

At the suggestion of Henry K. Townes that the anomalous ichneumonid genus *Lysiognatha* Ashmead apparently has much in common with *Idiogramma* Foerster, I recently sent sketches and descriptive matter of Lysiognatha to J. F. Perkins, hymenopterist of the British Museum of Natural History, with the request tha the investigate the possible synonymy. Mr. Perkins had examined the type of *Macrochasmus alysiina* Thomson (genotype of *Macrochasmus* Thomson) and specimens determined by Foerster of *Idiogramma euryops* Foerster (genotype of *Idiogramma*), and in 1940 (The Entomologist, vol. 73, p. 55) had synonymized the genera and their genotypes.

Mr. Perkins' statement that there appears no doubt that the American species of *Lysiognatha* and *I. euryops* are congeneric is the basis for the inclusion of *Lysiognatha* in the following synonymy, which includes all the significant references to all three generic names.

In his letter Mr. Perkins further stated: "I also believe that the European species is distinct from the three North American species; it comes in the group with the entire occipital carina."

Subfamily Idiogrammatinae, new name.

Lysiognathinae Ashmead, 1900, Proc. U. S. Nat. Mus. 23: 104.

IDIOGRAMMA Foerster.

Idiogramma Foerster, 1868, Verh, nat. ver. Preuss. Rheinlande 25: 163 (no species included by name); Schmiedeknecht, 1888, Zool. Jahrb. 3: 429, and 1906, Opusc. Ichn., fasc. 13, p. 1010 (one species); Perkins, 1940, Entomologist 73: 55. Genotype.—*I. euryops* (Foerster) Schmiedeknecht. Monobasic.

Macrochasmus Thomson, 1888, Opusc. Ent., fasc. 12, p. 1279; Schmiedeknecht. 1911, Opusc. Ichn., fasc. 28, p. 2161; Roman, 1939, Ent. Tidskr. 60: 192, Genotype.—*M. alysiina* Thomson. Monobasic.

Lysiognatha Ashmead, 1895, Proc. Ent. Soc. Wash. 3: 275; 1900, Proc. U. S. Nat. Mus. 23: 104; Cushman, 1934, Proc. Ent. Soc. Wash. 36: 262; 1937, Jour. Wash. Acad. Sci. 27: 438–442. Genotype.—*L. comstockii* Ashmead. Monobasic. (New synonymy.)

MINUTES OF THE 524TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 524th regular meeting of the Society was held at 8 P. M., January 8, 1942, in Room 43 of the National Museum. In the absence of the President and other ranking officers, the Recording Secretary presided, and W. H. Anderson fulfilled the duties of the latter officer. Six visitors and 22 members attended. The report of the December meeting was read and approved.

The Committee on Audit, composed of D. J. Caffrey and L. G. Baumhofer, reported that the 1941 accounts of the Treasurer had been examined and found correct.

The Chairman announced the recent death of Alonzo C. Davis, and, in response to an invitation to do so, L. J. Bottimer spoke briefly of Mr. Davis' life, paying tribute to his entomological work.

In the absence of L. A. Hetrick, R. A. Cushman presented for him a note on an undescribed species of the primitive sawfly genus *Xyela* that Mr. Hetrick had reared from galls on young shoots of loblolly pine (*Pinus taeda* L.) at West Point, Va., and exhibited specimens and biological material. The infested shoots are numerous and usually die, producing an effect on the tree like that of the pine shoot moth, *Rhyacionia frustana* (Comst.).

The larvae from which the reared adults developed were placed in jars with soil in an outdoor insectary in May, 1940, and the adults emerged 19 months later on December 31, 1941. There had been no previous emergence either in these jars or in a soil cage started at the same time or in similar cages started in May, 1941. Data are as yet insufficient to determine whether this long diapause is usual for the species as a whole or, as so frequently occurs among the sawflies, of only a part of the brood. Even though the winter emergence of these individuals. occurred out-of-doors, there may be some question whether this is the normal season for emergence or if the somewhat abnormal ecological conditions of the rearing jar in an unusually warm early part of the winter may have hastened emergence. When full-grown the larva leaves the gall and goes to the ground. The pupa is capable of awkward locomotion and has heavily sclerotized, functional mandibles. By this means the pupa makes its way to the surface of the ground, where transformation to the adult takes place. The pupal exuviae shows very clearly that the long basal segment of the antennal flagellum is composed of nine fused segments. In the pollen-feeding species of *Xyela* the ovipositor is very thin and weakly sclerotized, with oblique, fine striations on its lower members, and in oviposition is inserted between the scales of the staminate cone of the pine. In the gall-forming species the ovipositor is of the piercing type, more heavily sclerotized, more pointed and with several serrations at the apex. To date, two species of parasites have been reared from the *Xyela* galls, *Eurytoma tylodermatis* Ashmead and *Habrocytus thyridopterigis* Howard. Both of these also parasitize the larvae of the pine shoot moth. (Authors' abstract.)

The regular program was as follows:

1. December meeings of the Entomological Society of America. C. F. W. Muesebeck, Bureau of Entomology and Plant Quarantine.

Mr Muesebeck reported that attendance at the meetings held in San Francisco had been surprisingly good, in spite of war conditions. He reviewed three of the

more prominent items on the program, i. e., a joint symposium on the Relation of Taxonomy to Economic Entomology, the Annual Public Address by G. F. Ferris of Stanford University, and the Taxonomists' Conference. In the symposium emphasis was continually placed on the important part insect taxonomy has in all aspects of economic entomology. Our comparatively fragmentary knowledge of immature stages was also brought out. One of the results of the Taxonomists' Conference was the appointment of two individuals to take the leadership in the formation of an unofficial advisory committee on nomenclature, this committee to be composed of representative North American entomologists. Several of the individual papers presented at the meetings were also discussed, and the election of Charles P. Alexander, of the Massachusetts State College, as the new President of the Entomological Society of America, was announced. (Secretary's abstract.)

2. December meetings of the American Association of Economic Entomologists. Floyd Andre, Office of Experiment Stations.

Dr. Andre summarized the address presented by the Retiring President, J. R. Parker, and spoke briefly of other outstanding features of the annual meetings. Remarks were made by Townes and Hyslop.

3. Entomological features of the New York meetings. S. B. Fracker, Bureau of Entomology and Plant Quarantine.

Dr. Fracker reviewed a series of meetings held in New York City primarily for the benefit of statistical workers, but which included programs of interest to any one concerned with the interpretation of data connected with biological problems. He warned against accepting all results based on mathematical formulas, and gave a digest of the discussions most applicable to the work of our members. (Secretary's abstract.)

4. Meetings of the American Association for the Advancement of Science. S. A. Rohwer, Bureau of Entomology and Plant Quarantine.

The recent meetings held in Dallas, Texas, were attended by Mr. Rohwer, who found a large number of entomologists present, in spite of the meetings held in San Francisco. He told of a very enthusiastic symposium on virus diseases in relation to plant quarantines, and emphasized the great abundance of free, thought-provoking discussions. (Secretary's abstract.)

Two visitors, Richard P. Dow and Herbert T. Dalmat, were introduced, and each spoke briefly.

Adjournment at 10 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

MINUTES OF THE 525TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

The 525th regular meeting of the Society was held at 8 P. M., February 5, 1942, in Room 43 of the National Museum. President Cory presided, and 33 member and 13 visitors attended. The report of the previous meeting was read.

The Corresponding Secretary, F. M. Wadley, read a letter from Mrs. E. D. Ball in which appreciation was expressed for the action of the Executive Committee in placing Dr. Ball, a member for many years, on the list of retired members.

The President announced that F. C. Bishopp and H. H. Stage had been appointed to prepare an obituary of the late J. L. Webb, and that C. A. Weigel and L. J. Bottimer were serving in a similar capacity in connection with the death of A. C. Davis. Obituary statements were read by Stage and Bottimer, and it was voted to publish them in the Proceedings.

The following individuals were elected to membership in the Society: R. Joseph Kowl, Division of Forest Insect Investigations, Bureau of Entomology and Plant Quarantine, Beltsville, Md.

W. L. Popham, Bureau of Entomology and Plant Quarantine, Washington, D. C.

Frank H. Spencer, Bureau of Entomology and Plant Quarantine, Washington, D. C.

Sidney L. Suib, National Institute of Health, Bethesda, Md.

Under Notes and Exhibition of Specimens, A. G. Böving reported the recent receipt of larvae of a European scarabaeid beetle, collected in New York State. It is suspected of being *Amphimallus solstitialis* (L.) Further developments regarding the apparently limited infestation are awaited with interest.

The first item on the regular program was the Address of the Retiring President, H. E. Ewing, "The origin and classification of the Apterygota." This was presented with the aid of lantern slides and has been prepared for publication in the Proceedings.

A second talk, entitled "Feeding mechanism of the honey bee," was given by R. E. Snodgrass. This dealt with functional and morphological details of the mouth structures of the honey bee, accompanied by an abundance of illustrations, and will eventually appear elsewhere as a published paper. Questions by Bohart and Cope followed.

Austin H. Clark introduced Gordon J. Lockley, an English scientist now in the Royal Navy. Bryant E. Rees similarly introduced Oliver B. Cope and George E. Bohart, of the United States Navy. Brief greetings were made by the following visitors: H. D. Harradon, of the Department of Terrestrial Magnetism, Carnegie Institute of Washington; W. E. Dove, of the Bureau of Entomology and Plant Quarantine; Waldo L. Schmitt, of the U. S. National Museum.

Adjournment at 10 P. M.

ASHLEY B. GURNEY,
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PROCEEDINGS OF THE

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A NEW, APPARENTLY PARASITIC ANT.

By MARION R. SMITH,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture

The ant *Leptothorax curvispinosus* Mayr, which is distributed over most of the eastern half of the United States, is recorded as a host to two other species, *Harpagoxenus americanus* (Emery) and *Leptothorax duloticus* Wesson. The interesting relationship that exists between *curvispinosus* and *americanus* has been carefully studied by Sturtevant (Psyche 34: 1, 1927), Creighton (Psyche 34: 11, 1927), and Wesson (Amer. Ent. Soc. Trans. 65: 97, 1939); and that between *curvispinosus* and *duloticus* by Wesson (Bklyn. Ent. Soc. Bull. 35: 73, 1940).

A new ant, described below as *Leptothorax minutissimus*, is also believed to be associated with *L. curvispinosus*, since several workers of the latter which have been examined belong to the same collection series as the four minute females of *minutissimus;* and it was the habit of the collector to take ants only from colonies. The female has a general habitus somewhat similar to that of the female *curvispinosus*. The possibility that the new species may be a parasite is strongly suggested by its exceedingly small size. Unfortunately, the lack of sufficient specimens and of biological data prevents assignment of *minutissimus* to its proper subgenus.

Leptothorax minutissimus, new species.

(Fig. 1, *A*.)

Dealate female.—Length 3 mm. (with the gaster greatly distended).

Head approximately as broad as long when measured through the eyes, with distinctly emarginate posterior border, rounded posterior corners, and subparallel sides. Ocelli small, but clearly visible. Eye not large, but rather convex, approximately its greatest diameter from base of mandible. Antenna 11-segmented; scape rather robust, not attaining posterior border of head; antennal club 3-segmented, longer than remainder of funiculus. Clypeus broader than long, convex, with rounded anterior and posterior borders. Mandible with 2 prominent apical teeth and a number of smaller, indistinct teeth. Thorax short, stout, broadest anteriorly; pronotum with angular humerus posterior to which is a slight lateral concavity; epinotum with a pair of unusually long, bluntly pointed, posteriorly divergent, digitiform spines directed slightly

MAY 5

dorsad. Petiole with a very high and short node narrower above than below, and with steeply descending anterior and posterior faces; postpetiolar node approximately twice as broad as long, broadest anteriorly, the node narrowed above and short, anterior and posterior faces also steeply descending; superior border of petiole, and postpetiole, slightly emarginate; petiole, in profile, appearing almost nonpedunculate and with the anterior and posterior faces meeting above to form a very sharply defined angle, which is much less than a right angle; postpetiole, in profile, with anterior and posterior faces meeting in a broadly rounded angle.

Dorsal surface of head covered with dense, minute alveoli; cheeks and region between eyes and frontal carinae also with very small longitudinal rugulae. Sculpturing on dorsal surface of thorax more indistinct than on head, the prothorax, however, with a tendency to rugulose-reticulate sculpturing, especially around the humeri. Petiole and postpetiole weakly alveolate except on their anterior faces, which are smooth and shining. Femora, tibiae, and gaster also smooth and shining.

Hairs rather sparse; coarser, longer, and more erect on head and thorax than on gaster.

Light brown or yellowish brown, with edge of mandible, head, sutures on dorsum of thorax, and gaster much darker.

The holotype and three paratype specimens, all females, bear the label Eastern Branch, District of Columbia, January 6, 1921, H. S. Barber. According to Mr. Barber they were collected at the edge of a marsh and presumably from a single colony.

Holotype and three paratypes, U. S. National Museum, No. 56210.

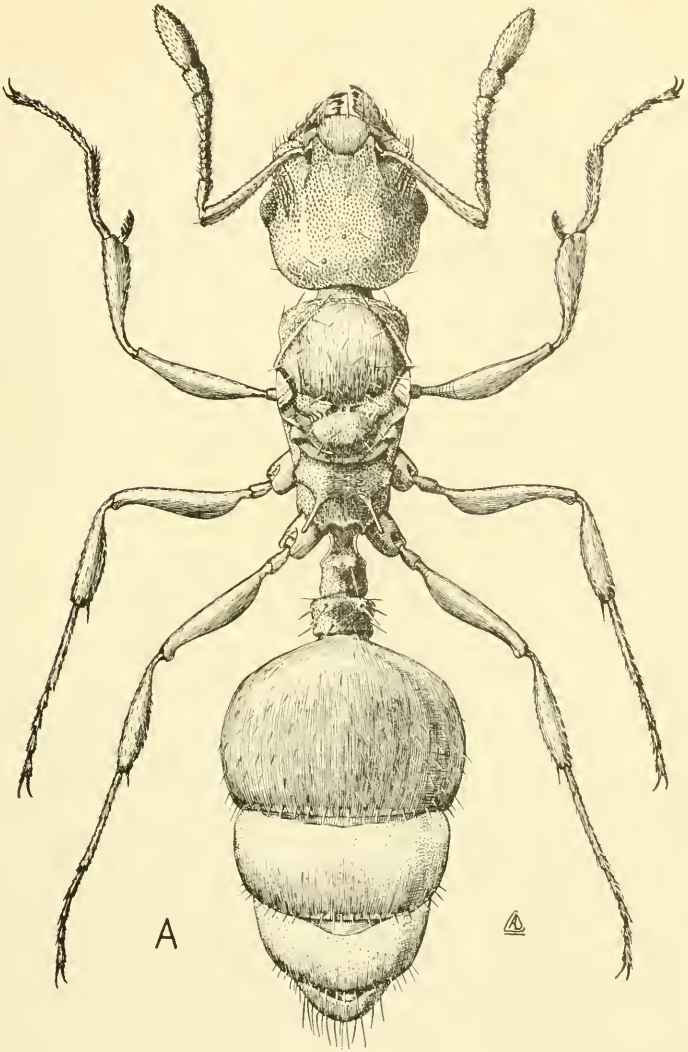
The paratypes range in length from approximately 2.3 to 2.5 mm. Two of the three specimens have shorter and more horizontally directed epinotal spines than the holotype. The anterior wing of the only alate paratype (Fig. 1, *B*) has a cubital cell but lacks a radial and a discoidal cell.

The female of *minutissimus* can be distinguished from that of *duloticus* by its smaller size (*duloticus*, 3.25 mm.), emarginate posterior border of the head, lack of an emargination on the anterior border of the clypeus, longer, digitiform epinotal spines, shorter thorax and legs, smaller eyes, differently shaped petiole and postpetiole, and absence of a discoidal cell in the anterior wing. (For a description of the female of *duloticus* see Ent. News 48: 125, 1937.) The female of *minutissimus* differs from that of *curvispinosus* in its smaller size (*curvispinosus*, 2.75–3.3 mm.), more slender head with posteriorly emarginate border, smaller and less convex eyes, longer, more digitiform epinotal spines, differently shaped petiole and postpetiole, and different sculpture and color.

Explanation of Plate 6.

Fig. 1, *A*, Dealate female of *Leptothorax minutissimus*, new species; *B*, anterior wing of female.

(Female drawn from holotype specimen, wing from paratype specimen. The illustrations by Arthur D. Cushman.)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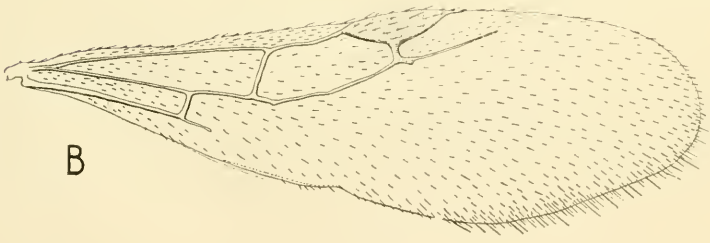
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THE MALES OF TWO NORTH AMERICAN CERAPACHYINE ANTS.

MARION R. SMITH,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture

The very rare and primitive ants of the subfamily Cerapachyinae Forel were previously represented in the United States by only two species, *Acanthostichus* (*Ctenopyga*) *texanus* Forel and *Cerapachys* (*Parasyscia*) *augustae* Wheeler. This paper includes the description of the male of a new species of *Cerapachys* subgenus *Parasyscia*, and that of the heretofore unknown male of *augustae*.

Our first recorded cerapachyine species was *augustae*, which Wheeler described and figured from workers and a female collected at Austin, Tex., by Miss Augusta Rucker. Later he was able to add some interesting observations on the biology of this species and to furnish a description and figure of the egg and larval stage. Forel (Ann. Soc. Ent. Belg. 48: 168, 1904) described the second species, *texanus*, from a female collected at Brownsville, Tex., by Wickham. Except for workers of *augustae* in the United States National Museum, and for the types of the two species which are in other museums, no North American ants of the subfamily Cerapachyinae seem to have been recognized heretofore in the collections of this country. Of the 25 specimens of *augustae* in the United States National Museum, 3 were taken at El Paso, Tex., by a quarantine official of the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, from plants originating in Mexico. The remaining 22 specimens were removed from the stomach of an armadillo at Huntsville, Tex., by F. W. Tabor, of the Bureau of Biological Survey, United States Department of Agriculture.

Since no male has ever been described for any species of *Cerapachys*, subgenus *Parasyscia*, the descriptions of the male of *augustae* and of the new species should be of considerable significance; for this reason, I have thought it advisable to figure the male of *augustae*.

Although the male of *Acanthostichus texanus* is still unknown, the generic characters for the caste of this species can well be obtained from that of the Mexican species *Acanthostichus* (*Ctenopyga*) *townsendi*, which was described and figured by Ashmead (Proc. Ent. Soc. Wash. 8: 29, 1906). The males of our North American *Acanthostichus*, subgenus *Ctenopyga*, can be distinguished from those of *Cerapachys*, subgenus *Parasyscia*, by the prescence of Mayrian furrows, more than one cubital and discoidal cell (usually two or three of each) in the front wing, an impressed or flattened area (pygidium) with scalloped

border on the sixth gastric tergite, and a very much stouter forked process on the seventh gastric sternite.

Cerapachys (Parasyscia) augustae Wheeler.

Cerapachys augustae Wheeler, 1902, Biol. Bull. 3: 182; Wheeler, 1903, Psyche 10: 205.

Male.—Length 3.2–3.5 mm. (Fig. 1, A.)

Fig. 1A, Male of *Cerapachys* (*Parasyscia*) *augustae* Wheeler. B, Front wing. Drawn by Arthur D. Cushman.

Head measured through the eyes approximately 1.15 to 1.25 times as broad as long. Mandible well developed, masticatory border curved, ending in a long tooth, remainder of border toothless or with very minute teeth. Anterior border of clypeus with a median tooth or angular projection. Antennal fossa contiguous with posterior border of clypeus. Frontal carinae subparallel, not concealing articulations of antennal scapes. Clypeus broader than long. Eye large, very convex, placed near anterior border of head. Ocelli prominent, placed at summit of head. Posterior border of head round, meeting each side to form a rather distinct, subangular, posterior corner. Antenna 13-segmented; scape very slightly longer than combined length of first 2 funicular segments, funiculus gradually enlarging apically, segments robust, last funicular segment longer than combined length of the 2 preceding segments. Pronotum less than one-third as long as mesonotum, strongly inclined, but not concealed by mesonotum. Parapsidal sutures but no Mayrian furrows, the former seen only in certain lights. Front wing (Fig. 1, B) with a very large stigma, discoidal cell absent or present but without cubital or radial cell. Legs moderately long, tibial spurs pectinate, spurs on front and hind tibiae especially well developed. Anterior three-fifths of mesonotum convex in profile. Petiole nonpedunculate, sybcylindrical in profile, slightly flattened above, approximately one and one-third times as long as high. First gastric segment distinctly higher than long. Gaster subelliptical from above, with distinct constrictions between the segments. Sixth gastric tergite without an impressed area (pygidium). Seventh gastric sternite with a forked process, each fork slender, narrowed and curved apically, with the point directed slightly dorsad.

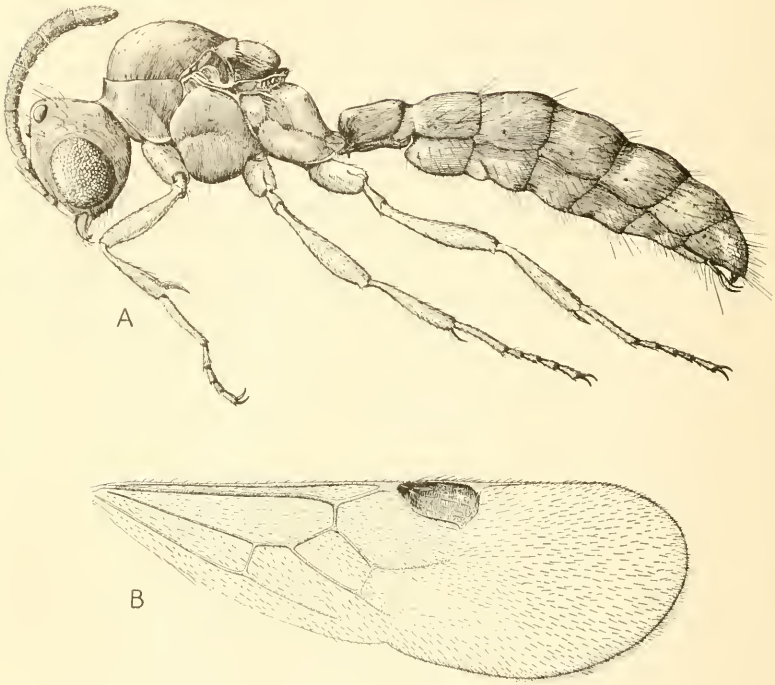
Body smooth and shining, with the following exceptions: Coarse rugulae between mesonotum and scutellum, and fine reticulae on side of scutellum, and on metanotum; a few scattered, piligerous punctures on the body, these especially noticeable on summit of head, mesonotum, and posterior part of dorsal surface of gaster.

Hairs moderately abundant, slender, grayish, unusually long at apex of gaster; row of hairs at posterior border of each gastric segment; pubescence rather dense and closely appressed on funiculus, apparently longer and less appressed on legs.

Rather uniform dark reddish brown; legs lighter.

Described from 4 specimens labeled as follows: Florence, Ariz., June 13, 1902, Ashmead collection; Florence, Ariz., July 28, 1917, W. M. Wheeler; Higley, Ariz., October 1, 1916, E. G.

Holt; Quijotoa, Pima County, Ariz., August 27, 1927, Cornell University, Lot 542.



Cerapachys (Parasyscia) davisi, new species.

The male holotype of *davisi* differs from the known males of *augustae* as follows:

Size larger (3.8 mm.); posterior border of head rounded and merging into each side without forming as definite a subangular posterior corner; all funicular segments except first distinctly longer than broad (less incrassated than in *augustae*); pronotum almost one-half length of mesonotum; front wing with or without a closed cubital cell; veins more prominent and more nearly enclosing radial and cubital cell (when cubital cell is not completely enclosed); sculpture different, *davisi* having fine rugulae between inner border of eye and antenna, and similar rugulae on epinotum, especially the sides of epinotum; sixth tergite more coarsely sculptured, subopaque; color dark brown, almost black.

Described from holotype and 3 paratype specimens, each bearing the label "Fort Davis, Tex., Jeff Davis County, 5000 feet, Davis Mountains, Mrs. O. C. Poling, Nov. 15, 1927." These have been assigned United States National Museum Number 56091.

The paratypes range in length from 3.8 to 4.2 mm.

A NEW GENUS AND SPECIES OF BRACHYCISTIDINAE (HYMENOPTERA : TIPHIIDAE).

By Karl V. Krombein,
Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The male specimens on which the following new genus and species are based were found recently while I was sorting some miscellaneous material in the collection of the United States National Museum. The genus is described at this time so that it will be available for inclusion in a forthcoming revision of brachycistidine males by C. E. Mickel. The illustrations are by Arthur D. Cushman of the Bureau of Entomology and Plant Quarantine.

Superficially the specimens bear a very strong resemblance to some of the more pilose species of *Tiphia* in the Tiphiinae, but they possess simple claws and lack an epicnemial furrow, and the tegulae do not cover the axillary sclerites of the forewing, characters which separate the Brachycistidinae from the Tiphiinae. Apparently this new genus is most closely related to the Castanea Group in *Brachycistis* Fox, though differing abundantly in generic characters, as indicated in the diagnosis given below.

The dark color, small ocelli, and compound eyes indicate that this species is diurnal, as contrasted to most brachycistidine males, which are nocturnal, stramineous or brownish orange, and have enlarged ocelli and compound eyes.

COLOCISTIS, new genus.

Genotype.—Colocistis pilosa, new species.

Generic characters.—Male: Head transverse, rounded, broader than high in anterior aspect, coarsely and closely punctate and clothed with abundant, long pilosity; mandible tridentate apically, the lowest tooth longer than the others, and with a curved carina running from anterior attachment of mandible to innermost tooth; compound eye relatively smaller than in *Brachycistis*, not protruding laterally beyond temple in anterior aspect, the inner orbits moderately convergent toward clypeus and not so distinctly emarginate as in *Brachycistis*.

Thorax short, broad, and clothed with abundant, long pilosity; humeral angles of pronotum rounded, not prominent; parapsidal furrows long and deep; scutellum very convex; propodeum very short, the dorsal, lateral, and posterior surfaces distinct, the dorsal and posterior surfaces separated by a low ridge.

Forewing with three submarginal cells; stigma large, subrectangular.

Abdomen with fringes of long, abundant pilosity at apices of first to sixth tergites and second to fifth sternites; pygidium with a deep lateral sulcus on apical half; first tergite with a transverse carina between anterior declivous and posterior horizontal surfaces; second sternite with anterior fourth sharply and

slightly raised above remainder of sternite, the posterior margin of the raised portion broadly and shallowly V-shaped.

Female.—Unknown.

Remarks.—The comparatively smaller compound eyes and ocelli, the relatively coarser puncturation, very convex scutellum, abbreviated propodeum, very abundant pilosity, and deep lateral sulcus of the pygidium distinguish *Colocistis* from its closest relative, the Castanea Group of *Brachycistis*.

Colocistis pilosa, new species.

Male.—Length 11.5 mm. Black; palpi, tegula, and legs tinged with fuscous. Pilosity white, tinged with yellow.

Head (fig. 2) shining, on the whole rather closely and coarsely punctured, clothed with abundant, erect pilosity; clypeus transverse, finely and sparsely punctured, the median third somewhat produced apically, the apical margin of produced portion thickened and tridentate; inferior border of antennal socket slightly raised but not carinate; front with an impunctate space before fore ocellus; ocelli small, arranged in a low triangle, fore ocellus set in a depression, hind ocelli facing distinctly laterad, postocellar distance only slightly less than ocellocular distance; hypostomal carina low, separated posteriorly from occipital carina by a very short distance.

Thorax shining; pronotum dorsally with close, contiguous punctures and abundant, erect pilosity, laterally less closely but more coarsely punctate and with sparse pilosity; propleuron very sparsely punctured, with little pilosity; mesoscutum with moderately coarse punctures which are closer anteriorly and between parapsidal furrows and with sparse, short pilosity; tegula glabrous, with a few scattered punctures; scutellum strongly convex, declivous posteriorly and laterally, and with moderately close, coarse punctures around declivity and longer pilosity than on mesoscutum; postscutellum rather closely punctured laterad of a median impunctate area and with long pilosity; mesopleuron coarsely and subcontiguously punctured, the pilosity moderately dense and long; metapleuron impunctate except for some contiguous punctures above; dorsal surface of propodeum irregularly rugose, bare, separated from posterior surface by an irregular, low ridge; posterior surface of propodeum antero-laterally coarsely and closely punctured and pilose, finely and closely punctured near abdominal attachment, remainder of surface impunctate; lateral surface of propodeum impunctate along metapleural suture, coarsely and rather closely punctured elsewhere.

Wings (fig. 3) hyaline except for infumated apex of forewing; stigma and veins fuscous; forewing with first and second submarginal cells subequal in length, the third subquadrate and less than half as long as second submarginal cell along cubital vein, the marginal cell truncate, its apex not extending much beyond apex of third submarginal.

Legs, except tarsi, covered with sparse, moderately long pilosity, tarsi with decumbent, shorter pilosity, middle and hind tibia with a few spines near apices, hind coxa carinate along inner margin beneath.

Abdomen, except first segment, somewhat subopaque owing to very fine

shagreening, apices of first to sixth tergites and second to fifth sternites with abundant, long, recumbent pilosity; first tergite shining, anterior declivous and posterior horizontal surfaces separated by a low, transverse ridge, the anterior declivity with fine, scattered punctures, the horizontal portion with moderately coarse, subcontiguous punctures on sides and apical half; second tergite with scattered, smaller punctures except along apical margin, where punctures are subcontiguous; third to sixth tergites with smaller punctures which are not so scattered on the disk and are about as close along apical margins as on second tergite; pygidium with a rather sharp, median, longitudinal ridge on apical half, on each side of which is a broad, shallow, punctate sulcus, the area laterad of sulcus with coarse, deep, moderately close punctures; second sternite with basal fourth sharply but slightly raised, the posterior margin of raised portion broadly and shallowly V-shaped, the apical three-fourths sparsely and coarsely punctured except laterally and along posterior margin, where punctures are closer; third to fifth sternites more finely and closely punctured discally; sixth sternite with basal two-thirds finely and closely punctured, the apical third impunctate.

Genitalia (fig. 1) with parameres very hairy; postero-dorsal area of left basiparamere (fig. 1, *a*) decidedly asymmetrical (apparently this is an abnormal development, since the basiparameres of the paratype are symmetrical and shaped like the right basiparamere of the holotype).

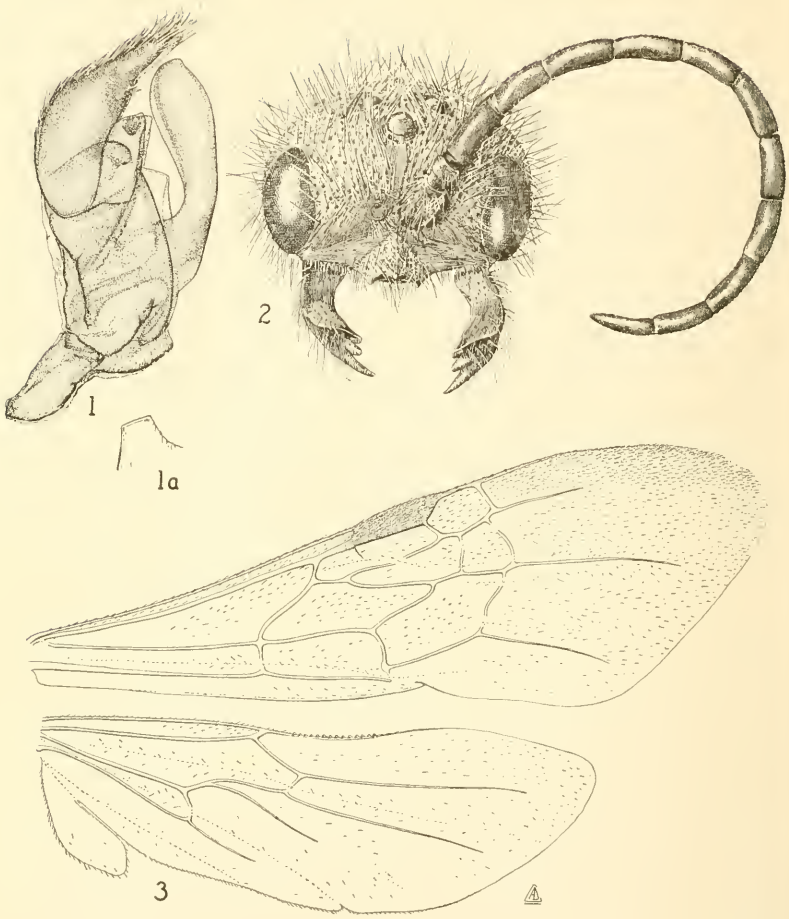
Female.—Unknown.

Type.—Male, San Diego, Calif., June 22, 1890 (F. E. Blaisdell). (From Bridwell Collection.) [United States National Museum type no. 55728.]

Paratype.—One male with same data as type, but August 26, 1891. [U. S. National Museum.] The paratype has been deposited in the collection of the University of Minnesota.

The paratype is 11.0 mm. long and the antenna is fuscous beneath, long and filiform, the flagellar segments moderately crenulate and subequal in length, except for the first, which is slightly shorter.

The form of the apical margin of the clypeus is quite different from that of the various species of *Brachycistis* and possibly may be of generic significance, though material of other species of *Colocistis* will be needed before this point can be ascertained.



EXPLANATION OF PLATE 7.

Colocistis pilosa, new species.

Fig. 1. Right lateral aspect of genitalia (holotype).

Fig. 1a. Left lateral aspect of postero-dorsal corner of basiparamere (to illustrate asymmetry of this part in holotype).

Fig. 2 Frontal aspect of head.

Fig. 3. Wings.

TRAP-LIGHT STUDIES ON LEAFHOPPERS OF THE GENUS EMPOASCA (HOMOPTERA: CICADELLIDAE), 1932-1941.[1]

By Nancy H. Wheeler,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture

Over a period of 10 years, 1932–41, two trap lights were in operation at Arlington Experiment Farm, Arlington, Va., to collect species of leafhoppers of the genus *Empoasca*. This project was terminated in December, 1941, when the Arlington Experiment Farm was occupied by the War Department.

Results of determinations of *Empoasca* obtained in the trap lights during the period 1932 to 1935, inclusive, have already been published (5), and it is the purpose of this paper to bring these data up to date with a summary of the determinations of the species of *Empoasca* obtained during the entire period, 1932 to 1941, inclusive.

The equipment and methods, previously described, were the same for each season. The period of operation, as usual, was determined by weather conditions, the earliest starting date in any year being April 4, and the latest concluding date being December 5, at least a week after the last *Empoasca* had been caught.

The various empoascan species obtained from the trap lights during the ten seasons, together with the total number of each species collected, are listed in table 1 in the order of their abundance. A total of 60,938 specimens was counted, of which 26,062 were females and 34,876 were males. From the 29,528 males identified by examination of the structures of their internal genitalia, and by means of the sternal apodemes, when present, 30 species were determined, the maximum number of species obtained during a single season being 21.

Table 1.—Summary of empoascan males determined as to species, collected in trap lights, Arlington Experiment Farm, Va., 1932–41.

SPECIES	TOTAL NUMBER	SPECIES	TOTAL NUMBER
abae (Harris)	24,953	*ditata* DeLong and Caldwell	9
erigeron DeLong	2,685	*unica* Provancher	8
pergandei Gillette	558	*delongi* Poos	7
alboneura Gillette	239	*copula* DeLong	2
solana DeLong	201	*curvata* Poos	2
recurvata DeLong	199	*incida* DeLong	2
sativae Poos	194	*pallida* Gillette	2
bifurcata DeLong	140	*radiata* Gillette	2
birdii Goding	82	*ellisae* Wheeler	1

[1] Grateful acknowledgment is made to various members of the laboratory staff for assistance in obtaining these collections.

salicis Wheeler	67	*luda* Davidson and DeLong	1
atrolabes Gillette	66	*smaragdula* Fallen	1
obtusa Walsh	36	*torqua* DeLong and Davidson	1
patula DeLong	20	*trifasciata* Gillette	1
maligna (Walsh)	13	*vergena* DeLong and Caldwell	1
chelata DeLong and Davidson	12	Indeterminate	11
dentata DeLong and Davidson	12		
		Grand total	29,528

Species not previously obtained in field collections were obtained for the first time in this locality by means of the trap lights. These were *atrolabes*, *chelata*, *copula*, *dentata*, *ellisae*, *incida*, *obtusa*, *pallida*, *patula*, *torqua*, *trifasciata*, *and unica*. Most of these species are relatively scarce in this vicinity and their collection in the trap lights furnished in 9 out of the 12 instances new records for their occurrence in this locality. A comparatively rare species, *luda*, was collected for the first time in the trap lights in 1941. Only a few specimens had previously been recorded, two in the original description (1), one from Ohio and the other from Illinois; six collected by F. W. Poos, July 21, 1932, on a birch tree at Arlington, Va.; one identified in a collection from R. H. Beamer (no host given) collected August 20, 1934, at New Haven, Conn.; and three males and two females recently identified in a collection received from W. L. Putnam, collected on *Betula pendula* var. at Vineland Station, Ontario, June 28, 1940.

The trap-light collections have yielded specimens used in the descriptions of new species. *Empoasca sativae* was described by Poos (3), and *ellisae* and *salicis* were described by the author (5). Species studied in connection with the revision of certain groups have also been procured from this source. Specimens of *alboneura* have been collected in the trap lights and were of use in the revision of the *alboneura* group (7). Likewise, two specimens of *radiata*, of the group recently revised (6) and not commonly found in this locality, were taken in the trap lights during 1941. Specimens of *birdii*, *vergena*, *and pallida*, species involved in the establishment of new synonymy (5), have also been collected in the trap lights.

Of interest during one season was the appearance of *pergandei* in considerable numbers in May, indicating that a brood of adults of this species had appeared at this time. This observation was confirmed by the rearing of nymphs collected on black locust early in May, all of which proved upon identification to be this species.

The data obtained on the seasonal occurrence and abundance of *fabae* in the trap lights, as correlated with those obtained in the field, have been more or less constant throughout the 10-year period. The earliest record for the appearance of *fabae*

(verified by the determination of males only) was the collection of one male April 19, 1938, the only time that this species has appeared at Arlington, Va., either in the field or in the trap lights, before the first week in May. The evidence that *fabae* has not been taken in the trap lights or in collections made by sweeping with an insect net in the field at Arlington Experiment Farm prior to this date continues to indicate that this species migrates northward each season (2). Observations (4) on the significance of young oak and hickory foliage in the northward migration of this species and of its appearance and increase in populations in the trap lights have been confirmed each spring. First indications of extreme abundance of this species have been obtained at approximately the same date in mid-June each year. Even in the season that this leafhopper made its earliest appearance at Arlington Experiment Farm, 16 days earlier than it had ever been observed here, the usual heavy populations of *fabae* did not appear until the middle of June, owing no doubt to the cool, dry weather during May. The last species to be taken seasonally in the trap lights has also been *fabae*, two males of which were collected November 22, 1940, although a female (indeterminate) was taken as late as November 29, 1934.

Each year after its initial appearance, *fabae* has invariably increased in population as the season advanced and has remained by far the most abundant of all the empoascan species taken in the trap lights, with 24,953 out of the total of 29,528 males identified. Others, in order of abundance, were *erigeron*, 2,685; *pergandei*, 558; *alboneura*, 239; *solana*, 201; *recurvata*, 199; *sativae*, 194; and *bifurcata*, 140. Twenty-two other species were represented in the trap-light collections by less than 100 specimens each, 6 of which were represented by only a single specimen. Eleven specimens, listed as indeterminate, may involve some undescribed species, but lack distinct enough characters, both externally and internally, to justify description until larger series are procured for further study.

In a comparison of trap-light collections of empoascan leafhoppers at Arlington Experiment Farm with those received from trap lights operated in Kansas (by H. H. Walkden) and in Tennessee (by W. W Stanley), the variety of species obtained was similar, with the usual occurrence of single specimens of species rarely found in field collections. The more common species occurred in like proportions, with *fabae* by far the most abundant and usually reaching its maximum abundance in June and July.

From the data submitted, therefore, it may be concluded that the operation of the two trap lights at Arlington Experiment Farm has proved their value in determining the variety of empoascan species present, the time of their occurrence, and their relative abundance. Throughout the entire period, col-

lections of *Empoasca* in the trap lights have continued to yield a greater variety of species (including some rare and some new to science) than it has been possible to collect by the sweeping method, and with very much less effort. New information on various species of *Empoasca* has been obtained, as well as the confirmation of other data. With particular reference to the potato leafhopper, *Empoasca fabae* (Harris), practical use has been made of data obtained by the use of these trap lights when correlated with observations (4)[2] on this economically important insect, made under field conditions during the same period.

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[2] Poos, F. W., and Wheeler, Nancy H. Unpublished data.

BOOK NOTICE.

College Entomology: E. O. Essig, Professor of Entomology, University of California, 8 vo., buckram, pp. I–VII and 1–900, illustrations 308. $5.00, New York, The MacMillan Company, 1942.

As a college text book, this work differs somewhat from existing American school texts in that it includes much information on insects of the world at large. In his preface the author states that he has desired "to create a feeling of concern and good will toward insects in general," rather than to emphasize their destructive tendencies. In systematic arrangement, the rules and decisions of the Commission of Zoological Nomenclature have been followed so far as possible. The illustrative matter as a whole is very good although fluctuating rather widely in merit of the individual figures. It is cleverly and usefully arranged and evinces earnest endeavor to render the figures effective in conveying the desired information to the student. In many cases, the names of the depicted anatomical parts are placed adjacent to their respective figures, thus eliminating the use of letters or numbers to be referred to in the text. The text begins with a brief discussion of the metamorphosis of insects and is followed by 40 pages on their anatomy. The illustrations in this chapter are liberal in number and excellent in their ability to show clearly the internal anatomy in several orders. Chapter 3 on the Classification of Insects contains a key to the orders recognized, and the remainder of the work consists in a discussion of the insects ordinally, from the *Protura* to the *Siphonaptera*.

In most cases, keys to the suborders, superfamilies and principal families are included. In many orders, important anatomical characters of adults, both internal and external, are tabulated in a convenient and easily comparable form. Abundant reference material is interlarded with the accounts of the various orders. Indices both of authors and subjects are provided and a welcome innovation is the placing on the fly leaves and inside covers, of maps showing the zoogeographical regions of the world, in colors. This somewhat different, well-printed book should prove a welcome addition to existing entomological literature intended for the instruction of college and other students. —W. R. Walton.

MINUTES OF THE 526TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, MARCH 5, 1942.

The 526th regular meeting of the Society was held at 8 P. M., Thursday, March 5, 1942, in Room 43 of the National Museum. President Cory presided, and 30 members and 8 visitors attended. The report of the previous meeting was read.

A. G. Böving reported that the scarabaeid beetle discovered in New York, which had been suspected of being *Amphimallus solstitialis* (L.), has been tentatively identified as *A. majalis* Razoum. One adult female has been received, in addition to larvae.

E. A. Back exhibited a very old Russian icon recently purchased at an exhibit in Chicago. It had been injured by the anobiid beetle *Anobium striatum* Oliv., and many exit holes were visible. These icons are works of art executed on wood in egg tempera and gold leaf. Comment was made by Snodgrass.

A letter from Professor Hutson of Michigan State College was read, conveying the thanks and best wishes of R. H. Pettit. Professor Pettit was recently placed on the Society's list of retired members.

The regular program included two illustrated talks by members of the Bureau of Entomology and Plant Quarantine:

1. Dog fly control in Northwest Florida. H. H. Stage.

Stomoxys calcitrans (L.) has been breeding in enormous numbers in great windrows of fermenting aquatic vegetation cast up on the shores of bayous and backwaters reaching inland from coastal areas in northwestern Florida. The adults have been very troublesome and have resulted in important cattle losses. The best means of control has been found to be creosote oil, diluted in a light diesel fuel oil. Treatment was made from barges operating in shallow adjacent waters, each barge equipped with a power sprayer and lines of hose with nozzles. In 1941 the equivalent of 700 miles of shoreline were treated, due to the application of more than one treatment in some instances. About 270 gallons per mile were used. Inland areas in the Southeastern States have frequently experienced *Stomoxys* plagues resulting from fly breeding in decaying trash left in peanut fields, in which case disposal of the trash is the remedy. (Secretary's abstract.) Questions were asked by Back and Cory, and other comments were made by Jones and Yeager.

2. Queen rearing and nectar gathering by honeybees. J. I. Hambleton.

Mr. Hambleton gave an interesting discussion of the effect of the war on the importance of honey bees. Administrators connected with the war effort have recognized that bees are essential for purposes of pollination. Cruciferae and clovers in particular need insect visitors. The recent sugar shortage has led to large purchases of honey by ice cream manufacturers. Treatment of the seeds of certain plants before planting has been shown to have beneficial results. Many uses have been developed for beeswax, such as the water-proofing of gun shells. Vitamin B_1 is abundant in pollen, and special devices have been placed in use to collect the pollen gathered by bees. Three reels of motion pictures, depicting commercial queen rearing and other details of beekeeping, were shown. (Secretary's abstract.) Questions followed by Yeager, Cory and Snodgrass.

H. C. Huckett, of the N. Y. Agricultural Experiment Station, greeted the Society briefly.

Adjournment at 10 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

Actual date of publication, April 30, 1942.

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PROCEEDINGS OF THE

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THE ORIGIN AND CLASSIFICATION OF THE APTERYGOTA.[1]

By H. E. EWING,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

Very early in the study of insects, theories as to their origin began to crystallize, and as far back as 1869 Brauer formulated a theory that insects were evolved from lower arthropods through forms similar to the species of *Campodea*. These early theories were formed long before our knowledge of insect morphology was sufficiently complete to give the proper basis of facts for any sound theory. Also several of the primitive arthropod groups known to us today were little known then or had not yet been discovered.

MORE RECENT THEORIES OF THE ORIGIN OF INSECTS.

Three of the theories advanced relating to the origin of insects have had a considerable following up to the present. They are here considered.

(a) The Crustacean Theory, which at one time probably was the most acceptable of all, has been especially upheld by such entomologists as Hansen (1893), Carpenter (1903), and Crampton (1916, 1919, 1922). Exponents of this theory claim to be able completely to homologize the mouth parts of such primitive insects as the thysanurans with those of the crustaceans of the group Malacostraca. Also the parts of the most outstanding crustacean morphological structure, the biramus limb, are homologized with parts of the head appendages as well as with those of the abdominal appendages.

The weakest point to be found in the Crustacean Theory is our inability properly to homologize the internal organs of Insecta with those of Crustacea. Furthermore, the vestigial abdominal appendages of primitive insects, together with their accompanying basal sclerites and closely associated sacs or glands, fit into an almost continuous intergrading system with those of certain primitive groups of land arthropods.

Tillyard (1930) pointed out the difficulty of deriving the

[1] Address of the retiring president of the Society, delivered at the February meeting, 1942.

insectean type of reproductive system from that of the Crustacea. The Insecta and Crustacea are even more divergent in regard to their excretory systems. This system in most of the crustaceans consists either of the antennal glands, which open on the bases of the antennae, or the maxillary "shell-glands," which open on the bases of the second maxillae. These glands represent modified nephridia, and open to the exterior, having no connection with the alimentary canal. They are structures vastly different in origin and relationships from the malpighian vessels of insects. However, in some of the amphipod crustaceans either single or paired caeca, having an excretory function, open into the posterior end of the mesenteron. Their position and structure indicate that, while they probably are not homologous with the malpighian vessels of insects, they are suggestive of such and possibly may be considered as forerunners of malpighian vessels.

(b) The Protaptera Theory of Tillyard (1930) calls for a hypothetical ancestral group from which the Insecta, the Progoneata, and the Opisthogoneata are derived and continued as three distinct lines of descent. This hypothetical group is called the Protaptera, and was supposed to have paired gonads on postcephalic body segments IV to VIII. In presenting his theory Tillyard has given an interesting review of some of the different theories of the origin of insects, and has pointed out very effectively some of the weaknesses of each.

Imms (1936), in addition to calling attention to certain discrepancies and statements that are "obviously incorrect" in Tillyard's paper, in one sentence states this chief objection to the theory: "The theory of Tillyard, which formulates an oligomerous protomorphic ancestor, has resulted in an attempt to trace the origin of insects much farther back in the evolution of arthropods than the evidence of comparative morphology and embryology appears to justify."

To this criticism should be added another relating to the evidence presented in the consideration of the evolution of the arthropod leg. Tillyard's conclusion not only is based upon an insufficient study of leg segmentation, but, because the musculature of the legs was not studied, subsegments were frequently confused with true segments, and the composition and identity of certain segments were not properly detected. Thus Tillyard regarded the leg of Symphyla and Collembola as being identical in segmentation, each being composed of four segments, not counting the pretarsus, and in each group the distal segment was regarded as the tibiotarsus. Yet the writer (Ewing, 1928) had previously shown from a study of the musculature of the legs in these two groups that in the symphylid leg there are five movable segments in addition to the immovable subcoxa, and that the tibia and tarsus are distinct. Further, it should

be stated that in regard to the collembolan leg there is much variation in its segmentation. While the leg is commonly four segmented (not counting the subcoxa or the pretarsus), and possibly has the tibia and tarsus fused into a tibiotarsus, it may be five-segmented, possessing either two trochanters or a freely articulated tibia and tarsus.

Again, according to Tillyard (1930) the leg in the Thysanura is either seven or eight segmented (counting subsegments) while in most of the pterygota it was regarded as nine-segmented. Actually, however, the legs of most of the Machilidae and Lepismatidae are identical in segmentation with those of the generalized type for the Insecta, being composed of a coxa, trochanter, femur, tibia, a tarsus of three subsegments, and a pretarsus. This point has been made clear by a study of the musculature of the legs (Ewing, 1928).

Tillyard's explanation of the evolution and variation of the tracheal system is particularly interesting. He points out that the original terrestrial arthropods probably had no tracheae but breathed through their cuticle. This apparently is in accordance with the evidence. Particularly it should be noted that in the primitive group Pauropoda there are no tracheae and in the Symphyla a very simple tracheal system opens through a single pair of spiracles situated on the head. However, Tillyard's reference to the tracheal system of the Protura as a very primitive type hardly agrees with the evidence. More probably it represents a greatly reduced system of the segmental type wherein most of the body segments had a pair of spiracles. In the Protura the tracheae open entirely through two pairs of thoracic spiracles, but it is to be noted that of the three families of the Protura, the tracheae are wanting in the two that are most specialized. Thus, the course of evolution is indicated. The proturans without tracheae are the most specialized, not the most generalized as would be required by Tillyard's theory.

(c) The Symphylan Theory. Of the several theories of the origin of insects the Symphylan Theory is the one that has been most acceptable to the writer (Ewing, 1940). According to this theory the winged insects, or Pterygota, have been derived from symphylid, or symphylid-like ancestors through apterygotan insects of the order Thysanura. Packard (1873, 1881) did much to establish the Symphylan Theory, but it appears that Menge (1851) was the first to demonstrate the phylogenetic importance of symphylids. Ryder (1880), a contemporary of Packard, named the order Symphyla and subsequently gave Menge credit for first demonstrating the true phylogenetic position of symphylids. Ryder (1881) states: "Since the publication of my notice above referred to (Ryder, 1880), I have met with a paper unknown to me at the time mine was written, which in many respects anticipates the observations

made by the writer * * *." Ryder then quotes (in English) several paragraphs from Menge's German text, the following sentence being significant; " 'I believe, accordingly, that *Scolopendrella* may be regarded as the type of a genus or family intermediate between the six-footed *Lepismidae* and the *Scolopendridae.*' " Ryder (1880), when he named the order Symphyla, stated: "I name the new group *Symphyla*, in reference to the singular combination of myriapodous, insectean and thysanurous characters which it presents."

This theory was further supported by the work of Silvestri (1901, 1907), who found, in the then recently discovered dipluran genus *Projapyx* Cook, that the jointed cerci served as outlets for spinning organs homologous with those of *Scolopendrella* and of many diplopods. Later Silvestri himself described the dipluran genus *Anajapyx*, which is even more nearly related to the Symphyla. In recent years Imms (1936) and Snodgrass (1938), in particular, have brought together much additional evidence in favor of the Symphylan Theory.

Those who reject the Symphylan Theory of the origin of Insecta on the grounds that insects are opisthogoneate while the symphylids are progoneate may be a bit illogical. Actually the position of the genital opening in the Collembola is nearer to that in the Symphyla than it is to the position of the genital opening in the hexapod group Protura, yet students of the phylogeny of the Insecta hold that all insects have had a common origin. In the Collembola the genital opening is on the eight postcephalic segment, in the Symphyla on the fourth, and in the Protrua between the fourteenth and fifteenth. Thus the genital opening in the Collembola is only four segments from its position in the Symphyla, while it is six or seven segments from its position in the Protura. Can we not, without being illogical, regard the Collembola as being progoneate, since the genital opening in this group is anterior to the sixth abdominal segment, which holds the middle position in the abdomen of a generalized insect?

THE GENERALIZED MANDIBLE OF THE DIPLOPODA.

The mandible in Diplopoda shows much variation, but in its more generalized state consists of a large basal part and a heavily sclerotized and marginally toothed, movable, distal part. The basal part usually is divided by a transverse suture into two sclerites, called by some authors the cardo and stipes and believed by them to be homologous with parts of the maxillae having the same names. Since the distal part is supplied by its own muscles and is movably articulated with the basal part, it must represent functionally a true segment. A study of the muscles of the basal part, according to Snodgrass (1928), shows

apparently that the two sclerites correspond to the cardo and stipes of the maxilla and, if so, probably do not represent distinct segments.

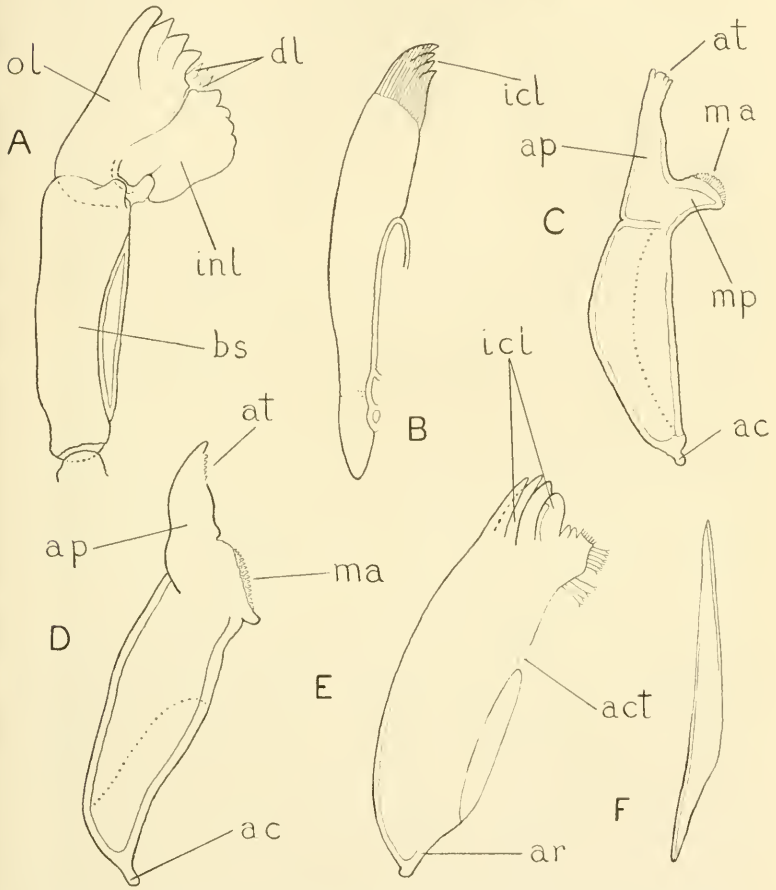

FIG. 1.—Types of mandibles found in the Symphyla and Apterygota. Dorsal view of each, not equally enlarged: *A*, Of *Hanseniella* sp., a symphylid (original); *B*, of *Heterojapyx gallardi* Tillyard, a japygid (after Snodgrass); *C*, of *Corethromachilis brevipalpis* Carpenter, a machilid (after Carpenter); *D*, of *Cremastocephalus pallidus* Carpenter, a springtail (after Carpenter); *E*, of *Ctenolepisma urbana* Slabaugh, a lepismatid (original); *F*, of *Acerentulus confinis* (Berlese), a proturan (after Berlese). Abbreviations: *ac*, Articulating condyle; *act*, shallow acetabulum; *ap*, apical process; *ar*, articulating ridge; *at*, apical teeth; *bs*, basal segment; *dl*, dentate lamella; *icl*, incisor lobe; *inl*, inner lobe; *ma*, molar area; *mp*, molar process; *ol*, outer lobe.

THE MANDIBLE IN SYMPHYLA.

In the Symphyla the mandible (Fig. 1, *A*) is clearly two-segmented. The basal segment is long and narrow and appears to form a part of the lateral wall of the head. It is articulated with the cranium by means of a broad groove-ridge type of hinge, the groove being on the mandible and the ridge, which in some species might be called a condyle, on the cranial margin. The distal segment is short and broad and bears large and small teeth modified chiefly for cutting and tearing. This segment is divided longitudinally by an indistinct groove or suture and has toward the middle of its anterior, toothed margin a conspicuous notch. In this notch is situated a very small sclerite that bears a few minute, sharp teeth. It has been called the dentate lamella and is regarded by some authorities as homologous with the much larger and differently formed prostheca of the members of the dipluran family Projapygidae.

The distal segment of the symphylid mandible is hinged in a peculiar way to the proximal segment and has not been properly described by previous workers. The two segments have a three-point or tricondylic joint (Fig. 1, *A*), two of the condyles, or articulating processes, being on the base of the distal segment and one on the apex of the proximal segment. One or more of these heavily sclerotized articulating processes have been figured by others as if they were sclerites. Only by dissection and staining can their true nature be detected.

EVOLUTION OF THE INSECTEAN MANDIBLE.

Within the Symphyla and the Apterygota alone can be noted the major aspects of the evolution of the insectean type of mandible (a process well described by Snodgrass, 1935, and others). In the Symphyla (Fig. 1, *A*, *bs*) the plate-like sclerites of the basal segment of the diplopod mandible have already become anchylosed, yet the mandible as a whole is clearly two-segmented, very long, and hinged to the cranium only at its base. In the Diplura (Fig. 1, *B*) the whole mandible is consolidated into a single segment and has its proximal end cone shaped and fitting into a funnel-shaped socket on the head. In the Machilidae (Fig. 1, *C*) and the Collembola (Fig. 1, *D*) a definite articulating condyle which fits into an acetabulum on the cranium has been developed at the basal end of the mandible; and in addition an inner, subapical grinding surface, the molar area, has appeared. Finally, in most of the Lepismatidae a second articulation with the head (Fig. 1, *E*, *act*) has been attained, thus forming a mandible typical of the generalized pterygotan insects except for the depth of the acetabula, the prominence of the articulating processes, and its shape, which is considerably longer and less flattened than the mandible of

the grasshoppers, roaches, and most of the generalized pterygotans.

THE NUMBER OF THORACIC SPIRACLES IN APTERYGOTA AND THEIR POSSIBLE PHYLOGENETIC SIGNIFICANCE.

In the apterygotan hexapods there are two series of thoracic spiracles, a dorsolateral and a ventrolateral. The dorsolateral spiracles are confined to the mesothorax and metathorax, each being situated in the pleural membrane above the leg base. The ventrolateral spiracles, which are more commonly absent, are usually found on the mesothorax and metathorax. However, the first pair of the ventrolaterals may be shifted from their normal position to the posterior part of the prothorax. These ventrolateral spiracles, although situated in the pleural area, are not so closely associated with the subcoxal sclerites of the leg base as are the dorsolateral spiracles. In the Campodeidae the second pair of the ventrolateral spiracles is missing and in the Protura both pairs of ventrolateral spiracles are missing.

Since nearly all the arthropods possessing trachae have no more than a single pair of spiracles to a body segment, it is of particular importance to know why there are two pairs on a single segment in some of the thysanurans. To explain properly the origin of an additional pair of spiracles on a single thoracic segment, we should begin with a spiracular tracheal cluster served by a very short, dichotomous trunk. A further shortening of this trunk to the point of obliteration would give each branch a separate opening into the atrium of the spiracle. This process can be observed in some arthropods today. The shifting apart of these two openings, accompanied by an elongation of the atrium, should be the next step. Finally, the much elongated atrium becomes constricted and then transversely divided into two atria each having its own trunk and cluster of tracheal branches.

It is a matter of importance from the standpoint of phylogeny to know, if possible, which of the four pairs of thoracic spiracles found in the Japygidae persist in pterygote insects. That the ventrolateral mesothoracic spiracles represent the first thoracic pair in the Pterygota is indicated by their position, by the fact that they usually are better developed than the other thoracic spiracles, and by the further fact that they nearly always are present in insects known to possess thoracic spiracles, and finally because they tend to migrate into the prothorax in the Apterygota, just as they do in the Pterygota.

In the Campodeidae the ventrolateral spiracles of the metathorax have been lost, whereas the dorsolateral pairs of the mesothorax and metathorax persist. These two latter pairs

are in exactly the same position as the only known spiracles in the Protura and in a somatic position analogous to that of the abdominal spiracles of the pterygote insects. However, since the first dorsolateral pair of thoracic spiracles is evidently lost in pterygote insects, one is led to believe that possibly the second pair may also have been lost, yet the evidence presented by the present conditions in the Campodeidae indicates otherwise.

THE NECK SPIRACLES OF COLLEMBOLA.

Tillyard (1930) not only would derive the arthropods from a primitive atracheate type, but he also held that the most primitive Insecta had no tracheae, and that the tracheal system of the Collembola, far from being of a very degenerate type, really is of a very primitive type. He states: "I submit that, if the Collembola were descended from tracheate forms, any type which now possessed a tracheal system would not have been the most highly specialized type, but one of the more primitive forms; nor would the tracheae have been in the head, but in some segment which would have clearly indicated a reduction from the original postcephalic segmentation system, as exhibited for instance in the more primitive Thysanura or Pterygota."

Nearly all the springtails are without spiracles, but a single pair is found in the sides of the neck close to the head in certain members of the family Sminthuridae and in the genus *Actaletes* Giard, a genus of questionable position. Although these spiracles have been considered as the prothoracic pair by Davies (1927), Snodgrass (1935) has pointed out that they really "lie in the region of the second maxillary segment," hence probably represent "persisting examples of the second maxillary spiracles, known otherwise only as temporary tracheal openings in the embryo of the honey bee."

In this connection it should be noted that in the Symphyla the only pair of spiracles present is a head pair. Each spiracle of this head pair usually is situated in the membrane between the base of the mandible and the epicranium, but in some species the spiracle and a part of the tracheal trunk have become included in the sclerotization of the basal segment of the mandible. For this reason this pair of spiracles should be known as the mandibular pair. Their position, so much more anterior to that of the so-called head spiracles of Collembola, indicates that they are not homologous with the latter. The presence in several groups of arthropods of spiracles situated near or upon the mouth parts indicates that primitive arthropods probably had a pair of tracheal invaginations on each appendage-bearing segment of the head.

TYPES OF ANTENNAE IN INSECTS AND IN THEIR NEAR RELATIVES.

Some differences of opinion have long existed among entomologists relative to the number of true segments in the antennae of various groups of insects. In most groups the antenna has been recognized as typical for all insects and composed of the following: A large basal segment, the scape, articulated to the epicranium at a single point, followed by a somewhat smaller subsegment, the pedicel, which bears distally a long whiplike terminal flagellum marked by many annulations. Such an antenna evidently should be regarded as composed of only two true segments. In various groups different workers have reported the occurrence of muscles in segments of the antenna beyond the first, but their findings have not been generally accepted.

The whole matter of segmentation of the antennae in insects and other arthropods has been recently thoroughly investigated by Imms (1939). As a result of these investigations he concludes that, "The first antennae of arthropods are divisible into two main types, viz. (1) segmented antennae and (2) annulated antennae." In the first type the antenna is composed of a variable number of true segments, each being supplied by one or more muscles. In the second type the antenna is composed of a basal peduncle, consisting of one or more true segments, and a distal annulated flagellum or pair of flagella.

Among the outstanding facts apparently established by Imms was his demonstration that in the "Thysanura Entognatha" the antennae are of the first type (Fig. 2), having many true segments; while, in the "Thysanura Ectognatha" and all the Pterygota the antennae are of the second type, having a true basal segment and a distal annulated flagellum.

Another important result of Imms' work was his demonstration that in all the Collembola only four true segments are to be found in the antennae. In the genus *Orchesella*, where the antennae have been regarded as six-segmented, he showed that, according to the musculature, the first and second antennal segments are each divided into two false segments or subsegments. He found that the first and second segments each contain a levator, a depressor, and an extensor muscle for moving the approximate distal segment. The third antennal segment, according to Imms, contains only a levator and a depressor for moving the distal segment, which is without contained muscles. The muscles contained in the first and second segments are very weak and slender.

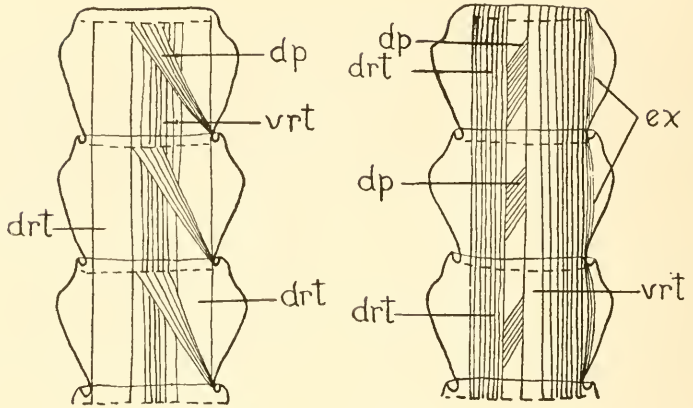

FIG. 2.—Antennal segments VIII to X of a species of *Japyx;* to the left, ventral view; to the right, dorsal view; *dp*, depressor muscle; *drt*, dorsal retractor muscle; *ex*, extensors; *vrt*, ventral retractor muscle. (After Imms, 1939.)

I have examined many mounts of Collembola, some of which show the muscles in good condition, and find a corroboration of most of the claims stated by Imms. In one species, *Aphorura ambulans* (Linn.), the muscles in the second and third segments are large and conspicuous while in another species, *Tomocerus arcticus* Sch., no muscles were detected in the third segment, although they were unusually well developed in the second, showing clearly the cross striations which easily identify muscle fibers. It should be stated that in this species, the third segment is excessively long, being longer than the other three segments combined, and annulated throughout.

Could not the arthropods with the antennae of the first type, as given by Imms, be further divided into two major groups, (1) those in which the antenna is composed exclusively of a large and indefinite number of true segments, and (2) those in which the antenna is composed of a definite, small number of true segments, but may also possess annulations? If this division is made, it gives the following grouping:

Under (1): Diplopoda, Chilopoda, Symphyla, "Thysanura Entognatha," and certain crustaceans.

Under (2): Pauropoda and Collembola.

FOSSIL APTERYGOTANS.

The most ancient fossil apterygotan, according to Tillyard (1928), is a collembolan found in Lower Devonian peat bogs. The species is represented by only a few head fragments, which contribute nothing to our knowledge of the relationships of the group, yet the finding of an insect in such ancient rocks is a matter of much importance.

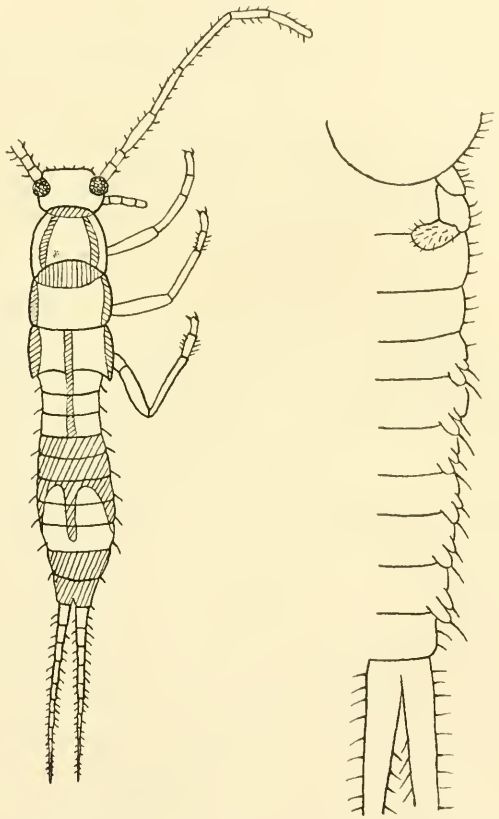

FIG. 3.—*Ocellia articulicornis* v. Olfers, a diplurid in fossil amber; at left, dorsal view; at right, ventral view of left half of abdomen. (After v. Olfers, 1907.)

In general, but few fossil apterygotans have been found, and most of them were in amber. Some of these, however, have been well described and figured. For the most part they represent species belonging to modern genera or to genera closely

related to modern genera. Two of the species are unusual because they exhibit characters of considerably phylogenetic importance. The first is the type of the genus *Ocellia* established by Olfers (1907). This species, *O. articulicornis* (Fig. 3), is represented by two specimens and is quite remarkable in that it has the characters of both the Diplura and Triplura. Because of the presence of but two caudal appendages it is placed in the Diplura, but a new family is created for it. According to Olfers (1907) this species (Fig. 3) is about five millimeters long. In general it has the appearance of a campodeid, but it has the hypognathous head, the long maxillary palpi, and the compound eyes of a lepismatid. The antennae are intermediate in character between the true pterygotan type of most of the Triplura and the long beaded type, typical of the Diplura. The two-segmented tarsi also are intermediate in character between the unsegmented tarsi of the other diplurans and the typical three-segmented tarsi of the triplurans. The thorax, with its three

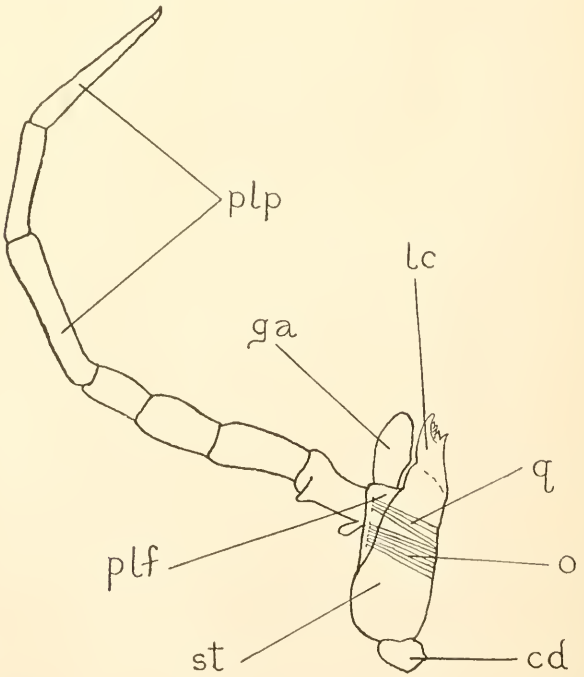

FIG. 4.—Maxilla of a machilid, *Nesomachilis* sp., *cd*, cardo; *ga*, galea; *lc*, lacinia; *o*, levator muscle of palpus; *plf*, palpifer; *plp*, maxillary palpus; *q*, depressor muscle of palpus; *st*, stipes. (Adapted from Snodgrass, 1928.)

subequal, freely articulated segments, is like that found in the subfamily Maindroniinae, of the family Lepismatidae.

The other fossil apterygotan of particular interest is a collembolan, described by the late J. W. Folson (1937) from Canadian amber. He described it as *Protentomobrya walkeri* and erected for it a new family, the Protentomobryidae. This collembolan is remarkable in not having a true spring or furcula but being provided instead with a pair of slender, diverging stylets, each swollen basally. Except for this peculiar character, *P. walkeri* would be placed in the family Entomobryidae. That it is a more primitive form connecting the Entomobryidae with the remainder of the Collembola is evident.

INTERRELATIONSHIPS OF SOME OF THE GROUPS OF PRIMITIVE INSECTS.

In recent years morphologists, as a result of a more intensified study of some of the common and larger species of apterygotans, have emphasized points of their apparent disunity. Particularly have they been inclined to break up the old group Thysanura into two orders or subclasses, to which the names Entognatha (= Entotropha) and Ectognatha (Ectotropha) have been given. Thus, on the basis of a study of the mandibles, the Lepismatidae have been regarded as having the two-hinged insectean type, and to be closely related to the Pterygota; while the Machilidae, with a single-hinged mandible, are to be placed in a lower category with other apterygotans.

Also the Lepismatidae have been regarded as having the true insectean type of antenna, with a basal segment, followed by a subsegment bearing a multiannulated flagellum, while the Entognatha are observed to have the long, beaded type, with an indefinite number of true segments.

While such conclusions are warranted by a study of the more common forms of Apterygota, yet some of the smaller and rarer species show characters that are intermediate and in a way connect these groups that appear to be so diverse. Thus, while it is true that the mandibles of the typical members of the Lepismatidae are two-hinged and similar to those of pterygote insects, yet in some genera there is no articulating condyle at the basal hinge, as is found in most insects, but a ridge. Further, the anterior, or more distal, articulation in some genera is so primitive as to be represented merely by two thickened pressure points of the integument, there being no socket or process.

The distinction made between the Lepismatidae and most other primitive insects, on the basis of their antennae being of the pterygotan type with a scape and a long, annulated flagellum, is not so sharp when some of the rarer members of the sub-

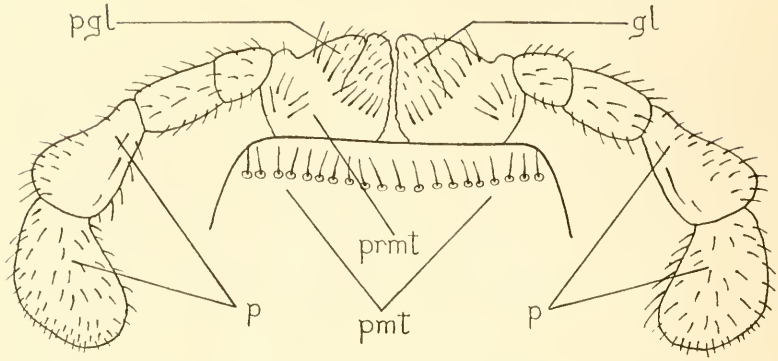

FIG. 5.—Ventral view of labium of lepismatid, *Ctenolepisma longicauda* Escherich; *gl*, glossa; *p*, labial palpi; *pgl*, paraglossa; *pmt*, postmentum; *prmt*, prementum. (Adapted from Escherich, 1905.)

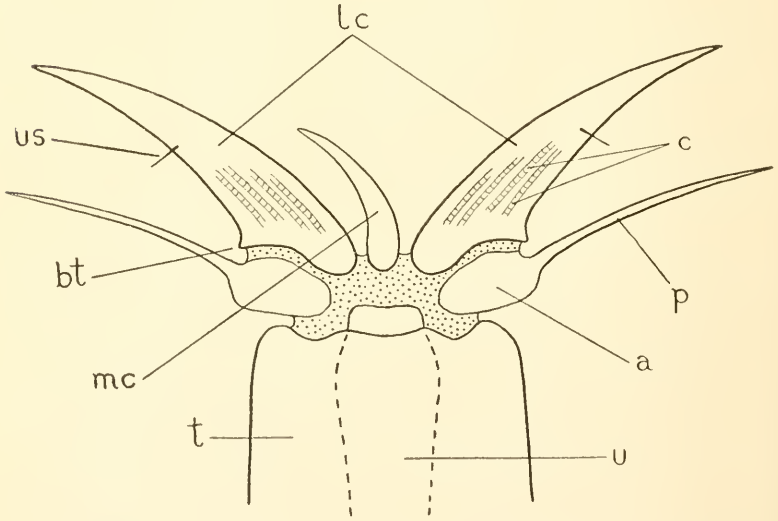

FIG. 6.—Ventral view of pretarsus and end of tarsus of a campodeid (family Campodeidae) with terminology for different parts (semidiagrammatic); *a*, auxilia; *bt*, basal tooth of lateral claw; *c*, canaliculae; *lc*, lateral claws; *mc*, median claw (arolium); *p*, setalike pulvillus; *t*, tarsus; *u*, unguitractor; *us*, ungual seta.

family Maindroniinae are considered. Some of these (Fig. 7) have antennae of the beaded type as found in the Diplura.

Those who divide most of the apterygotan insects into two groups, the Entognatha and the Ectognatha, emphasize a

character which in most species is easily detected yet in others is ascertained with difficulty. Actually there is a great variation in the degree to which the mouth parts have been infolded, and the deeper significance of such infolding, such as it is, has not been properly understood. The writer has noted that the type of mandible present in the Japygidae, with its long, unsegmented shaft and cone-shaped basal end articulating with a funnel-shaped socket in the head, is repeated in some of the Collembola

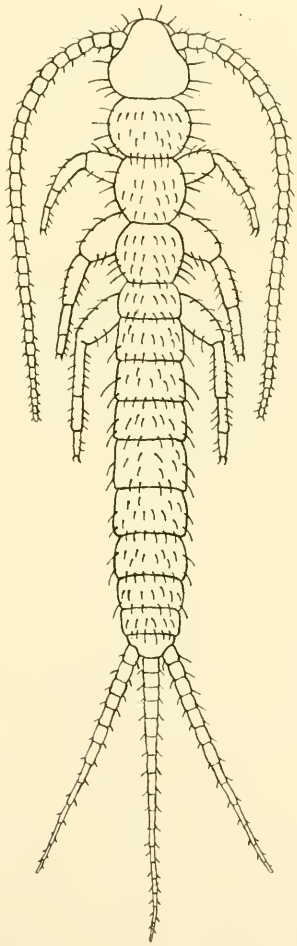

FIG. 7.—*Trinemophora michaelseni* Schäffer, a lepismatid, with several diplurid characters. (After Escherich, 1905.)

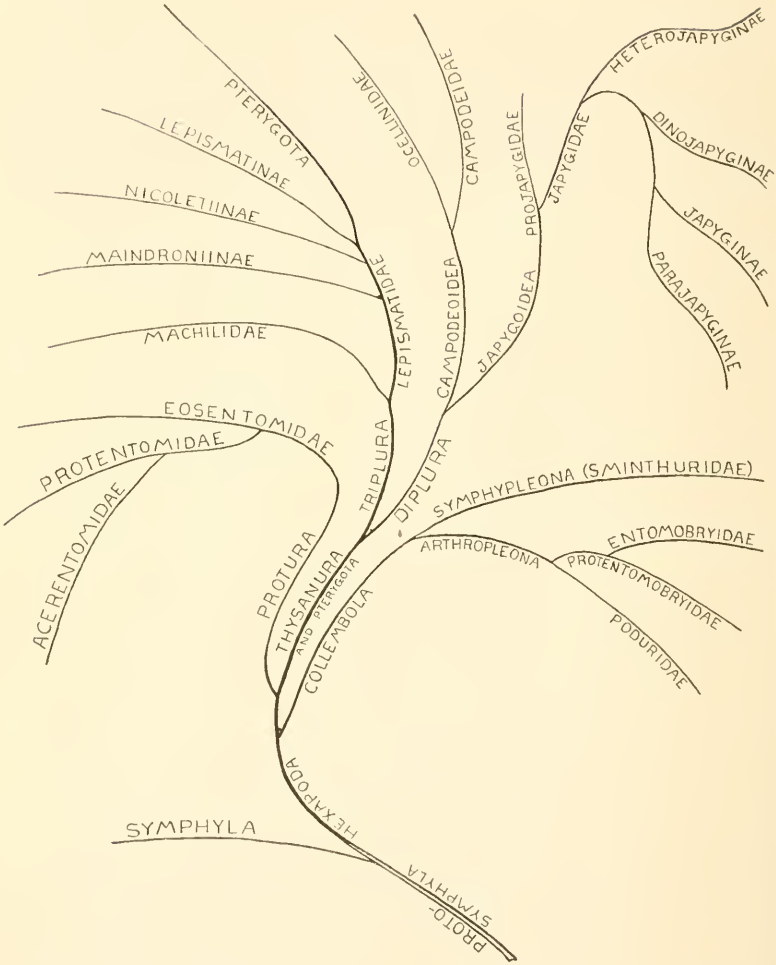

FIG. 8.—Phylogenetic tree indicating the suggested origin of the Apterygota and the derivation and relationships of its various subgroups.

which are entognathous, yet the mandibles of certain other collembolans (Fig. 1, *D*) have a typical articulating condyle.

While most of the members of the family Lepismatidae have the characters with which entomologists in general are familiar, yet those of *Trinemophora* (Fig. 7) are strangely mixed with those of members of both the old groups, Ectognatha and Entognatha. This is well displayed in Escherich's figure of

Trinemophora michaelseni Schäffer (Fig. 7). Although this species is a lepismatid and a tripluran it has the following diplurid characters: The general shape of the body, which is campodeiform, the prognathous head, the absence of eyes, the beaded antennae, the absence of body scales, and a thorax with subequal, freely articulated segments. It is further noted that the two-segmented tarsi represent an intermediate condition between the old groups Ectognatha and Entognatha.

THE FAMILIES AND SUBFAMILIES OF COLLEMBOLA.

As compared to the Thysanura, the Collembola are more homogenous and undoubtedly constitute a more compact natural group, yet apparently because of their large numbers and extremely wide distribution, they have been placed in several families and many subfamilies. The numbers of both of these are here much reduced. The family Actaletidae Handlirsh, based on the genus *Actaletes* Giard, probably is not well founded. In *Actaletes* the head is hypognathous, with the antennae situated in the middle, and the last three abdominal segments are fused. Further, it is claimed that cephalic tracheae are present and the gonads are of unusual shape. The head characters here mentioned would apply equally to *Podura* and the fusion of the last three abdominal segments is not restricted to *Actaletes*. Lastly, the claims of the presence of cephalic tracheae and the peculiarities of the gonads need further confirmation. If this family is to be recognized as a subfamily it should come next to the Isotominae in the family Entomobryidae. The family Neelidae Folsom differs but slightly, due to intergrades, from the Sminthuridae. Its retention as a subfamily possibly is indicated.

Key for the Classification of Certain Primitive Arthropod Groups, Including the Apterygota.

A. Body divided into 2 regions, a head, consisting of the consolidation of the preoral segments plus the first 4 postoral segments, and a chain of freely articulated segments; genital opening farther forward than the fifth postcephalic body segment.

B. Body region composed of 12 segments, and with most of the terga fused into couples, their number being less than that of the 9 evenly spaced legs; first body segment with vestigial appendages; head hypognathous; antennae branched at apex of fourth segment; mandibles unsegmented; genital opening on third postcephalic body segment ... *PAUROPODA* Lubbock

BB. Body region composed of more than 12 segments, and with none of its terga fused into couples, number of terga greater than that of the 12 pairs of legs usually present (the first pair may

be either reduced or absent); head prognathous; antennae not branched; mandibles 2-segmented; genital opening on fourth postcephalic body segment.....*SYMPHYLA* Ryder

AA. Body divided into 3 regions, a head, composed of the preoral and first 4 postoral segments, a leg-bearing thorax, composed of the first 3 postcephalic segments, and an abdomen composed of a chain of 6 to 12 segments; genital opening farther back than seventh postcephalic segment.

B. Dorsum of head frequently showing a series of transverse sutures possibly indicating its division into primitive terga; antennae absent; mandibles lancelike, toothless, protrusible; pretarsi with a single claw; abdomen with 12 segments in adult, a single segment being added during each molt of immature individual; abdominal appendages absent from segments behind the third; genital opening between sterna XI and XII.....*PROTURA* Silvestri

BB. Dorsum of head never showing a series of transverse sutures; antennae present; mandibles usually with teeth and adapted for chewing; pretarsi in adults with 1 to 3 claws each; abdomen never with more than 11 segments and no segments added after embryonic stage; abdominal appendages may be on any segment; genital opening never farther back than membrane between sterna IX and X.

C. Abdomen composed of 6 segments in all instars, including the embryo; 2 or more adjacent segments frequently partially or entirely anchylosed; segment I with a median ventral appendage in the form of a tube; II usually with a short, greatly modified ventral appendage; IV usually with a forked appendage used for jumping; total cleavage taking place in embryonic development; antennae composed of 4 true segments, but segments I and II each may be divided into 2 subsegments and III and IV into many annulations; mandibles usually present and adapted for chewing, rarely reduced to stylets or absent; tracheae, when present, without anastomosis and opening through a single pair of spiracles on the neck; malpighian vessels absent; tarsi very short, or absent (probably being fused with tibiae).....*COLLEMBOLA* Lubbock

CC. Abdomen composed of 10 or 11 freely articulated segments; appendages of no pair fused into a tube or forming a forked, median appendage; antennae composed of a large number of true segments or a basal true segment and many annulations; mandibles always present and adapted for cutting or chewing; tracheae opening through spiracles situated farther back than the neck; malpighian vessels sometimes present, but poorly developed; tarsi not reduced or fused with tibiae.....*THYSANURA* Lubbock

KEY FOR THE CLASSIFICATION OF THE FAMILIES AND SUBFAMILIES OF PROTURA.[2]

A. Tracheae present and opening through 2 pairs of spiracles, 1 on mesothorax and 1 on metathorax; abdominal segments I–III each with a pair of 2-segmented appendages; abdominal combs absent ..... *EOSENTOMIDAE* Berlese

AA. Tracheae absent; abdominal segment III with a pair of unsegmented appendages; a pair of abdominal combs usually present on segment VIII.

B. Abdominal terga without transverse lines or sutures or laterotergites but each with 1 complete, transverse row of setae; abdominal combs reduced or absent ..... *PROTENTOMIDAE* Ewing

C. Second pair of abdominal appendages 2-segmented; abdominal combs present; tarsus I with sensory setae ..... *PROTENTOMINAE* Mills

CC. Second pair of abdominal appendages unsegmented; abdominal combs absent ..... *MICROENTOMINAE* Ewing

BB. At least some abdominal terga each with 1 to 3 transverse lines or sutures, a pair of laterotergites, and 2 complete transverse rows of setae; abdominal combs not reduced ..... *ACERENTOMIDAE* Berlese

KEY FOR THE CLASSIFICATION OF THE SUBORDERS, SUPERFAMILIES, FAMILIES, AND SUBFAMILIES OF THYSANURA.

A. Mouth parts withdrawn into the head; antennae usually divided into many true segments none of which is annulated; mandibles each articulating with head by means of its cone-shaped proximal end fitting into a funnel-shaped socket; tarsi usually simple, never divided into more than 2 subsegments; abdomen provided with only 2 caudal appendages (cerci) ..... *DIPLURA* Börner (= *THYSANURA ENTOTROPHA* Grassi)

B. Tracheal system with longitudinal connecting trunks between adjacent spiracular trunks; thoracic spiracles, when unreduced in number, 4, a dorsolateral and ventrolateral pair on each of the last 2 segments; abdominal spiracles, when unreduced, 7, 1 pair on each of first 7 segments; pretarsal claws without dorsal foliaceous expansions; cerci stout, relatively short ..... *JAPYGOIDEA*, new superfamily

C. Cerci segmented, straight, tapering, each bearing apically the opening of a duct from spinning glands; mandible with prostheca (inner, subbasal appendix); abdominal segment I with 2 pairs of appendages; segment IX of abdomen not greatly shortened but similar to the other segments; female with 2

[2] The keys for the classification of the different groups of Apterygota that are presented in the following pages have been based in part or largely upon the work of the following: Protura, Ewing (1940); Japygidae, Womersley (1939); Machilidae, Verhoeff (1910); Lepismatidae, Escherich (1905), and Collembola, Mills (1934).

pairs of ovaries situated in abdominal segments IV to VI; 6 very short malpighian tubes present *PROJAPYGIDAE* Cook

CC. Cerci unsegmented, modified into a pair of hooked pincers; spinning glands absent; mandible without prostheca; abdominal segment I with 1 pair of appendages in addition to a pair of seta-bearing subcoxal organs; segment IX of abdomen greatly shortened and modified so as firmly to join with the lengthened and heavily sclerotized segment X; female, in some species at least, with a pair of simple ovaries in each of abdominal segments I to VII; malpighian tubes vestigial or absent..... *JAPYGIDAE* Lubbock[3]

D. Antennae with sense-setae on some of the segments.

E. Antennae with sense-setae on other segments in addition to IV to VI.

F. Sense-setae on antennal segments IV to XIII; labial palpi present; body almost naked above; pretarsi each with a middle claw; spiracles on abdominal segment VII very oblong and greatly enlarged *HETEROJAPYGINAE* Womersley

FF. Sense-setae on antennal segments IV to XX; labial palpi wanting; body and appendages provided with many long, hairlike setae; pretarsi each with 2 subequal claws..... *DINJAPGINAE* Womersley

EE. Antennae with sense-setae on segments IV to VI only *JAPYGINAE* Womersley

DD. Antennae without sense-setae; labial palpi wanting..... *PARAJAPYGINAE* Womersley

BB. Tracheal system of a primitive type in that there is no anastomosis betwteen the tracheae opening through one spiracle with those opening through another spiracle; thoracic spiracles, as far as known, 3, a dorsolateral and a ventrolateral pair on mesothorax and a dorsolateral pair on metathorax; abdomen without spiracles; pretarsal claws frequently with a dorsal foliaceous expansion; cerci long, slender, flagelliform, marked by many annulations..... *CAMPODEOIDEA* Handlirsch

C. Head prognathous; eyes absent; antennal segments short, frequently beadlike; tarsi unsegmented; abdominal segments III to VII with appendages, VIII and IX without..... *CAMPODEIDAE* Meinert

CC. Head hypognathous; compound eyes present; antennal segments much longer than broad; tarsi 2-segmented; abdominal

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[3] The family name Japygidae is based on the generic name *Japyx*, which originally was spelled *Iapyx*. Although the emended spelling of the name has been almost universally used in recent years, justification for the emendation is to be questioned since Latin dictionaries give the spelling *Iapyx*. The word is derived from the Greek poetical name for an inhabitant of Calabria, that part of Italy forming the "toe of the boot."

segments II and III without appendages, IV to IX each with 2 pairs of appendages. Contains a single extinct species ... *OCELLIIDAE*, new family

AA. Mouth parts not withdrawn into the head; antennae usually divided into a basal true segment, followed by a short subsegment bearing a distal flagellum composed of many annulations; mandibles with either 1 or 2 articulations to the head; tarsi divided into 2, 3, or 4 subsegments; abdomen provided with 3 caudal appendages..... *TRIPLURA*, new name (= *THYSANURA ECTOTROPHA* Grassi)

B. Body compressed, or flattened laterally; mandibles each articulating with the head by means of a condyle on its proximal end fitting into an acetabulum; tracheal system of a primitive type in that there is no anastomosis between the tracheae opening through one spiracle with those opening through another; coxae II and III frequently with a styletlike process; tarsi each with 3 subsegments, the first usually being so reduced as to permit the middle subsegment to articulate dorsally with the tibia..... *MACHILIDAE* Grassi

C. Not more than a single pair of eversible sacs on any one abdominal segment.

D. Abdominal segments II to VII with large, triangular sterna..... *PREMACHILINAE* Carpenter

DD. All abdominal sterna very small, some not visible..... *MEINERTELLINAE* Verhoeff

CC. Two pairs of eversible sacs on each of 2 or more abdominal segments..... *MACHILINAE* Verhoeff

BB. Body depressed or flattened dorsoventrally; mandibles usually having 2 articulations with the head, a basal and an inner distal; tracheal system, when unreduced, with both longitudinal and transverse connecting trunks between the spiracular trunks; coxae II and III without appendages; tarsi with 2 to 4 subsegments, when with 3 subsegments, the first usually the longest, the second short and never articulating with the tibia..... *LEPISMATIDAE* Burmeister

C. Body slender, without scales, and with sides subparallel; head longer than prothorax; inner margin of maxillary lacinia smooth..... *MAINDRONIINAE* Escherich

CC. Body stouter, usually with scales, and sides seldom subparallel; head shorter than prothorax; inner margin of maxillary lacinia with teeth and setae.

D. Eyes absent; body with or without scales; subcoxae of genital segments narrow, not covering bases of gonapophyses..... *NICOLETIINAE* Escherich

DD. Eyes present; body with scales; subcoxae of genital segments broad, covering bases of gonapophyses..... *LEPISMATINAE* Escherich

KEY FOR THE CLASSIFICATION OF THE SUBORDERS, FAMILIES, AND SUBFAMILIES OF COLLEMBOLA.

A. Body elongate, not swollen; segments of thorax and abdomen distinct from one another, except in a few cases where some of the most posterior segments of abdomen are ankylosed; antennal segments I and II each may be divided into 2 subsegments; postantennal organ may be present; sacs of ventral tube small, without warts ..... *ARTHROPLEONA* Börner

B. Abdominal segment IV provided with a pair of long, slender stylets, but no furcula; first abdominal segment much reduced. Contains a single extinct species, known only from Canadian amber ..... *PROTENTOMOBRYIDAE* Folsom

BB. Abdominal segment IV without a pair of stylets, but usually provided with a forked appendage called the furcula.

C. Integument smooth (rarely minutely granulate), covered with setae or scales; prothorax much reduced dorsally, without prominent dorsal setae; furcula usually present. ..... *ENTOMOBRYIDAE* Tömösvary

D. Tergum IV of abdomen usually much longer than III; posterior abdominal segments never ankylosed ..... *ENTOMOBRYINAE* Schäffer

DD. Tergum IV of abdomen subequal to III; some of posterior abdominal segments may be ankylosed.

E. Body scaled; antennal segments III and IV annulate; posterior abdominal segments never ankylosed ..... *TOMOCERINAE* Schäffer

EE. Body not scaled; antennal segments III and IV seldom annulate; last 2 or 3 abdominal segments may be ankylosed ..... *ISOTOMINAE* Schäffer

CC. Integument granulate or tuberculate, never bearing scales; prothorax much less reduced, with prominent dorsal setae; furcula frequently wanting ..... *PODURIDAE* Lubbock

AA. Body short, swollen, frequently subglobose; first 4 abdominal segments, and frequently those of the thorax in addition, ankylosed, forming a single mass; neither antennal segment I nor II divided into subsegments; postantennal organs absent; sacs of ventral tube large, frequently warty ..... *SYMPHYPLEONA* Börner
Contains but a single family ..... *SMINTHURIDAE* Lubbock

CONCLUSIONS.

1. Only three of the several theories of the origin of insects have any important following today.

2. Since the prevailing evidence appears to be against the acceptance of the Crustacean Theory of the origin of insects, it is ill advised to use such crustacean terms as endopodite and exopodite, as well as certain others, in naming parts of an insectean segmental appendage. The use of such terms in describing

the male genitalia (of fleas, for example), as is done today by some of the leading authorities for that group, is unwarranted confusing, and not justified on the grounds of homology.

3. The distal segment of the two-segmented mandible in the Symphyla is joined in a peculiar way to the first segment by means of a tricondylic hinge.

4. Of the two pairs of mesothoracic spiracles found in the Japygidae, apparently it is the ventrolateral pair that persists in pterygote insects.

5. The so-called neck spiracles of certain Collembola probably are not of the most primitive type as has been claimed, but represent a reduction from a segmentally arranged system. This is indicated by the presence of spiracles on or near the mouth parts in arthropod groups other than the Collembola, and by the presence of maxillary spiracles in the embryo of the honey bee.

6. Although the antennae of all arthropods may roughly be regarded as belonging to two types, segmented antennae and annulated antennae, an intermediate type may be recognized for those antennae that are composed of a small but definite number of true segments, some of which may be annulated.

7. The characters of certain of the little known and of fossil species of Thysanura tend to unite the families and subfamilies of the same into a more unified group than has been granted by most students of phylogeny.

8. While the Protura and Collembola are to be regarded as groups of very ancient origin and probably should not be included in Insecta proper, yet they both have many of the characteristics of other apterygotans and some of those of the more generalized pterygotans.

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NEW OR LITTLE-KNOWN WEST INDIAN KINNARIDAE (HOMOPTERA : FULGOROIDEA).

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The Kinnaridae have been separated by Muir from the Cixiidae by reason of their different male genitalia and the presence in the female of wax-bearing glands on the sixth, seventh and eighth abdominal tergites. In 1930 seven genera were listed in this family, and an eighth is added below. Five of these occur in the West Indies, as follows: *Atopocixius* Muir in Haiti, *Oeclidius* Van Duzee in Jamaica, *Paroeclidius* Myers in Cuba, *Prosotropis* Uhler and *Quilessa* (described below) in the Lesser Antilles.

Mr. W. E. China has kindly compared the Lesser Antillean genera with the closely allied *Eparmene* Fowler. His notes and drawings are incorporated in the present paper with grateful acknowledgment.

Key to the genera of Kinnaridae.

(1) (8) No median carina on frons.....(2)
(2) (3) A subantennal process in form of a ridge across gena..*Kinnara* Dist.
(3) (2) No such ridge on gena.....(4)
(4) (7) Vertex extremely narrow, projecting not less than a quarter before eyes, lateral frontal carinae prominent.....(5)
(5) (6) Vertex produced not more than one-third before eyes....*Oeclidius* V. D.
(6) (5) Vertex produced fully one-half before eyes.....*Paroeclidius* Myers
(7) (4) Vertex not extremely narrow, lateral carinae of frons small..... *Paramicrixia* Dist.
(8) (1) Median carina on frons.....(9)
(9) (10) Median carina not nearly reaching apex of frons; clypeus as wide as frons at widest part, without a median carina..... *Eparmene* Fowl.
(10) (9) Median carina of frons reaching apex; clypeus narrower than widest part of frons, with a median carina.....(11)
(11) (12) Pronotum tricarinate on disc.....(13)
(12) (11) Pronotum with only median carina on disc .....*Quilessa* gen. nov.
(13) (14) Scutellum rounded at apex; apex of clavus almost exactly bisecting commissural margin .....*Prosotropis* Uhl.
(14) (13) Scutellum pointed at apex; apex of clavus beyond middle of commissural margin.....*Atopocixius* Muir

Of the genera which have a median frontal carina, *Eparmene* has frontal margins parallel in the apical half, while the remainder have frontal margins sinuately expanded in the apical third, and narrowing thence to the apex. *Atopocixius* has a frons twice as long as wide, whereas in *Prosotropis* and *Quilessa* the

frons is scarcely a third longer than wide. In *Prosotropis* the base of the vertex is almost straight, in *Quilessa* it is usually angularly emarginate. The differences in tegminal venation between these four genera are well marked (for *Atopocixius* see Muir, Proc. Haw. Ent. Soc. VI, 2, 1926); less information is available concerning the wings, but *Prosotropis* differs from *Quilessa* in having the fourth apical cell bluntly triangular and much shorter than its stalk, the corresponding cell in *Quilessa* being elongate and exceeding the length of its stalk.

The holotypes or topotypes of species discussed in this paper have been deposited in the U. S. National Museum. Topotypes of *P. decorata* Uhl., and paratypes of all species except *P. rubiginosa* and *P. marmorata* have been sent to the British Museum (Natural History) and to the Museum of Comparative Zoology, Cambridge, Mass., U. S. A.

PROSOTROPIS Uhler.

1895, Uhler, Proc. Zool. Soc. Lond. p. 70. Genotype *P. decorata* Uhl.

Head, with eyes, scarcely two-thirds width of pronotum. Vertex longer than wide, expanding to base, which is shallowly excavated; median and lateral carinae well developed, curving uninterruptedly on to frons; no transverse carina. Frons longer than its widest part (1.4 to 1), base about half as wide as apex; sides expanding to six-sevenths from base, then smoothly converging to apical margin; lateral and median carinae distinct. Clypeus at base four-fifths as wide as widest part of frons; tapering acutely to apex; median and lateral carinae present. Clypeus and apical half of frons convex, basal part of frons sloping smoothly posteriorly into vertex. No median ocellus. Genae somewhat tumid below antennae; antennae with basal segment very short, second segment slightly longer than broad; no subantennal process. Eyes abruptly emarginate ventrally. Pronotum slightly longer than vertex, anterior margin shallowly excavated behind eyes, posterior border scarcely emarginate, curving anteriorly at sides. Median carina distinct, two weak lateral carinae on disc diverging posteriorly; a strong carina at each lateral margin, between eye and tegula. Mesonotum feebly convex, tricarinate, the carinae feebly elevated, apical region strongly concave, tip of scutellum bluntly rounded. Hind tibiae unarmed. Anal segment of male deeply bifid, aedeagus with a ventral keel and two sclerotised rods, genital styles with a lateral setigerous eminence. Ovipositor incomplete. Egg bluntly ovoid.

Tegmina with sides expanding apically for two-thirds of length, almost symmetrically rounded at tip, length two and a quarter times greatest width; margin bordered all round, border widening at stigma, transversely rugose distally. Clavus not granulate. Costal cell wide, slightly expanding apically; Sc+R joined to near stigma; common stalk Sc+R+M half as long as basal cell. Typically seven or eight apical cells, the first trapezoidal with inner side curved, the second triangular with inner angle acutely curved, the third smaller, triangular, the fourth long, rectangular, occupying apex of tegmen;

the following one, two, or three triangular, the penultimate long, curved, almost wedge-shaped, the last triangular with two sides curved, one point touching apex of clavus; an ante-apical series of three cells, two with curved sides; claval vein joining commissural margin before apex; apex of clavus almost exactly bisecting posterior margin. Wing with fourth apical cell shorter than its basal stalk.

Prosoptropis decorata Uhl.

Male.—Length, 1.6 mm.; tegmen, 1.8 mm. *Female.*—Length, 1.9 mm.; tegmen, 2.1 mm.

Vertex testaceous, a dark spot on each side of middle line. Frons fuscous basally, becoming paler towards apex; clypeus and genae pale fuscous; eyes red; second joint of antennae very pale yellow. Pronotum fuscous with testaceous patches; mesonotum dark, almost piceous, scutellum pale cream, often edged posteriorly with white. Pro- and mesocoxae and angles of hind femora fuscous, legs otherwise very pale. Abdominal sclerites and genitalia fuscous, membrane red. Tegmen hyaline, costal cell crossed obliquely by three fuscous areas, the middle largest; a broad undulate dark band from base of clavus to stigma, narrowly produced posteriorly to apex of clavus; a trapezoidal dark area at apical margin, anterior to middle. Vein M3 forking into two before apex. Wings hyaline, smoky towards base.

Anal segment of male bifid into two processes curving inward distally; telson a broad horizontal plate with posterior margin setose; aedeagus composed of a crescentic keel-like plate ventrally, two long spines directed posteriorly and curving slightly upwards distally, and a transparent tube, similarly curved, truncate at apex; genital styles irregularly pitted along dorsal margin, with a shallow cup-like indentation near apex; a triangular flange near middle, curving outward, densely beset with short setae on anterior margin; basad of this a small setigerous eminence curved outwards and downwards.

Anal segment of female short with small lobes laterally at apex; telson as in male. Lateral styles tapering to slender upturned point, with a setigerous lobe below; ventral styles abruptly tapering distally, with straight inner margin. Pregenital plate equilaterally triangular with angles almost equally truncate.

Genus and species redescribed from 26 male and 23 female topotypes collected by the writer in Petit Bordel Valley, St. Vincent, B. W. I. (Aug. 23, 1941) on *Tabernaemontana* sp. Specimens from this material were compared with Uhler's female type by Mr. W. E. China and were found to agree perfectly. As far as is known the species is endemic in St. Vincent, where it is the only representative of the genus.

Prosotropis trinervosa, sp. n.

Male.—Length, 1.7 mm.; tegmen, 1.8 mm. *Female.*—Length, 1.8 mm.; tegmen, 2.1 mm.

Vertex piceous; frons piceous basally, fuscous at apex; clypeus and genae pale fuscous; eyes red; second joint of antennae pale fuscous. Pronotum and mesonotum fuscous, scutellum white or pale. Pro- and mesocoxae and part

of hind femora pale fuscous, legs otherwise very pale. Abdominal sclerites fuscous, membrane red to pallid. Tegmina hyaline, costal cell crossed obliquely by three mottled fuscous bands, a broad sinuate band heavily mottled with fuscous from base of clavus to stigma, produced broadly posteriorly to apex of clavus, a large fuscous area occupying apex of tegmen. Vein M3 three branched before apex. Wings hyaline, smoky towards base.

Anal segment of male bifid into two processes curving inward distally; telson a broad horizontal plate with posterior margin setose; aedeagus with a crescentic keel-like plate ventrally, two long spines directed posteriorly, and a transparent tube, curved upward distally, truncate at apex; genital styles irregularly pitted along dorsal margin, with a long shallow crescentic indentation near apex; a triangular flange directed outward near middle, densely beset with short setae; basad of this a small setigerous lobe curved outward and downward.

Anal segment of female short with small lobes laterally at apex. Lateral styles tapering to a slender point, ventral styles tapering abruptly. Pregenital plate equilaterally triangular with angles almost equally truncate.

Described from 45 males and 37 females collected by the writer on Morne Fortunée, St. Lucia, B. W. I. (Nov. 21, 1939) on *Tabernaemontana* sp. and other shrubs. This species is extremely close to *P. decorata*. The genitalia are all but identical. A difference has been noted in the shape of the crescentic indentation near the apex of the male genital styles, that of *P. trinervosa* being shallower. In *P. decorata* M3 forks into two; in 82 specimens of *P. trinervosa*, 6 were found with the veinal condition of *P. decorata*, 74 had three brancehs to M3, and 2 specimens had four branches to M3. Two specimens possessed an extra vein dividing the first apical cell. The tegminal patterns of the two species are quite distinct; both are very stable and not a single intergrade has been found. The differences in the colour of the vertex and pronotum are also constant.

Prosotropis rubiginosa, sp. n.

Female.—Length, 2.4 mm.; tegmen, 2.6 mm.

Vertex stramineous, with a dark spot on each side basally; frons, clypeus, genae and antennae stramineous; eyes red. Pronotum testaceous; mesonotum pale ferruginous anteriorly, testaceous medially, scutellum pale to white. Abdominal sclerites ferruginous, membrane pale. Legs stramineous. Tegmina hyaline, costal area crossed by three rusty-brown oblique lines, the middle of which is connected posteriorly with a band passing to base of tegmen; a narrow band from stigma to apex of clavus; a large patch occupying apex; a spot between claval vein and commissure, and an irregular spot between claval veins. Vein M3 two-branched apically. Wings hyaline, brownish towards base.

Anal segment of female short with a minute lobe on each side of apex. Lateral styles tapering sinuately to slender point. Pregenital plate, large, scoop-shaped with a horizontal lip posteriorly.

Described from one female collected by the writer at 1,000 ft. in mountain forest near the Imperial Road, Dominica, B. W. I. (June 19, 1939). This species differs from all others in colour and in tegminal markings, and from *P. decorata* and *P. trinervosa* in the shape of the pregenital plate.

Prosotropis marmorata, sp. n.

Male.—Length, 1.9 mm.; tegmen, 2.0 mm.

Vertex piceous, frons piceous basally, fuscous apically, carinae testaceous; clypeus, genae, basal segment of antennae fuscous, second segment of antennae very pale; eyes red. Pronotum and mesonotum piceous, scutellum very pale or white. Pro- and mesocoxae and hind femora pale fuscous, apex of metatibiae fuscous, legs otherwise very pale. Abdominal sclerites fuscous, membrane pale. Tegmina hyaline, costal cell with three dark areas, the middle broad, connected by a broad band to apex of clavus; Sc+R+M fork hyaline; an irregular band from stigma to apex of clavus; a broad band inside apical margin. Vein M3 three-branched apically.

Anal segment of male bifid apically, with slender lateral lobes deflexed; telson a broad horizontal plate posteriorly fringed with setae. Aedeagus with a crescentic keel-like plate ventrally, one simple and one bifid spine curving upward distally; a transparent tube expanded and somewhat uncinate at tip overlying spines. Genital styles with dorsal margin not pitted, lateral lobe with projection on inner posterior border.

Described from one male collected by the writer at 1,500 ft. in the Central Hills, Montserrat, B. W. I. (May 21, 1941) on a low bush in mountain forest. The species is well distinguished by its tegminal pattern and the shape of the genitalia.

QUILESSA, gen. nov.

Head, with eyes, scarcely two-thirds width of pronotum. Vertex longer than wide, expanding to base, which is shallowly, and usually angularly, excavated; median and lateral carinae well developed, curving uninterruptedly on to the frons; no transverse carina. Frons longer than its widest part (1.2 to 1), base about half as wide as apex, sides expanding nearly to six-sevenths from base, then subangularly converging to apex, lateral and median carinae distinct. Clypeus at base three-quarters as wide as widest part of frons tapering acutely to apex, median and lateral carinae present; clypeus and apical half of frons somewhat convex, basal part of frons sloping smoothly posteriorly into vertex. No median ocellus; genae somewhat tumid below antennae; no subantennal process; antennae with basal segment very short, second segment slightly longer than broad; eyes widely emarginate ventrally. Pronotum as long as vertex, anterior margin shallowly excavated behind eyes; posterior border shallowly emarginate, curving anteriorly at sides; median carina distinct, lateral carinae of disc obsolete; a strong carina at each lateral margin between eye and tegula. Mesonotum feebly convex, the three carinae distinctly elevated, apical region strongly concave, tip of scutellum acute. Hind

tibiae unarmed. Anal segment of male bifid, often asymmetrically; aedeagus with a ventral keel, often containing a complex sclerotised rod, and often with a process overhanging dorsally. Pygofer with a lateral process. Ovipositor incomplete. Egg bluntly ovoid.

Genotype, *Quilessa lutea*, sp. n.

Quilessa lutea, sp. n.

Male.—Length, 2.3 mm.; tegmen, 2.4 mm. *Female.*—Length, 2.4 mm.; tegmen, 2.5 mm.

Vertex testaceous, frons, clypeus, genae and antennae pale stramineous; eyes red. Pronotum and mesonotum ferruginous, paler at scutellum; pleurites and legs very pale. Abdominal tergites fuscous, sternites paler, membrane pale. Tegmina uniformly transparent yellow. Wings hyaline, faintly clouded.

Vertex with posterior border shallowly emarginate in a very obtuse angle. Anal segment of male bifid, lobe of right side bluntly hooked at tip, that of left side incurved. Pygofer with a long slender process directed backward and upward on each side posteriorly. Aedeagus asymmetrical; a blunt knob-like lobe above base; ventrally a keel-like sheath enclosing a sclerotised rod ending in two large prongs with a fringe of minute teeth on right side basad of apex; on left side of crescentic rod curved upward and backward, ending in a distinct knob. Genital styles with two lobes at apex, the inner with a thickened posterior margin, resembling a hook; below this, between the lobes, a second similar hook; a setose tuft at base of inner lobe.

Anal segment of female short with a minute lobe at each side apically. Lateral styles falcate, a horizontal filament arising from dorsal edge, ventral styles tapering to a blunt point. Pregenital plate scoop-shaped, slightly tapering posteriorly, posterior margin slightly excavated.

Described from 39 males and 47 females collected by the writer near Quilesse, at 1,000 ft. in mountain forest, St. Lucia, B. W. I. (Nov. 24, 1939) on *Cyathea* sp. This species is distinguished by its pale genae and clear yellow tegmina from all except *Q. gladiolata* (see below), from which it is separated in the male by the genitalia and by the narrow rod-like process on the pygofer, and in the female by the scoop-shaped pregenital plate.

Quilessa gladiolata, sp. n.

Male.—Length, 2.7 mm.; tegmen, 2.4 mm. *Female.*—Length, 2.9 mm.; tegmen, 2.7. mm.

Vertex testaceous, frons, clypeus, genae and antennae stramineous or very pale. Pronotum and mesonotum testaceous or ferruginous; pleurites and legs very pale, almost white. Abdominal tergites fuscous, sternites and membrane almost white. Tegmina uniformly transparent yellow; wings hyaline, faintly clouded.

Vertex with posterior border shallowly emarginate in a very obtuse angle.

Anal segment of male elongate, bifid apically, lateral lobes incurved. Pygofer

with a long process, sinuately expanding from base and tapering to a point apically, on right side, a small sinuate lobe correspondingly on left side. Aedeagus with a blunt knob above base; ventrally a keel-like sheath, enclosing a sclerotised bar forking near apex, fork of right side spatulate, toothed, with a denticulate ramus basad, fork of left side pincer-like at apex. Genital styles with a setigerous eminence on dorsal margin, sides terminating in a broad rounded lobe; apex a very shallow cup.

Anal segment of female short with a minute lobe on each side apically. Lateral styles bifid, a rounded lobe below, a tapering filament above. Ventral styles flat, tapering to a blunt point. Pregenital plate deeply bifid into two large rounded foliaceous lobes.

Described from 21 males and 11 females collected by the writer at 1,000 ft. in mountain forest near Saltoun, Dominica, B. W. I. (June 11-July 8, 1939) on low bushes and on ferns. This species is readily distinguished from all except *Q. lutea* by the pale genae and clear yellow tegmina; it differs from *Q. lutea* in the genitalia of both sexes.

Quilessa maculata, sp n.

Male.—Length, 2.2 mm.; tegmen, 2.3 mm. *Female.*—Length, 2.4. mm.; tegmen, 2.5 mm.

Vertex testaceous, frons, clypeus, genae and antennae very pale. Pronotum and mesonotum ferruginous sometimes suffused with fuscous, scutellum usually red at tip. Pleurites and legs very pale. Abdominal tergites fuscous, sternites and membrane almost white. Tegmina transparent, yellow, a round fuscous spot at stigma, a small smoky area beyond apex of clavus. Wings hyaline, faintly clouded.

Vertex with posterior border emarginate almost in a right angle.

Anal segment of male with deep lateral lobes, bifid beyond telson into two short incurved processes. Pygofer with a short upturned digitate process on right side, a smaller lobe correspondingly at left. Aedeagus with a ventral keel bifid apically, enclosing an elongated sheath covering a sclerotised plate denticulate ventrally and on left margin. Genital styles with a setigerous eminence on dorsal border near base, a shallowly deflexed hook directed posteriorly at apex.

Anal segment of female very short, truncate at posterior margin. Lateral styles tapering, somewhat sinuate. Ventral styles deep, with lower margin reflexed to form a broad trough basally, dorsal and ventral margins tapering abruptly to pointed apex. Pregenital plate broadly hexagonal.

Described from 18 males and 21 females collected by the writer at 1,000 ft. in mountain forest near Saltoun, Dominica, B. W. I. (June 11-July 8, 1939) on low bushes and ferns. This species is readily distinguished by the markings of the tegmina and by the genitalia of both sexes.

Quilessa nigrigena, sp. n.

Male.—Length, 2.4 mm.; tegmen, 2.6 mm. *Female.*—Length, 2.9 mm.; tegmen, 3.0 mm.

Vertex testaceous; frons piceous at base, pale distally; clypeus pale yellow; genae piceous below antennae, pale yellow in front of antennae, dark above ocelli; second joint of antennae piceous; eyes red. Pronotum testaceous; mesonotum testaceous on disc, suffused ferruginous laterally, tip of scutellum very pale. Legs pale. Abdominal sclerites and genitalia fuscous or ferruginous. Tegmina hyaline, veins yellow, stigma sometimes suffused yellow. Wings hyaline.

Vertex slightly emarginate posteriorly.

Anal segment of male bifid beyond telson, process of right side expanded, that of left tapering, both incurved. Pygofer with a short rounded process on each side posteriorly. Aedeagus with a deep, flattened, cowl-like ventral keel, dorsally a sclerotised rod somewhat spatulate at apex directed backward. Genital styles shallowly grooved lengthwise below, directed upward and backward distally to a point at apex.

Anal segment of female short, terminating in a blunt lobe on each side. Lateral styles tapering sinuately to a narrow point; ventral styles very broad, in the shape of a blunt hook at apex. Pregenital plate short, scoop-like, convexly triangular in ventral view.

Described from 3 males and 2 females collected by the writer at 1,000 ft. in mountain forest near Saltoun, Dominica, B. W. I. (June 11-July 8, 1939) on low bushes. This species is readily distinguished by the clear yellow tegmina and the piceous area on the genae, as well as by the genitalia of both sexes.

Quilessa caerulea, sp. n.

Male.—Length, 2.0 mm.; tegmen, 2.2. mm. *Female.*—Length, 2.4 mm.; tegmen, 2.4 mm.

Vertex testaceous; frons pale fuscous at base, very pale distally, apical line narrowly fuscous; clypeus testaceous clouded with fuscous; genae fuscous below antennae, very pale in front of antennae, somewhat fuscous above ocellus; eyes red; basal segment of antenna pale, second segment piceous. Pronotum testaceous, sometimes infuscate; mesonotum ferruginous marked with fuscous apically, scutellum concolorous; pleurites and coxae somewhat fuscous, legs very pale yellow. Abdominal sclerites and genitalia fuscous, membrane red or pallid. Tegmina yellow, costal cell smoky near stigma, which is fuscous, apical cells smoky. Wings hyaline, faintly clouded. In life the tegmina are powdered dusky blue.

Vertex shallowly emarginate posteriorly.

Anal segment of male bifid beyond telson, processes short, incurved. Pygofer with a somewhat pincer-shaped process laterally, directed posteriorly and inward. Aedeagus a shallow trough rounded at apex, with a percurrent sclerotised rod curved transversely near apex; a tongue-like eminence in middle of left dorsal

margin. Genital styles shallowly grooved on inner surface, terminating in a recurved point apically.

Anal segment of female short; truncate apically. Lateral styles spatulate, with a short filament projecting posteriorly from ventral margin; ventral styles tapering upward near apex to a blunt point. Pregenital plate broad, posterior margin indented medially, the left posterior lobe often larger than the right.

Described from 65 males and 60 females collected by the writer at 1,000 ft. in mountain forest near Saltoun, Dominica, B. W. I. (June 11-July 8, 1939) on low bushes. This species is readily distinguished by the dusky tegmina, by the dark frons, and by the genitalia of both sexes.

Explanation of Plates 8 and 9.

1. *Eparmene*, facial view of head (from drawing supplied by W. E. China).
2. *Quilessa*, facial view of head.
3. *Prosotropis*, facial view of head.
4. *Eparmene*, dorsal view of head and thorax (from drawing supplied by W. E. China).
5. *Prosotropis*, dorsal view of head and thorax.
6. *Prosotropis*, wing.
7. *Quilessa*, wing.
8. *Eparmene*, tegmen (from drawing supplied by W. E. China).
9. *Quilessa caerulea*, tegmen.
10. *Q. maculata*, tegmen.
11. *Quilessa*, dorsal view of head and thorax.
12. *Prosotropis marmorata*, tegmen.
13. *P. rubiginosa*, tegmen.
14. *P. trinervosa*, tegmen.
15. *P. decorata*, tegmen.
16. *P. decorata*, dorsal view, anal segment of male.
17. *P. decorata*, dorsal view, anal segment of female.
18. *P. decorata*, lateral view of anal segment of male.
19. *P. decorata*, aedeagus.
20. *P. decorata*, lateral view, genital style of male.
21. *P. trinervosa*, lateral view, genital style of male.
22. *P. decorata*, ventral view, genital style of male.
23, 25. *P. decorata*, ventral and lateral views of ventral process of ovipositor.
24. *P. decorata*, pregenital plate of female, ventral view.
26. *P. marmorata*, ventral view, genital style of male.
27, 28. *P. rubiginosa*, lateral and ventral views of pregenital plate.
29. *P. rubiginosa*, lateral view of lateral process of ovipositor.
30, 31, 32. *P. marmorata*, anal segment of male, aedeagus, genital style of male, lateral view.
33, 34. *Quilessa gladiolata*, dorsal and lateral views of anal segment of male.
35, 36. *Q. gladiolata*, processes of pygofer of right side and left side.
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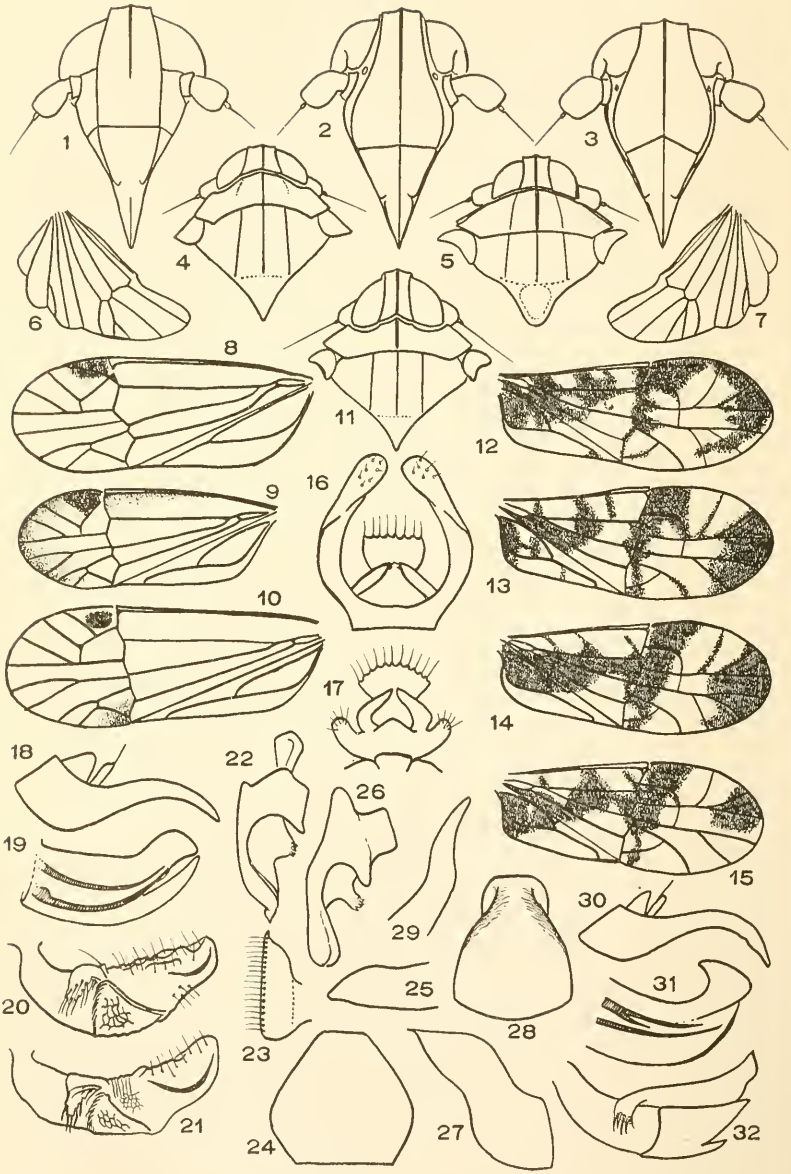
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38, 39. *Q. gladiolata*, left side and right side of aedeagus.
40. *Q. gladiolata*, pregenital plate of female.
41. *Q. gladiolata*, lateral view of anal segment and processes of ovipositor.
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67. *Q. caerulea*, lateral view, anal segment of male.
68. *Q. caerulea*, lateral process of pygofer.
69, 70. *Q. caerulea*, left side and right side of aedeagus.
71. *Q. caerulea*, ventral view, pregenital plate of female.
72, 73. *Q. caerulea*, ventral and lateral views of male genital style.
74. *Q. caerulea*, lateral view, processes of ovipositor.

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DESCRIPTION OF THE THIRD-STATE LARVA OF AMPHIMALLON MAJALIS (RAZOUMOWSKY).

By ADAM G. BÖVING,

Associate in Zoology, Smithsonian Institution, Washington, D. C.

The material on which the following description is based is in the U. S. National Museum and in the collection of the Department of Entomology, Cornell University, Ithaca, N. Y. It consists of—

1. Six third-stage larvae from turf, Newark, N. Y., collected by F. L. Gambrell, N. Y. Agr. Station, on April 27, 1940 (one adult reared from this material).
2. Fifteen third-stage larvae, Newark, N. Y., collected by F. L. Gambrell and S. C. Mendall, N. Y. Agr. Exp. Station, on February 16, 1942.

The determination of all larvae to genus has been made by Adam G. Böving, and the determination to species on the strength of the reared adult has been made by E. A. Chapin, Curator of Insects, U. S. National Museum.

DESCRIPTION OF THE THIRD-STAGE LARVA.

(Plate 10, plate 11 with figures 1 to 13.)

The middorsal length of the larva measured from anterior margin of frons to anus, 30 to 35 mm.; the average extreme width of the cranium, 4 mm.

Cranium[1] (fig. 1) narrower than prothorax (the width of the prothorax being about 5 mm.); broader than long with length about 3 mm. Surface of cranium smooth, shining, cadmium brown and pitted with numerous punctures. Clypeo-frontal suture (CLFS) well marked; frontal sutures (FS) (=epicranial arms auct.) fine, whitish, anteriorly convex toward the outside, posteriorly slightly concave, almost straight, meeting considerably in front of hind margin of head, forming an angle of about 60 degrees. Epicranial suture (ES) (=epicranial stem auct.) about one-third the length of one of the frontal sutures, brown ochre with a slightly impressed small anterior enlargement. Anterior marginal region of frons with two long and three or four shorter setae (k) on each side in a single transverse series; opposite the middle of the anterior and convex lateral outline of frons with one seta (l) on each side, between this seta and the frontal condyle, one seta (m), and one seta (o) at the base of the condyle.

[1] The term cranium is used here for the head-capsule formed by the two immovable parts, viz. the frons and the epicranium.

Epicranium furnished with two setae (p) opposite the slightly concave part of each frontal suture; near the middle of the lateral outline of epicranium with a single seta (q), and partly encircling the ring-shaped support (or torulus) of the antenna (Ant) with a group of eight rather long setae and some short setae (r^1 fig. 1 and r^2 fig. 2), the latter (r^2) in a patch extending backwards on the ventral side of the cranium.

Clypeus (fig. 1) subtrapezoidal, divided into an anterior whitish naked part, anteclypeus (ACL) and a larger darkly sclerotized part, postclypeus (PCL), the latter carrying setae and pitted with numerous punctures. On each side of postclypeus with one anterior and one posterior lateral seta, and between the anterior seta and the sagittal line with one seta on each side.

Labrum (fig. 1) somewhat longer and slightly narrower than clypeus, angular at the middle of each lateral outline, and apically somewhat projecting. Across labrum with a median transverse and complete ridge which is irregularly wrinkled on its broad, rounded crest; anterior to this ridge, approximately parallel with it, with two similar but shorter and less complete ridges, one in front of the other. Surface of labrum pitted with numerous punctures and bearing setae distributed on each side as follows: On apical projection, two moderately long, stiff setae (a) (a third seta, marked x, close to the sagittal line, belongs to epipharynx); anterior to the medium transverse ridge and in the lateral margin itself three setae (b), near the lateral margin one long seta (c); in front of the median, complete ridge two long setae (d); and behind the ridge a transverse somewhat irregular series of four long setae (e).

Ocelli absent.

Antenna (fig. 1) as long as the cranium, slender, with four movable articles, carried by a connate antennal support or torulus (Ant). Subapical article ventrally produced into a conical process; apical article subelliptical, somewhat asymmetrical, distally slightly constricted, and furnished with many minute sensorial pegs in a whitish membrane, dorsally with a kidney-shaped, semi-transparent sensory spot (sensilla placodea). First, second, and third (or subapical) articles rather slender; first and third of about equal length, second article somewhat longer; first and second articles each with a single seta, and the antennal support with several setae.

Mandible (figs. 4, 5, 6, 9, 10) about as long as cranium and generally as light colored, but distally with black scissorial part (Sci), and proximally with black manducatorial part (Mc), dark mandibular fossa, dark condyle, and dark accessory ventral condyle (AcC). *Scissorial part* (Sci) with a slightly wavy, almost straight cutting edge which posteriorly is limited by a notch whose hind wall is produced into a small tooth (figs. 5, 6). On dorsal side, scissorial part marked by one large sensorial pit (x, fig. 6) accompanied by two or three small punctures, and in antero-exterior direction from the pit with a short groove having another pit (y, fig. 6); edge of scissorial part behind the notch smooth. *Manducatorial part* (Mc, fig. 5) with a molar structure (Mo, fig. 6). Molar structures different and asymmetrical on right and left mandibles. Molar structure of right mandible (figs. 6, 9) trilobed with the lobes increasing in size posteriorly. Last lobe or calx (Cx) about one and one-half times as long as wide, with a flat subtrapezoidal face divided in two almost equal regions by a transverse carina, and posteriorly slightly emarginate. Molar structure of left mandible (figs.

4, 5) projecting anteriorly and receding posteriorly, bilobed with anterior lobe shielding the lower posterior lobe; calx (Cx-U) poorly developed but characterized by a flat, rather thin and pale, piliferous projection termed hamus (H). A well-developed brush of long bristles found at the bases of both right and left molar parts. On ventral side of each mandible with a condyle-formed marginal projection between calx and the mandibular condyle articulating with the hypopharyngeal sclerite and coordinating the protrusion and retraction of hypopharynx with the opening and closing of the mandibles. Dorsal surface of right mandible with a few well-developed setae and punctures at the molar structure; dorsal surface of left mandible only with some vestigial setulae in the corresponding place. Dorso-exterior regions of mandibles (DER, fig. 5) without punctures and setae. Laterally and exteriorly each mandible with elongate-subtriangular and somewhat sunken surface forming a scrobis (Scr, fig. 5) limited by two apically converging, low carinae. Distal end of scrobis marked by a rather short seta and wider part of scrobis with a longitudinal row of about seven punctures. On and below the ventrolateral carina (VLC, fig. 5) with a longitudinal row of about eight setae. On ventral side of mandible with a region, termed the baso-lateral region (BLR, fig. 10) by P. O. Ritcher, extending from the ventral condyle in anterior direction and carrying a patch about ten setae. A zone between ventral condyle and accessory marginal projection (AcC, fig. 10) provided with numerous minute, pointed granules which constitute a vestigial stridulatory organ (StrZ, fig. 10).

Maxillary lobes (lacinia and galea) fused proximally into a single structure but distally free. Ventral surface almost exclusively formed by galea; dorsal surface formed by both galea and lacinia (G and L, fig. 8); galea ending in a single strong tooth (GT, fig. 8), lacinia in three, basally fused, strong teeth (LT, fig. 8). *Stipes* on dorsal side with a longitudinal row of about 14 pointed, conical stridulatory teeth (SD, figs. 7, 8). *Maxillary palpus* (fig. 8) projecting beyond galea, with four articles; apical article suboval, with sensorial groove (SG, fig. 8) exteriorly; first, second, and third (or subapical) articles approximately of same size and one and one-third as long as wide; apical article as long as second and subapical articles together, at the end with several minute sensorial pegs in a pale membrane. *Maxillary articulating area* (AM, fig. 8) large and setose.

Hypopharynx (fig. 8) with large round glossa (Gl) beset with short, strong setae posteriorly and long fine setae anteriorly. Hypopharyngeal sclerite (HS) blackish, strong, with several tufts of setae and a fossa on each side for the accessory projection of the mandible.

Labial palpus (fig. 8) with two articles, the apical similar in form to the apical article of the maxillary palpus but without a sensorial groove laterally.

Epipharynx (fig. 3) situated under labrum and clypeus, continued into the dorsal wall of the pharynx, with boundary line toward pharynx marked by the transverse, curved crepis (Crep). *Apical region* (AR) anterior to zygum (Z) beset with numerous, strong, spine-like setae, one pair (x) seated on the underdsie of the apical process. Each *plegmatium* (P) with about 15 rather short plegmata; *proplegmatia* (Pr) weak, each consisting of about 12 proplegmata. *Acanthoparia* (Ap) with coarse, cultriform setae, each placed at the exterior

end of a plegma; *gymnoparia* (Gp) present; *chaetoparia* (Cp) large, with setae of various sizes but without sensory punctures interspersed among them. Haptomeral region with distinct *epizygum* (EZ) between zygum (Z) and anterior margin of epipharynx, with a curved series of six dark, rather large *equidistant punctures* and some much smaller punctures near them, and with a similarly curved series of six or seven *heli* (H). *Pedium* (Ped) longer than wide. *Laeotorma* (Lt) with apotormal and epitormal processes (Apot and Epit); *dexiotorma* (Dxt) almost straight. About eight long *phobae* (Phob) in a longitudinal series extending forward from inner end of laeotorma, and a similar number of less well-developed phobae in a single patch at the inner end of dexiotorma. *Crepis* (Crep) thin as a hair, somewhat expanded near inner end of dexiotorma; a series of phoba-like hairs arranged in front of left end of crepis, accompanied by two larger punctures, termed macrosensilla, and three or four small crepidal punctures; two triangular *nesia* (Ns) present, both small and slightly different in size, one placed almost in the middle line of epipharynx, the other nearer the inner end of dexiotorma.

Legs (plate 10) gradually and slightly increasing in length from first to third, beset with long yellowish-brown setae, particularly dense on the posterior surfaces of coxa, trochanter, femur and tibiotarsus. Claws (I, II, III, fig. 13) unequal in length and different in shape. On first and second legs, claws about one-third length of tibiotarsus (first claw somewhat the longer) enlarged at base, tapering gradually toward the pointed end, and gently curved. Claw of third leg with distinct base but very short distal part; less than one-half as long as first or second claw. Base of each claw armed with two long, spine-like setae.

Body areas (plate 10). Prothorax (1) with one dorsal area; mesothorax (2) and metathorax (3) each with three dorsal areas. Prescutum and spiracle-bearing part of mesothorax closely connected with prothorax and appearing as part of it. *Prothorax* with a series of fairly long setae on the entire margin toward the head and with a thinly sclerotized long plate behind. Prescutum, scutum and scutellum of *meso-* and *metathorax* beset with fine curved setae and no small, stiff, and pointed setulae. Prescutum, scutum and scutellum of *first abdominal segment* with fine curved setae and no setulae. Prescutum, scutum and scutellum of *second to sixth abdominal segments* each beset with a patch of yellowish-brown setulae interspersed with a single transverse row of long, fine setae. Postscutellum (PO) present on first to sixth abdominal segments; laterally placed, not reaching across the back, but varying in size on the different segments, largest on fifth and sixth segments, bearing two fine setae. Prescutum and scutum of *seventh abdominal segment* each with a transverse patch of setulae interspersed with long, fine setae in a single transverse row; scutellum without setulae but with long fine setae. Prescutum, scutum, scutellum and postscutellum of *eighth abdominal segment* indistinctly limited, furnished with fine long setae but no setulae. *Ninth and tenth abdominal segments* not completely united; individual areas of both segments obliterated; dorsally with long, or, on tenth abdominal segment, with both long and short setae, but without setulae.

Anus (An, fig. 12) Y-shaped; upper anal lip (UAL) entire, but lower anal lip (LAL) divided by a straight, sagittal cleft (AnC). Both lips covered with very

long and moderately long, fine setae and also with some stout setae and numerous very short setulae.

Raster (fig. 12) consisting of septula, a pair of palidia and a pair of tegilla. *Septula* (Sep) approximately hastate (i. e. like an arrowhead, but with the lobes pointing outward nearly at right angles), extending from entire base of lower anal lip to about middle of venter of tenth abdominal segment (plate I). *Palidia* monosticous (i. e. with pali in a single row), subparallel in anterior half, outwardly curved behind. Pali in anterior half short, slightly curved toward septula, placed in a fairly regular row with the intervening distance between the pali as long as or much longer than the pali; pali in the outwardly curved part long, slender, straight and pointed, placed in a somewhat irregular row, with intervening space between the pali shorter than the pali. Each *tegillum* (TGL) with flat, distally bent setae, as long as or slightly longer than the longest pali; anteriorly tegilla passed conspicuously by palidia; *preseptular setae* consequently absent.

Spiracles (plate 10, plate 11, fig. 11) with strongly curved respiratory plate (RP); bulla (B) almost circular; spiracular orifice (or stoma) (O) biarcuate. Thoracic spiracle about same size as one of the first four abdominal spiracles; the concavity of its respiratory plate facing posteriorly, that of the abdominal respiratory plates facing anteriorly. Metathorax provided with a vestigial spiracle (Th II, fig. 11) of about the same size as the socket of an ordinary seta. First to fifth abdominal spiracles approximately of equal size; sixth to eighth somewhat smaller.

Systematic Relationship.

The general appearance of the third-stage larvae of *Amphimallon* is similar to that of the third-stage larvae of *Phyllophaga*, but the larvae of the two genera are readily separated by the following characters:

In the third-stage larvae of genus *Amphimallon:* The number of long setae in the anterior marginal region of frons is on each side three or less; the dorso-molar setae of each mandible are few or none; a zone with minute stridulatory granules is present between the ventral condyle and the accessory ventral process of each mandible; the maxillary stridulatory teeth are conical, straight, and pointed; the palidia are anteriorly longitudinal, straight and parallel, posteriorly obliquely diverging, outward directed; a distinct anal cleft divides the lower anal lip sagittally.

In the third-stage larvae of *Phyllophaga:* The number of long setae in the anterior marginal region of frons is with few exceptions more than three, often numerous, on each side; the average number of dorso-molar setae of each mandible is usually 15; a mandibular stridulatory zone is absent; the maxillary stridulatory teeth are low with a backward-bent, approximately horizontal, pointed end; the palidia are longitudinal in their entire length, never diverging posteriorly; a distinct anal cleft is absent, lower anal lip not divided sagittally.

The third-stage larvae have been described of three species of *Amphimallon*, namely—

A. solstitialis (Linnaeus) by Perris (1877), Znamenskie (1926), Fidler (1936), Golovianko (1936), Régnier (1939), Korschefsky (1940), and van Emden (1941);

A. assimilis (Herbst) by Grandi (1925), Znamenskie (1926), and Subklew (1938); and

A. majalis (Razoumowsky) by Régnier (1939).

The third-stage larvae of *Amphimallon ochraceus* (Knoch) and *Amphimallon ruficornis* (Fabricius) (?) have casually been recorded, but not described, by van Emden (1941).

Key to Known Species of Amphimallon.

1. Palidia not extending in front of tegilla, number of preseptular setae[3] about 15. (Pali shorter than the average tegillar setae even in the curved parts of the palidia; proplegmatia distinct; width of head-capsule varying from 4.1–5.1 mm.) . . . . *A. solstitialis* (and *A. ochraceus*, according to van Emden).
– Palidia extending conspicuously in front of tegilla, preseptular setae absent 2
2. Proplegmata absent ..... *A. assimilis*
– Proplegmata about 12 on each side, weak and short. (Pali of curved parts of palidia about as long as the average length of the tegillar setae; average width of head-capsule, 4 mm.; medio-dorsal length of larva from anterior margin of frons to anus varying between 30 and 35 mm.) ..... *A. majalis*

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Böving, Adam G.

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1942. Descriptions of the larvae of some West Indian melolonthine beetles, and a key to the known larvae of the tribe. Proc. U. S. Nat. Mus., vol. 92, No. 3146, p. 175, figs. 10–12. (With three figures referring to *Rhizotrogus solstitialis* L. = *Amphimallon solstitialis* L.)

[3] Tegillum is the term applied to a patch of more or less erect, strong setae on each side of the palidia. All tegillar setae are termed preseptular setae when located in front of an imaginary line extending across the entire venter through the bases of the anterior first pair of pali.

EMDEN, F. I. VAN.

1941. Larvae of British Beetles. II. A key to the British Lamellicornia larvae. Ent. Month. Mag., vol. 77, No. 927, pp. 117–127 and 181–192, 2 pl. (*Amphimallon solstitialis* L. in key to larvae of Melolonthinae, p. 125; head-width of larvae, notes on habits, p. 187, p. 189. *Amphimallon ruficornis* F. (?) in notes on larvae, p. 182; head-width of larvae; found under stones, at roots of grass. *Amphimallon ochraceus* Knoch, in key to larvae, p. 125.)

FIDLER, J. HAVELOCK.

1936. Some notes on the biology and economics of some British chafers. Ann. Appl. Biol., vol. 23, No. 2, May, 1936, pp. 409–427. (*Amphimallus solstitialis* L., egg, larva, and pupa described and compared with *Melolontha melolontha* L. and *Serica brunnea* L.; key for the rough identification of the 5 main genera of Scarabaeidae damaging field crops.)

GOLOVIANKO, Z. S.

1936. Les larves plus communes des Coléoptères lamellicornes de la partie européene de l' U. R. S. S.—Table analyt. Fn. U. R. S. S. No. 20. Inst. Zool. Acad. Sci. U. R. S. S., pp. 1–65, 70 figs. (In Russian.) (*Amphimallon solstitiale* (Sic.) L., p. 28, fig. 15; in key to genera and species of Scarabaeidea; general distribution given. A note (in Russian) evidently concerning larva of genus *Amphimallon*, p. 5.)

GRANDI, GUIDO.

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MOUTIA, L. ANDRE.

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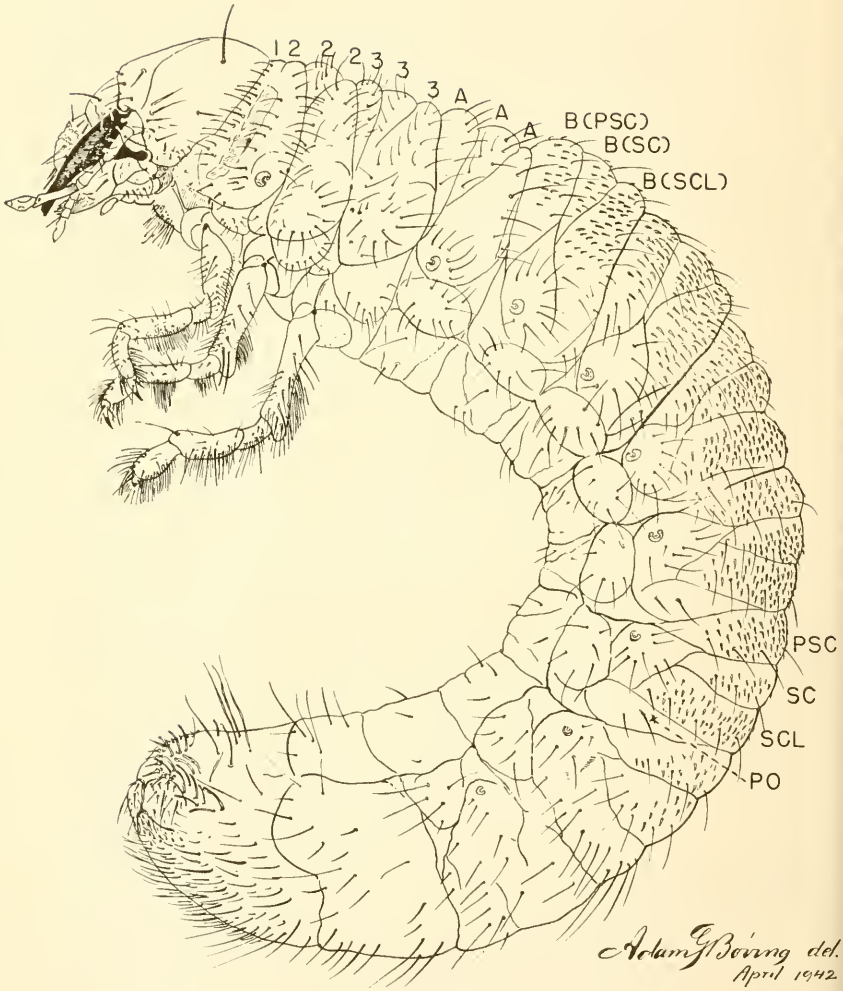
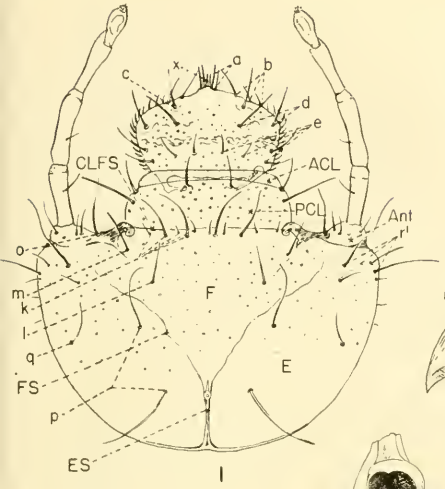
RÉGNIER, ROBERT.

1939. Contribution à l'étude des hannetons. Un grand ennemi des gazons: *Amphimallon majalis* Razoumowsky. Ann. des Epiphyt. et de Phytogénét., vol. 5 (n. ser.), part 3, 1939, pp. 257–265, figs. (Pest of sod, description of immature stages and information on life history; larva of *A. majalis* compared with those of *A. solstitialis* and *Melolontha melolontha*, pp. 259–260, 261–264, figs. 2a, 3, 4; bibliographical notes on contributions by older authors, as Éduard Perris, Xambeu and others.)



Amphimallon majalis (Razoumowsky)



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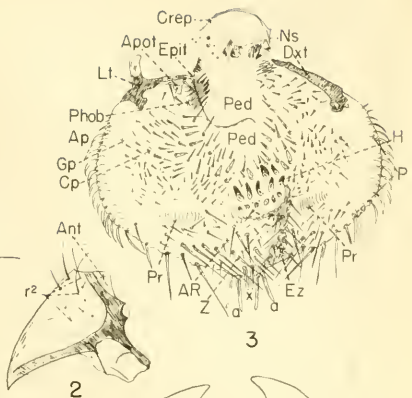

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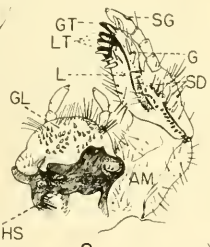

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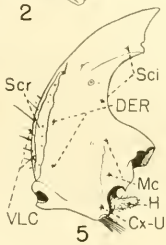

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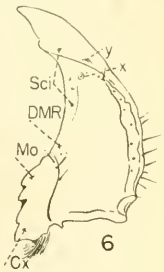

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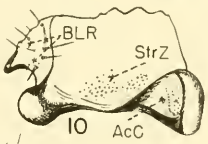

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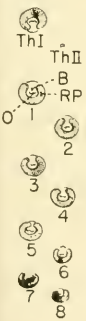

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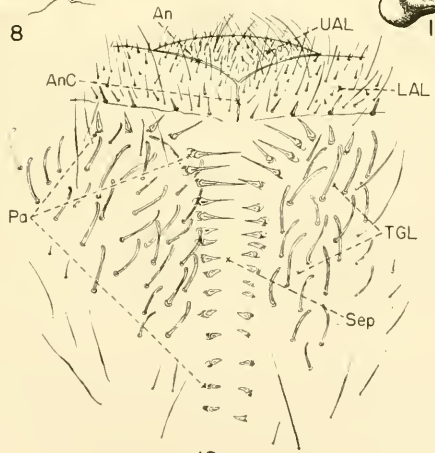

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SUBKLEW, WERNER.

1938. Zur morphologie der larve von *Melolontha hippocastani* F. Arch. Naturgesch. (Leipsig) (n. ser.) vol. 7, No. 2, June 18, 1938, pp. 207–304, figs. (Included notes on labrum, mandible, first maxilla, and tergum of *Amphimallus assimilis*, pp. 281, 283, 286, 291; mentioned that Ritterschaus found no egg-bursters in *Amphimallus solstitialis*.)

ZNAMENSKIE, A. V.

1926. Insects injurious to ground, part I. Injurious to grain plants. Poltava, U. S. S. R., Agric. Exp. Sta. No. 50, Ent. Sect. No. 13, 1926, pp. 1–296, figs. (*Amphimallon solstitialis* L. in key to scarabaeid larvae; taxonomic characters of larva; (figs. 83–86, 6a); additional descr. of larva, p. 193. *A. assimilis obscurus* Brenske, note of comparison with labrum of larva of *Melolontha hippocastani* F.; note that Grandi found no egg-burster in this species.)

EXPLANATION OF FIGURES.

(The drawings for the two plates accompanying this paper were made by the author.)

Amphimallon majalis (Razoumowsky).

Plate 10.

Full grown (third-stage) larva, lateral view; end of last segment turned slightly toward the observer. 1, prothoracic areas; 2, mesothoracic areas; 3, metathoracic areas; A, areas belonging to first abdominal segment; B, areas belonging to second abdominal segment; PO, postscutellum; PSC, prescutum; SC, scutum; SCL, scutellum.

Plate 11.

Fig. 1. Dorsal surface of head. ACL, anteclypeus; Ant, torulus; CLFS, clypeofrontal suture; E, epicranium; ES, epicranial suture; F, frons; FS, frontal suture; PCL, postclypeus—a–e, setae of labrum; k–m, setae of frons; o–r^1, setae of epicranium; x, seta on ventral side of apical projection of epipharynx.

Fig. 2. Ventral surface of head (part). Ant, torulus; r^2, setae of epicranium.

Fig. 3. Epipharynx. Ap, acanthoparia; Apot, apotormal process; AR, apical region; Cp, chaetoparia; Crep, crepis; Dxt, dexiotorma; Epit, epitormal process; Ez, epizygum; Gp, gymnoparia; H, helus; Lt, laeotorma; Ns, nesium; P, plegmatium; Ped, pedium; Phob, phobae; Pr, proplegmatium; x, seta on apical process of epipharynx; Z, zygum.

Fig. 4. Molar structure of left mandible, front view. Cx–U, calx; H, hamus.

Fig. 5. Left mandible, dorsal side. Cx–U, calx; DER, dorso-exterior region; H, hamus; Mc, manducatorial part; Sci, scissorial part; Scr, scrobis; VLC, ventrolateral carina.

Fig. 6. Right mandible, dorsal side. Cx, calx; DMR, dorsomolar region; Mo, molar structure; x, sensorial pit; y, short groove with a pit.

Fig. 7. Stridulatory teeth from dorsal side of right maxilla. SD, stridulatory tooth.

Fig. 8. Right maxilla and hypopharynx, dorsal surface. AM, maxillary articulating area; G, galea; GL, glossa; GT, terminal tooth of galea; HS, hypopharyngeal sclerite; L, lacinia; LT, terminal three teeth of lacinia; SD, stridulatory organ; SG, sensorial groove.

Fig. 9. Molar structure of right mandible, front view. AcC, accessory ventral condyle; Cx, calx.

Fig. 10. Stridulatory organ on ventral surface of right mandible. AcC, accessory ventral condyle; BLR, basolateral region; StrZ, stridulatory zone.

Fig. 11. Spiracles. B, bulla; O, orifice; RP, respiratory plate; ThI, first thoracic spiracle; ThII, vestigial second thoracic spiracle; 1 to 8, spiracles of first to eighth abdominal segments.

Fig. 12. Ventral terminal part of tenth abdominal segment, showing anus, upper anal lip, sagittally divided lower anal lip and raster. An, anus; AnC, anal cleft; LAL, lower anal lip; Pa, palidium; Sep, septula; TGL, tegillum; UAL, upper anal lip.

Fig. 13. Ends of tibiotarsi and unguli of the first to third (I, II, III) thoracic legs.

NOTE CLARIFYING THE STATUS OF ANOPHELES ALBITARSIS AND ANOPHELES DARLINGI (DIPTERA: CULICIDAE).[1]

By O. R. Causey, L. M. Deane, M. P. Deane and Machado Sampaio.
From the Laboratory of the Serviço de Malaria do Nordeste at Fortaleza, Brazil.

Anopheles albitarsis Lynch-Arribalzaga and *Anopheles darlingi* Root are perhaps the two most important malaria vectors in Brazil, now that *Anopheles gambiae* has been eliminated (Soper and Wilson, 1942). Their status as separate species and their differentiation from *Anopheles argyritarsis* in Brazil were established by Dr. F. M. Root (1926). There still exists confusion, however, especially in regard to the identity of the eggs of these two species. After studying and breeding out several thousand batches of eggs from isolated females from the States of Piauhy, Ceará, Rio Grande do Norte, Parahyba, Pernambuco, Alagôas, Rio de Janeiro, and the Federal District, including some of the areas studied by Dr. Root, we are convinced that the correction of certain errors in Root's description and interpretations can clarify the situation for subsequent workers.

During a short visit to Brazil in 1925 Dr. Root studied a number of species of mosquitoes from the State of Rio de Janeiro. From the "Baixada Fluminense" he reported the collection of *Anopheles tarsimaculatus*, *Anopheles albitarsis*, and a new species which he named *Anopheles darlingi*. He described and made drawings of three types of eggs which he thought to belong to these three species of mosquitoes. His descriptions are as follows:

"The eggs are all of the familiar boat shape, flattened dorsally, convex ventrally, and more broadly rounded at the anterior than at the posterior end. The posterior portion of the 'frill' seems to have disappeared and the anterior portion simply forms a collar-like structure, encircling the extreme anterior end of the egg and projecting dorsally or anterior-dorsally. In the specimens studied there appeared to be differences in the form of the frill in different species, thus in *tarsimaculatus* it was narrower, enclosed a large area, and was more dorsal in position than in *albitarsis* and *darlingi*. The apparent differences between the frills of *albitarsis* and *darlingi*, as shown in the figures, may very well be due to the incomplete expansion in the case of the latter species.

"The most obvious specific differences are in the length of the lateral floats and their degree of approximation. In *tarsimaculatus* the floats extend nearly the full length of the egg,

[1] The studies herewith reported were part of the program of the Serviço de Malaria do Nordeste maintained by the Ministry of Education and Health of Brazil, and the International Health Division of The Rockefeller Foundation.

covering all of the dorsal surface except the anterior area enclosed by the frill, a small tip posteriorly, and a narrow spindle-shaped region in the mid-line. In this case, as in the other two eggs, the floats of the two sides meet and fuse at their anterior and posterior ends. In *albitarsis* and *darlingi* the floats are much shorter, leaving a considerable area uncovered at both anterior and posterior ends. In *albitarsis* there is a comparatively large spindle-shaped area between the floats of the two sides, while in *darlingi* this is reduced to a mere line.

"The surface ornamentation seemed to be the same in all three eggs, the species of the *Nyssorhynchus* group seem not to show the elongate hexagonal markings, so conspicuous in the eggs of such species as *quadrimaculatus* and *pseudomaculipes*. Instead, one finds the whole ventral and lateral portion of the egg studded with little white stars, each consisting of eight or ten lines radiating from an imaginary common center."

The egg described by Root for *A. tarsimaculatus* was perhaps that of *A. oswaldoi*, which he considered synonymous with *tarsimaculatus*. Eggs obtained by us from 286 isolated females which were identified as *A. oswaldoi* from the Federal District have conformed with Root's description of *tarsimaculatus* eggs. However, it should be pointed out that a similar type of egg has been obtained from another species of the *tarsimaculatus* complex in the same region.

Dr. Root's description of the eggs from his new species, *A. darlingi*, was evidently based on a batch of immature eggs. We have also obtained eggs from *A. darlingi* like these, but the normal egg from this species as observed in more than 843 ovipositions from isolated females collected from many localities is of the same type as the egg associated by Root with *A. albitarsis*. In spite of this evident misassociation he drew the correct conclusion that the difference between these two eggs which he labeled *darlingi* and *albitarsis* might be due to incomplete expansion of the frills in the one case.

This consequent incomplete record of morphology for *A. darlingi* eggs and an ambiguous phrase in Root's description of the male genitalia have led to the creation of a new variety designated *A. darlingi* var. *paulistensis* by Galvão, Lane and Correa (1937). In describing the leaflets of the mesonome Root said they were "not obviously serrate." These authors interpreted this phrase as meaning absence of serration. Root evidently intended to record the fact that the leaflets are inconspicuously serrated as it requires careful dissection to reveal this structure. A dissection of one of Root's original specimens collected from Porto das Caixas has revealed that the leaflets are serrated to the same degree as in other recently obtained specimens in our collection, and as those described by Galvao for *paulistensis*. That *paulistensis* is in reality synonymous with

Root's original *darlingi* is further borne out by the discovery of eggs in our *A. darlingi* material showing all the variations described by Galvao for his new variety. Galvao himself suggested (1940) that this finding in the locality studied by Root, would invalidate the variety *paulistensis*.

Root apparently failed to obtain authentic *A. albitarsis* eggs. Among more than 5,194 ovipositions from isolated *A. albitarsis* females and several thousand other ovipositions by females of the same species confined together in cages, no eggs of the *darlingi* type have been observed. The normal eggs of *albitarsis*, while showing a marked variation in the length of floats and the degree of approximation of the floats are usually of the characteristic type and similar to those described for the species by Rozeboom (1937) from Panama, and by Galvao (1940) from southern Brazil. The fact that Root described a pattern on the exochorion of *albitarsis* eggs further indicates that he did not see eggs of this species, which are always uniformly dark in color.

Drawings of our *A. oswaldoi*, *A. albitarsis*, and *A. darlingi* eggs, and reproductions of Root's original drawings are shown in figures 1 to 6.

Description of Eggs.

Anopheles darlingi.—This is the only species of the *argyritarsis* series found to oviposit eggs with white markings on the exochorion (fig. 6). These spots occur ventrally and dorsally except for the areas occupied by the floats and frills. The floats are dorsally placed and fused at both ends. In some specimens the floats closely approximate each other dorsally throughout their length, in others they may be more widely separated. A large circular collar is present on the anterior end. In a few specimens a posterior collar was also observed, either isolated and small, or larger and fused with the posterior dorsal margin of the floats.

Anopheles albitarsis.—The eggs are dark, smooth and without pattern. The floats are about one-half the length of the egg, placed dorso-laterally, usually leaving a large black area exposed between them. A wide frill is present at each end, forming collars of about equal size. The inner portion of the frills is fused with the floats. When the floats are widely separated the frills are horseshoe shaped; when the floats closely approximate each other the areas enclosed by the frills are long and oval. The eggs differ from those of *argyritarsis* only in the structure of the floats. The float ridges in *albitarsis* are wide, distinctly separated and straight, while the float ridges of *argyritarsis* are indistinctly separated and wavy, which causes them to be more refractive to light. The floats in

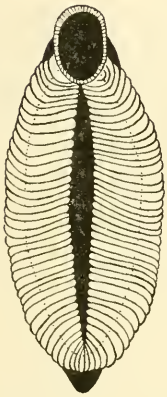

Fig. 1

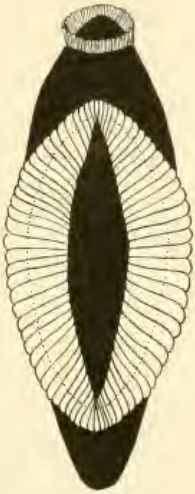

Fig. 2

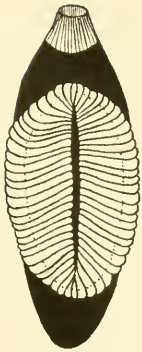

Fig. 3

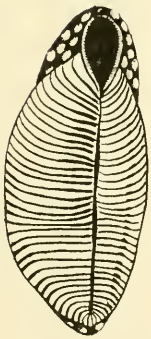

Fig. 4



Fig. 5

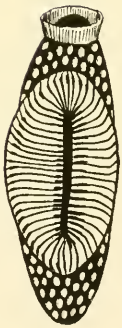

Fig. 6



in eggs from *albitarsis* collected in the Federal District are usually much shorter than those of eggs collected from northeast Brazil. (Fig. 5.)

Summary.

The eggs of *anopheles albitarsis* and *Anopheles darlingi* from isolated females are described. Certain errors in the literature resulting from previous probable misassociation of eggs and adults are corrected.

Explanation of Plate 12.

1. Reproduction of Root's drawing of *A. tarsimaculatus* egg.
2. Reproduction of Root's drawing of *A. albitarsis* egg.
3. Reproduction of Root's drawing of *A. darlingi* egg.
4. *A. oswaldoi* egg.[2]
5. *A. albitarsis* egg.[2]
6. *A. darlingi* egg.[2]

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[2] Camera lucida drawings.

MINUTES OF THE 527TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, APRIL 2, 1942.

The 527th regular meeting of the Society was held at 8 P. M., Thursday, April 2, 1942 in Room 43 of the National Museum. President Cory presided, and 21 members and three visitors were present. In the absence of the Recording Secretary, W. H. Anderson fulfilled the duties of that officer, and the report of the March meeting was read and approved.

C. F. Adams, of the Missouri State Board of Health, Jefferson City, Mo., was unanimously elected to membership in the Society.

Austin H. Clark noted that in our latest lists of butterflies of North America north of Mexico *Neonympha hermes sosybius* (F.) is included, but that the typical form has not been recorded from the United States. The National Museum collection includes two specimens of *N. hermes hermes* (F.) labeled "Esper Ranch, Brownsville, Texas," and one labeled "Brownsville, Texas." The list of American butterflies found north of Mexico should therefore include both subspecies. (Author's abstract.)

W. H. Anderson exhibited a specimen of the larva of *Diabrotica quadrigutta* Oliv. The larva was originally sent to Mrs. Doris Blake by S. C. Bruner, of the Department of Phytopathology and Entomology, Republic of Cuba. He had found larvae feeding in groups on the upper surface of squash leaves, and some were reared to maturity. The specimen differs markedly in appearance from the previously known larvae of *Diabrotica* since it is short, rather robust, and has distinctly pigmented sclerites on the mesothorax, metathorax and first eight abdominal segments, those on the abdomen being arranged in three transverse rows.

The regular program was as follows:

1. A new insect enemy of Mimosa in Washington, D. C.
Carl Heinrich, Bureau of Entomology and Plant Quarantine.

Mr. Heinrich gave a short sketch of the biology and type of injury caused by the larva of a moth of the glyphipterygid genus *Hamadaula;* the species is being described as new by J. F. G. Clarke. The genus is known to occur in Australia, but is previously unrecorded from the United States, and no near relatives occur here. Japan has been suggested as the native home of this apparently introduced species. Slides were shown which demonstrated the typical tying together of leaves and branches of the Mimosa by the larva. (Secretary's abstract.)

S. A. Rohwer commented that he believed that he had seen evidence of injury on the Virginia side of the Potomac River.

2. The relation between prey and sex in the cicada killer.
Richard Dow, Arlington, Virginia.

Dr. Dow, who was presented by Austin H. Clark, spoke on the relation of the prey of *Sphecius speciosus* (Drury) to the size and sex of the adult wasp. In weighing the material collected from a limited number of cells, it was found that the fresh cocoons fell into two distinct classes, as did also the sub-

sequently reared adults, It was apparent that these classes corresponded to the two sexes. The estimated weight of the prey stored in the same cells did not show a corresponding segregation in spite of the fact that some of the cells had one cicada and others two. All the reared females were from cells with two cicadas, and all but one or two males from cells with one cicada. The estimated weight of the prey in the one or two cells with two cicadas that produced males was intermediate between the maximum of the single cicadas in the other male cells and the minimum of the two cicadas stored in the female cells.

Notes were also presented on the preparation of a habitat group of this wasp for the New England Museum of Natural History. (Author's abstract.)

3. Codling moth work in Washington State.

B. A. Porter, Bureau of Entomology and Plant Quarantine.

Dr. Porter presented motion pictures showing phases of the experimental work carried out jointly by the Division of Fruit Insects and the Division of Insecticides. The appearance of the fruit and trees following application of diverse sprays was shown. Methods of sampling and making analyses for spray residues were included. (Secretary's abstract.)

Major E. A. Richmond, of the chemical warfare division, U. S. Army, greeted the Society briefly.

J. A. Hyslop spoke about the recent correspondence he has received relative to the use of spider webs in bomb sights. He described two commercial methods by which the web is removed from spiders. Remarks were made by Cushman and Clark.

S. A. Rohwer mentioned a recent decision concerning the disposition of three books containing the original minutes of the Entomological Club of the American Association for the Advancement of Science. The club was started at Hartford, Conn., in August of 1874. The name was changed to American Association of Economic Entomologists at the Toronto meeting held on August 20, 1889. The books are to be deposited in the library of the U. S. Department of Agriculture and will be available for consultation.

Adjournment at 9.35 P. M.

ASHLEY B. GURNEY,
Recording Secretary.

MINUTES OF THE 528TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON. MAY 7, 1942.

The 528th regular meeting of the Society was held at 8 P. M., Thursday, May 7, 1942, in Room 43 of the National Museum. President Cory presided, and 36 members and 11 visitors attended. In the absence of A. B. Gurney, who was commissioned, recently, a First Lieutenant in the Sanitary Corps, U. S. Army, W. H. Anderson acted as Recording Secretary. The minutes of the previous meeting were read and approved.

J. C. Bridwell presented several interesting notes concerning some insects he had collected on field trips in the vicinity of Washington. He exhibited nests of *Trypoxylon politum* Say from which he obtained the large males of a mutillid, *Sphaerophthalma pensylvanica* Lep. More than four years ago the male of the same species of mutillid was bred from the mud cell of *Anthophora abrupta* Say, which is the size of a small bumble bee. Old nests of the *Trypoxylon* which had been used, secondarily, by the smaller spider wasp *Pseudagenia mellipes* Say produced females of the mutillid, which are much smaller than the males. From these observations it would appear that the sex of the mutillid is dependent, at least to some extent, on the size of the host.

Mr. Bridwell also spoke of finding stem mothers of what is apparently *Prociphilus erigeronensis* Thomas in the nests of *Lasius interjectus* Mayr., and *L. minutus* Emory. In the colonies of the former the aphids appeared to be feeding on the cartons, made of red rotten wood, of which the nests were composed and new generation nymphs were produced there. In the colonies of *L. minutus*, made in soil, the stem mothers were found on red rotten wood but the new generation was on the roots of plants growing through the nests.

The usual habitat of *Zorotypus hubbardi* Caudell, in this vicinity at least, is in sawdust piles on the surface of buried bits of board. Mr. Bridwell collected specimens in an ancient, hollow, red rotten chestnut tree dead more than 20 years. The specimens were found on the flat surfaces of partitions between old termite runways and this type of environment obviously preceded sawdust piles.

In recent rather extensive collections from pine, Mr. Bridwell took service berry psyllids and blackberry psyllids, both belonging to the genus *Trioza*, in some numbers. Other species of psyllids likewise are found commonly on pine. One of these, *Livia maculipennis* (Fitch), lives, as nymphs, in galls on *Juncus acuminatus* Michx. A second species, *L. vernalis* Fitch, utilizes *Carex vulpinoidea* Michx., as a nymphal host and causes a typical blanching of the leaves suggestive of Stewart's disease of maize. The gall of *L. vernalis* has not been recorded previously. The nymphs of this species were preyed upon by syrphid larvae of a genus near *Syrphus*, but adults of the latter were not secured. (Author's abstract.)

The regular program was as follows:

1. Some insects problems in South America.

Emory C. Cushing, Bureau of Entomology and Plant Quarantine.

Mr. Cushing presented moving pictures and kodachrome slides of a recent

extensive trip through South America. In general the trip consisted of a loop down the western side of the continent to Argentina, thence up through Paraguay to Rio de Janeiro, Brazil. The more important insect borne diseases of man in South America include malaria, typhoid fever, bubonic plague and spotted fever. Three important insects which nearly if not completely prohibit cattle raising in all the countries except Argentina and Southern Uraguay are the cattle fever tick, warble flies and screw worm. (Secretary's abstract.)

2. Entomological activities in Colombia.

E. A. Chapin, U. S. National Museum.

Dr. Chapin related interesting observations made on a six-weeks trip to Colombia in February and March of this year. There are several collections of insects in Colombia, the most extensive being at Bogotá and Medellín. The entomologists in that country are handicapped by a shortage of many important books and periodicals on entomology. Dr. Chapin presented slides of the entomologists and the buildings in which the entomological activities are carried on. (Secretary's abstract.)

Adjournment at 10.00 P. M.

W. H. ANDERSON,
Acting Recording Secretary.

Actual date of publication, June 30, 1942.

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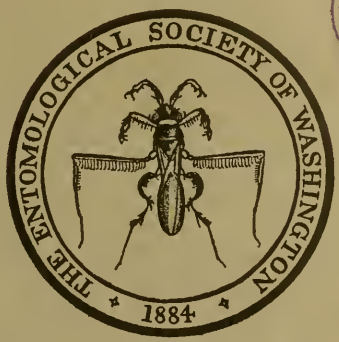

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PROCEEDINGS OF THE

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STENISTOMERA (SIPHONAPTERA): A REEVALUATION OF THE GENUS, WITH THE DESCRIPTION OF A NEW SUBGENUS AND SPECIES.[1]

By NEWELL E. GOOD,

Associate Entomologist, United States Public Health Service.

The genus *Stenistomera* Rothschild 1915 has heretofore contained but one, little-known, species, the odd *S. alpina* (Baker) 1895. This species has been known until now only from the male and female cotypes collected at Georgetown, Colorado, and from specimens collected at Salina, Utah. In 1938 three males of a new species quite distinct from, but related to, *S. alpina* were collected incident to routine field surveys for sylvatic plague in northern Mojave County, Arizona, while at various times specimens of *S. alpina* were collected during plague survey work in Montana, Wyoming, Colorado, New Mexico, and Arizona. The genus *Stenistomera* has usually been placed near the genus *Leptopsylla* in the family Hystrichopsyllidae, but it, as well as the new species described below, exhibits several striking differences from typical Leptopsyllinae and even from all Hystrichopsyllidae, and the writer has for some time considered that *Stenistomera* well deserves the rank of a separate subfamily.

STENISTOMERINAE, new subfamily.

Frontal region separated from the occiput by a deep, usually oblique, dorsal sulcus or suture connecting the antennal grooves. Eyes absent or vestigial. Gena without a ctenidium but the bristles of the preantennal region, as well as those of the occiput and fore coxa, numerous and usually enlarged toward their bases. Head helmet-shaped, with upper part of frons protruding, more or less angulate, and with the lower part of the frons receding. In the antennae the second joint, or scape, is broad and extends as a semitransparent sheath over the basal part of the third joint, or flagellum. The row of long, thin, close-set setae, which appear to arise from near the middle of the third joint, are situated on the margin of this extension of the second joint.

The pronotum is short and a pronotal comb is present. In the metathorax

[1] From the Plague Suppressive Measures Laboratory, San Francisco, California.

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the supraepisternum (episternum) is absent, i. e., completely fused with the infraepisternum (sternum) which is greatly narrowed in its upper part. The metaepimeron is incompletely separated from, or partially fused with the metanotum. The inner surface of the hind coxa is without spinulets or bristles. The abdominal tergites each have only a single row of bristles. One or more of the abdominal tergites bears apical spines. Antepygidial bristles are present. The females have one receptaculum seminis.

This subfamily is erected for the remarkable genus *Stenistomera* Rothschild 1915. It appears to be most closely related to the subfamily Leptopsyllinae of the family Hystrichopsyllidae, most of the members of which (*Leptopsylla*, *Peromyscopsylla*, etc.) have a similarly shaped head, and in which *Corypsylla* shows a decided, but different type of, reduction in the number of bristles on the abdominal tergites and a fusion of some of the sclerites of the metathorax. In none of these, however, is there the characteristic lack of the genal comb or an enlargement of some of the bristles of the head, or the presence of the sheath-like projection of the second segment of the antennae. This latter condition is not found in any other North American Hystrichopsyllidae and is very rare in the Siphonaptera, the genus *Callistopsyllus* of the subfamily Anomiopsyllinae being one of the few which is comparable. The subfamily Stenistomerinae also exhibits several other striking affinities with the genus *Callistopsyllus*, such as the fusion of and the shape of the metathoracic sclerites, the single row of bristles on each abdominal tergite, and even shows certain affinities in the genitalia.

Genus **STENISTOMERA** Rothschild (Novitates Zoologicae, 1915, *22*: 307).

Possesses, in addition to the characters of the subfamily, the following generic characters: Vestige of eye nearly or entirely obsolete, without pigment. The posterior margin of the antennal groove is without minute bristles or spinulets. Club of male antenna long and projecting slightly past the lower margin of the head. Frontal notch small, shallow. On the front there is one dermal pit midway between the dorsal sulcus and the frontal notch, one slightly posterodorsal to or touching the frontal notch, while midway between the frontal notch and the oral angle is a small circle which may represent a degenerate dermal pit. Labial palpus, 4-segmented, but the first segment divided by an oblique, thickened, chitinous band. Maxillary palpus shorter than the labial palpus and not reaching to the apex of the fore coxa.

Pronotal comb consisting of approximately 17 to 21 spines. Along the anterior margin of the mesonotum, under the pronotal comb, there are a number of small spinulets or minute teeth. Legs long and slender, the hind coxa very narrow and the first hindtarsal joint nearly or quite as long as the hind tibia. The bristles on the second hind-tarsal joint do not extend past the apex of the third joint. The 5th joint of the hind tarsi bears 5 pairs of plantar bristles, of which

the first pair is set downward and inward between the second pair. The number of antepygidial bristles is three in both males and females.

Orthotype: Typhlopsylla alpina Baker 1895.

Subgenus **STENISTOMERA**, new usage.

Front of head decidedly projecting, angulate. Top margin of head almost level from rear of occiput nearly to frontal notch. Head high in front, i. e., from frontal angle to oral angle. All bristles of head large and greatly thickened toward their bases, spinelike, a prefrontal row of short, spine-like bristles extends along the anterior margin of the frons and backward along or near the dorsal margin to the antennal groove.

The bristles over the entire body are stout and slightly enlarged toward their bases.

Stenistomera (Stenistomera) alpina (Baker) 1895.

1895. *Typhlopsylla alpina* Baker, Can. Ent. *27*:189, 191.
1898. *Ctenopsylla alpina* (Baker), Wagner, Horae Soc. Ent. Ross, *31*:577.
1904. Ctenopsyllus alpinus (Baker), Baker, Proc. U. S. Nat. Mus. *27:* 427–428, 452. (Supplementary description).
1915. *Stenistomera alpina* (Baker), Rothschild, Nov. Zool. *22:* 307.

Male and female: (redescription)—

Head: The spine-like bristles of the preantennal region are arranged in several poorly defined rows over the gena and frons, and in an elbowed prefrontal row. The occiput bears either 3 or 4 rows of bristles. The maxillary palpus is short, extending only about ½ the length of the labial palpus. The labial palpus varies in length, in some specimens extending barely past the fore coxa, while in others (including the type) it overlaps the basal third of the fore femur.

Modified segments (male): Manubrium of clasper broadly triangular, the lower margin slightly convex and the upper margin slightly concave. One long bristle is situated midway of the postero-dorsal margin of the manubrium at the anterior end of the process. Process of clasper nearly obsolete. Movable finger of clasper fairly long, narrow, and parallel-sided, the anterior margin convex and the posterior margin concave. It bears two short, thick spines near the posterior margin, one subapical and the other at about 1/5 the distance from the apex to base, and in addition bears several small setae. Stigma of 8th tergite small. Penis slender, tapering, spring of penis coiled around approximately three times. Dorsal-apical hook of paramere of penis moderately curved. The external part of sternite IX is short, broad, and parallel-sided on the basal 2/3, thence the ventral margin slants obliquely upward to apex. It bears several setae and one strong spine on the postero-ventral margin at a point 1/3 the distance from the apex to the ventral angle. Internal part of sternite IX nearly straight on the antero-ventral margin but broadly rounded on the postero-dorsal side along most of its length. Tergite X and sternite X rather long and slender. Pygidium flat or very slightly convex.

Modified segments (female).—Head and tail of receptaculum seminis distinctly separated, the head well chitinized and about 1½ times as long as

broad, handle-shaped (length 0.097 (0.09–0.11) mm., maximum diameter 0.054 (0.05–0.06) mm.). Tail of receptaculum seminis moderately long, thicker near the apex than at base, curved upwards so that the apex of the tail is at right angles to the head, and with the apex rounded, without appendix. The bursa copulatrix is too lightly chitinized and indistinct in our specimens to determine its form. Sternite VII narrow horizontally, the long posterior margin nearly straight or very slightly sinuate, without notch or sinus. Sternite VIII terminating in a blunt point, thickly covered with bristles of various sizes and shapes, some of them spiniform. Stigma of tergite VIII small and situated well antero-ventral to the pygidium. Pygidium slightly convex. Stylet (length 0.104 (0.09–0.12) mm., width 0.025 (0.02–0.03) mm.) 4 or 4½ times as long as broad at the base, which is slightly bulbous, and terminating in an irregular series of contractions at the base of each of the 5 or 6 subapical setae. Terminal bristle slightly shorter than the stylet itself.

This species was originally described by Baker in 1895 from one male and one female collected at Georgetown, Colorado, on a "mountain rat" (undoubtedly *Neotoma* sp.). These cotypes are in the U. S. National Museum and were examined by the writer in December, 1939.

The collection of the U. S. Public Health Service, Plague Laboratory, contains the following 31 specimens:—

Arizona: Apache County, 15 miles west of Springerville, elev. 6,000 ft., 9/26/38, on *Neotoma* (*stephensi* ?), 2 females; Coconino County, 6 miles southeast of Red Lake, elev. 6,800 ft., 4/30/38, on *Peromyscus maniculatus*, one male; Coconino County, 9 miles north of Williams, elev. 6,700 ft., 4/20/39, on *Neotoma* (*stephensi* ?), 1 female; Navajo County, 24 miles southwest of Holbrook, elev. 5,900 ft., 5/10/39, on *Neotoma* (*stephensi* ?), 2 males, 2 females; Navajo County, 24 miles southwest of Holbrook, elev. 5,900 ft., 5/10/39, on *Peromyscus maniculatus*, 1 female.

Colorado: Huerfano County, 12 miles east of Walsenburg, elev. 6,400 ft., 6/29/40, on *Neotoma micropus*, 1 female; Rio Blanco County, 6 miles north of Meeker, elev. 6,400 ft., 6/28/38, on *Neotoma cinerea*, 1 female; Las Animas County, Delhi, elev. 4,300 ft., 6/20/41, on *Neotoma albigula*, 1 male, 3 females.

Montana: Custer County, 15 miles south of Miles City, elev. 2,400 ft., 3/28/40, on *Neotoma cinerea*, 9 females; Madison County, 6 miles northeast of Jeffers, elev. 5,400 ft., 5/18/38, on *Neotoma cinerea*, 2 females.

New Mexico: Santa Fe County, 6 miles southwest of Glorieta, elev. 6,500 ft., 5/27/39, on *Neotoma albigula*, 2 males, 2 females.

Wyoming: Sweetwater County, 15 miles southwest of Green River, elev. 6,300 ft., 8/23/38, on *Neotoma cinerea*, 1 male.

The following additional specimens were kindly loaned for examination by Prof. J. S. Stanford of Utah State Agricultural

College, and by Dr. W. L. Jellison of the Rocky Mountain Laboratory, U. S. Public Health Service:—

Utah: Salina, Sevier County, elev. 5,200 ft., collected by J. S. Stanford, Nov., 1928 to March, 1929, 15 males and 16 females from *Neotoma* sp., 3 males and 3 females from *Neotoma desertorum* (now *N. lepida*), 1 female from *Neotoma cinerea*, 4 males and 1 female from *Peromyscus* sp.

Wyoming: Jackson Hole, Teton County, elev. 6,800 ft., 11/20/28, 5 males and 4 females from *Neotoma cinerea*.

Subgenus **MIOCHAETA**, new subgenus.

Differs from typical *Stenistomera* as follows:—Frons projecting but less so than in typical *Stenistomera;* frons rounded or only slightly angular; labial palpus about as long as the fore coxa or slightly shorter; frontal tubercle absent or very small; bristles of head and body normal in size, not or very slightly enlarged or thickened toward their bases; prefrontal row of bristles lacking.

Subgenotype:—*Stenistomera* (*Miochaeta*) *macrodactyla*, new species.

Stenistomera (Miochaeta) macrodactyla, new species.

Male: head: Frons projecting, rounded, helmet-shaped. Frontal tubercle very small, frontal notch shallow. Eyes absent. The frontal row contains 5 or 6 bristles while the remaining 8 or 9 bristles, most of them slightly enlarged, are placed at irregular intervals over the middle and lower parts of the preantennal region. Postantennal region or occiput provided with three rows containing 1, 3, and 4 (or 3) bristles, respectively. Labial palpus short, extending 84% to 95% of the distance to the end of the fore coxa. Maxillary palpus about 4/5 the length of the labial palpus.

Legs: The fore coxa is densely covered with strong bristles, as in *S. alpina*, and on the hind tibia the spines of the rear margin are arranged singly or in pairs.

Modified segments (*male*): Manubrium of clasper very broad, being considerably broader and slightly shorter than that of *S. alpina*, upper margin very slightly concave and lower margin slightly convex. Process of clasper nearly obsolete as in *S. alpina*. It bears one long bristle anteriorly, well away from the margin. Movable finger of clasper very large, being about twice the length and twice the width of that of *S. alpina*. It is nearly parallel sided and squared apically. It bears several setae and two short, heavy spines on its posteroventral margin as in *S. alpina*, the one subapical and the other at slightly more than ¼ of the distance from the apex to the base. Stigma of tergite VIII small. Penis narrow, the spring of the penis coiled around 2 or 2½ times. The external part of sternite IX is broad at the base, curved upward and tapering evenly to the pointed apex. There is no ventral angle like that of *S. alpina*. It bears one rather weak spine and about 5 setae on its ventral margin. The internal part or dorsal arm of sternite IX is slender with a bulge on the posterodorsal side at a point ¾ of the distance to its apex. Tergite X and sternite X are rather long and slender. The pygidium is flat longitudinally.

Type host—*Peromyscus eremicus* (Baird).

Type locality: Mojave County, Arizona (north of the Colorado River). Holotype male and 2 paratype males collected on *Peromyscus eremicus*, Mojave County, Arizona, 21 miles south of St. George, Utah, elev. 4,500 ft., 4/27/38, by F. J. Gonderman of the U. S. Public Health Service Plague Survey.

The holotype is deposited in the collection of the U. S. Public Health Service Plague Laboratory, San Francisco, California. Paratypes are deposited at the U. S. National Museum, Washington, D. C., and at the U. S. Public Health Service Rocky Mountain Laboratory, Hamilton, Montana.

Summary of the Number of Spines and Bristles of *Stenistomera*.[2]

	S. (*S.*) *alpina*		*S.* (*M.*) *macrodactyla*
	MALES	FEMALES	MALES
Br. of preantennal region	17.5(16–19)	19.1(15–22)	14.0(14–14)
Bristles of occiput	10.1(9–15)	11.5(8–14)	7.7(7– 8)
Spines of pronotal ctenidium (total)	19.5(18–20)	20.0(19–21)	17.3(17–18)
Br. of pronotum	5.1(4– 6)	5.3(4– 6)	4.4(4– 5)
" " mesonotum	3.7(3– 4)	4.0(3– 5)	3.6(3– 4)
" " metanotum	3.9(3– 4)	3.9(3– 4)	3.5(3– 4)
" " mesoeptisternum	3.9(2– 5)	4.8(4– 5)	2.8(2– 3)
" " mesoepimeron	4.2(4– 6)	4.4(4– 6)	3.8(3– 4)
" " metaepimeron	8.9(7–11)	11.6(10–14)	10.3(8–13)
Lateral br. of all femora	none	none	none
Hind tibia—			
spines of rear margin	16.2(15–19)	18.4(17–22)	18.3(17–19)
lateral bristles	7.7(6– 9)	8.0(7–10)	8.3(7– 9)
Apical spinulets (total)—			
abd. tergite I	6.3(4– 8)	7.1(5–12)	6.3(5– 8)
" " II	0.0(0– 0)	0.1(0– 1)	1.2(1– 4)
Br. of abd. tergites—			
I	3.8(3– 4)	4.0(3– 5)	4.3(4– 5)
II	5.4(5– 6)	6.2(5– 7)	5.8(5– 6)
III	5.4(4– 6)	5.9(5– 7)	5.8(5– 6)
IV	5.1(4– 6)	5.9(5– 7)	5.6(5– 6)
V	5.1(5– 6)	5.5(5– 7)	5.5(5– 6)
VI	5.0(5– 5)	5.2(5– 6)	5.0(4– 6)
VII	3.6(3– 4)	2.8(2– 3)	4.2(3– 5)
VIII	none	8.3(5–12)	0.3(0– 1)

[2] The numbers given are for one side of the flea only, unless "total" is designated. Figures are based on counts on 10 to 13 males and 10 to 25 females of *S. alpina* from various localities, and on three males (type and paratypes) of *S. macrodactyla*. The figures in each column are arranged as follows:—Average (minimum-maximum), respectively.

Br. of abd. sternites—			
basal (lateral)	none	none	none
" (ventral)	none	none	none
III	2.2(1– 3)	5.4(4– 7)	3.0(2– 4)
IV	2.9(2– 3)	5.2(4– 6)	3.3(3– 4)
V	2.9(2– 3)	5.3(4– 6)	3.0(3– 3)
VI	2.8(2– 4)	5.6(4– 7)	3.3(3– 4)
VII	2.9(2– 3)	8.1(6–10)	4.3(4– 5)
VIII	2.4(2– 3)	none	4.3(3– 5)
Antepygidial bristles	3.0(3– 3)	3.0(3– 3)	3.0(3– 3)

SUMMARY OF MEASUREMENTS OF *Stenistomera*. (in mm.).[3]

	S. (*S.*) *alpina* MALES	*S.* (*S.*) *alpina* FEMALES	*S.* (*M.*) *macrodactyla* MALES
Total length	2.05 (1.7 –2.3)	2.73 (2.2 –3.2)	2.04 (1.8 –2.4)
Oral angle—fr. notch	.190(.18– .20)	.232(.22– .26)	.142(.14– .15)
Fr. notch—dorsal sulcus	.120(.11– .13)	.144(.12– .16)	.135(.12– .15)
Maxilla (length)	.157(.13– .19)	.198(.16– .23)	.130(.13– .14)
Maxillary palpus (total)	.264(.23– .29)	.288(.25– .32)	.245(.22– .26)
" " joint 1	.072(.07– .08)	.081(.08– .08)	.066(.06– .08)
" " " 2	.068(.06– .08)	.077(.07– .08)	.059(.05– .06)
" " " 3	.050(.05– .05)	.052(.05– .06)	.044(.04– .05)
" " " 4	.080(.08– .08)	.082(.08– .08)	.078(.07– .08)
Labial palpus (total)	.500(.46– .52)	.586(.49– .65)	.308(.28– .32)
" " joint 1	.203(.19– .22)	.234(.21– .26)	.146(.13– .15)
" " " 2	.086(.07– .09)	.097(.09– .10)	.036(.03– .04)
" " " 3	.086(.07– .10)	.117(.09– .13)	.041(.03– .05)
" " " 4	.134(.12– .16)	.157(.13– .17)	.080(.07– .08)
Apex rostrum beyond fore coxa	.043(.01– .07)	.038(.01– .05)	.102(.05– .12)
Length of fore coxa[4]	.407(.40– .42)	.519(.51– .54)	.385(.32– .42)
Fore coxa beyond base troch.	.049(.04– .06)	.054(.03– .07)	.052(.04– .06)
Hind coxa (length)	.409(.38– .45)	.513(.46– .55)	.373(.32– .40)
" " (width)	.228(.22– .26)	.295(.25– .33)	.243(.20– .27)
" trochanter (length)	.083(.07– .10)	.111(.09– .14)	.079(.06– .09)
" femur (length)	.366(.33– .40)	.446(.39– .46)	.358(.30– .40)
" tibia "	.301(.28– .33)	.363(.30– .41)	.313(.27– .34)
" tarsus joint 1	.311(.28– .35)	.355(.29– .40)	.305(.25– .35)
" " " 2	.127(.11– .15)	.144(.13– .15)	.140(.12– .16)
" " " 3	.083(.07– .09)	.089(.07– .10)	.084(.07– .09)
" " " 4	.054(.05– .06)	.058(.05– .06)	.055(.05– .06)
" " " 5 (–claw)	.101(.10– .11)	.107(.10– .12)	.093(.08– .10)
Antepygidial bristles (upper)	.059(.04– .08)	.204(.18– .24)	.076) .06– .08)
" " (middle)	.152(.13– .17)	.263(.23– .29)	.158(.13– .17)
" " (lower)	.078(.06– .10)	.215(.19– .23)	.096(.07– .12)
Movable finger (front marg.)	.139(.12– .16)		.270(.25– .29)

[3] All measurements are given in millimeters, and the figures in each column are arranged as follows: Average (minimum-maximum), respectively. Fingers are based on measurements of the following number of specimens: *S. alpina*=10(5–12) each of males and females from various localities (figures on total length based on 16 males and 20 females; *S. macrodactyla* 3 males (type and 2 paratypes).

[4] Measured to the apex of the rounded extension which projects well past the base of the trochanter.

" " (rear ")	.182(.16– .20)	.281(.27– .29)
" " (diameter)	.038(.036–.04)	.068(.06– .08)
" " (apex–lower sp.)	.028(.02– .04)	.072(.06– .08)
Sternite IX—external (length)	.158(.10– .20)	.197(.18– .20)
" " " (width–base)	.058(.04– .07)	.072(.06– .08)
" " " ("1/3 apex.)	.058(.05– .06)	.043(.04– .05)
" " —internal (length)	.255(.23– .29)	.348(.31– .37)

Explanation of Plate 13.

Figure 1. *Stenistomera alpina* (Baker) male. X 42.

Abbreviations.—Ant., antenna; Ap., apodeme; Ap. Sp., apical spines; Apy. Br., antepygidial bristles; B. St., basal sternite; Cl., claw; Cx., coxa; D. P., dermal pit; D. S., dorsal sulcus; Em., epimeron; Es., episternum; F., movable finger of clasper; Fe., femur; F. N., frontal notch; G., gena; Ies., infraepisternum; L. P., labial palpus; M., manubrium of clasper; Max., maxilla; Mes., mesonotum; Met., metanotum; M. P., maxillary palpus; Occ., occiput; Par., paramere of penis; P. C., pronotal ctenidium; Pen., penis; Pl. Br., plantar bristles; Pro., pronotum; Pv., proventriculus; Pyg., pygidium; Sp. P., spring of penis; St., sternite; Tar., tarsus; Ti., tibia; Tg., tergite; Tr., trochanter.

Figure 2. *Stenistomera alpina* (Baker), female, antenna. X 255.

Abbreviations.—Flg., flagellum; Ped., pedicel; Sc., scape; Sh., sheath.

Figure 3. *Stenistomera alpina* (Baker), female, modified segments. X 60.

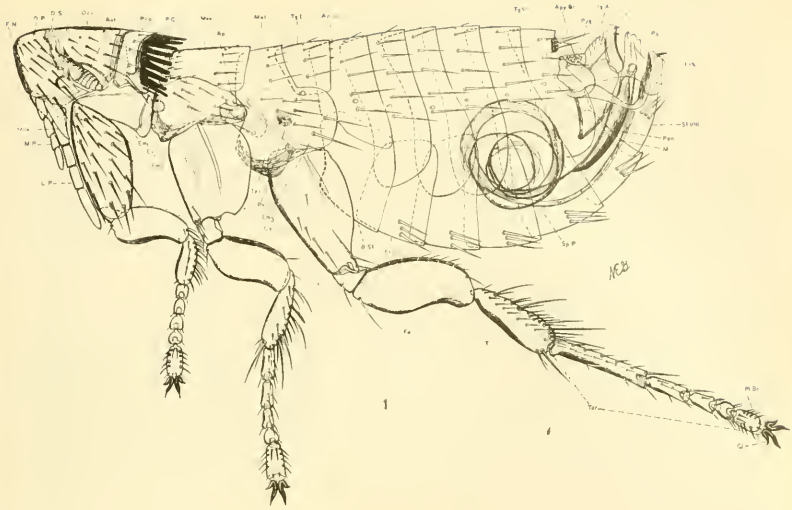
Abbreviations.—Ap. Br., antepygidial bristles; D. R. S., duct of receptaculum seminis; Pyg., pygidium; R. S. receptaculum seminis; St., sternite; Sti., stigma; Sty., stylet; Tg., tergite.

Figure 4. *Stenistomera* (*Miochaeta*) *macrodactyla*, new species, male, head. X 68.

Abbreviations.—Ant., antenna; D. P., dermal pit; F. N., frontal notch; L. P., labial palpus; Max., maxilla; M. P., maxillary palpus.

Figure 5. *Stenistomera* (*Miochaeta*) *macrodactyla*, new species, male, modified segments. X 65.

Abbreviations.—Ap. Br., antepygidial bristles; F., movable finger of clasper; M., manubrium of clasper; Par., paramere of penis; Pen., penis; Pyg., pygidium; Sp. Pen., spring of penis; St., sternite; Tg., tergite.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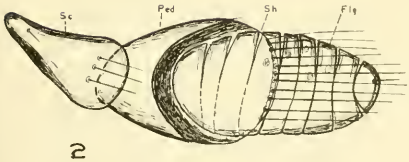
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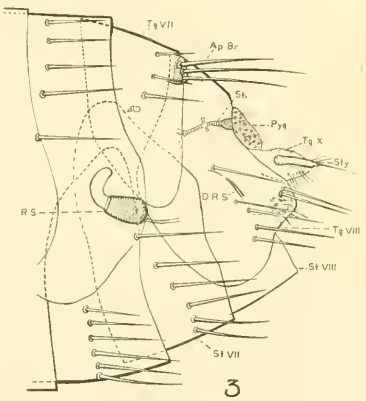
Ped
Sh
Flg
2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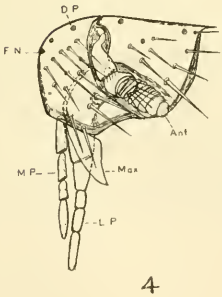
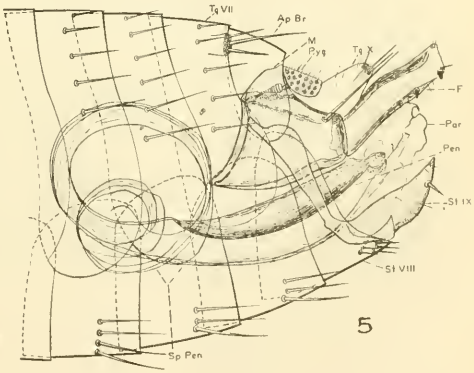
St
Pyg
Tg X
Sty
D R S
R S
Tg VIII
St VIII
St VII
3


D P
F N
Ant
M P
Max
L P
4


Tg VII
Ap Br
M
Pyg
Tg X
F
Par
Pen
St IX
St VIII
Sp Pen
5

A NEW HETEROTHRIPS FOUND ON OAK (THYSANOPTERA, HETEROTHRIPIDAE).

By J. C. Crawford,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The genus *Heterothrips* is represented in the eastern part of the United States by less than a dozen described species, and the discovery of a new form in great abundance after so many years of collecting seems quite unusual.

Heterothrips quercicola, new species.

Female.—Length (fully distended) 1.7 mm. Dark blackish brown, legs more distinctly blackened but with fore tibia lighter colored and pale yellowish apically and more or less along fore margin, mid and hind tibiae somewhat lightened apically, tarsi light yellowish; antenna dark brown, except that segment II is grayish yellow apically, III grayish yellow to second transverse incision, beyond which it is tinged with brown, and IV lighter brown than following segments.

Head about 1.4 times as wide as length (measured from front of eyes), widest forward of middle and with cheeks gently rounded; in dorsal aspect, with a few minute spines and with faint, transverse striae in front of ocelli and with distinct striae behind them; anterior ocellus less than one-half the diameter of a posterior ocellus; frontal costa with a deep V-shaped emargination; antennal segment I with a median, transverse, carinate line, segment III elongate, obconical, with the usual two incisions and lightly sclerotized bands at about basal one-fifth and three-eighths, respectively, II and IV each with a band of sensoria apically, that on IV in a light area, IV roundly tapering to base, V somewhat barrel shaped, VI to VIII with sides only very gently rounded, IX conical.

Prothorax with anterior and posterior margins almost straight, lateral margins rounded, pronotum with transverse anastomosing lines forming irregular polygons; mesonotum with close, strong, transverse lines anastomosing very sparsely except anteriorly; metanotum with close, concentric striae; forewings gray brown, with a light area extending from apex of anal lobe to the point where the basal spine on the hind vein is situated; costa, fore vein, and hind vein with about (29–)[1] 34, (20–) 24, and 14 (–15) spines respectively.

Abdominal terga II–VII laterally with sparse pubescence on transverse anastomosing lines, nearly free of pubescence medially; VIII with similar pubescence over entire surface except extreme median base; IX with similar pubescence on posterior two-thirds (forward to discal bristles), X bare; combs on segments I–V broadly interrupted medially, complete on VI–VIII; apical margins of terga II–V with a few slender spines medially; spines of combs with thick bases, the inner ones on terga I–V distinct or in part with irregularly coalesced bases, those outward coalesced into plates bearing six to eight spines, these plates much broader than long and the spines on them three to four times

[1] Numbers in parentheses represent the range of unusual variation, those outside parentheses, the usual number.

as long as plates; segment 6 with similar plates at extreme sides bearing about five spines per plate; segment 7 with some of lateral spines with coalesced bases; sterna II–VI with marginal fringes which laterally are basally coalesced into plates with two to five spines, segment 10 above split open to circlet of spines.

Measurements (in microns): Head, length from front of eye 120, total length 128, greatest width 172; prothorax, median length 192, width 241; pterothorax, median length 272, width 316; forewing, length 860; ovipositor 292.

Antennae:	1	2	3	4	5	6	7	8	9
	28	42	60	40	28	33	18	16	16

Male.—Length distended 1.20 mm. Similar to the female but third antenna segment tinged gray brown basad of transverse incision and light brown beyond, fourth antennal segment almost as dark in color as following segment; fringes of terga laterally only slightly and irregularly coalesced basally; tergum IX not fringed and without processes; sterna IV–VIII each with a subbasal, broadly elliptical, glandular area, that on sterna IV about 24 x 10 μ; sterna II–VIII with continuous fringes, the bristles of which have slightly enlarged bases.

Antennae (in microns):

1	2	3	4	5	6	7	8	9
24	36	58	40	26	29	16	15	15

Type locality.—Babylon, Long Island, N. Y.

Type.—Catalog No. 56445, United States National Museum.

Host.—*Quercus* sp.

Described from 62 female and 17 male specimens, including holotype female and allotype male, on slides (and many females in alcohol), taken from the catkins of a scrub oak, probably *Q. marilandica*, May 3, 1938; 4 males beaten from pine, April 26, 1938; and 3 males and 1 female beaten from pine, May 3, 1938 (J. C. Crawford, collector).

Differs from all the known American species which have the abdominal fringes coalesced into plates by having the spines on the plates three to four times as long as the plates and the plates themselves transverse; all the previously known species have spines no longer than the plates except *pectinifer* Hd. which has them about one and one-half times the length of the plate but the plate itself as long as or longer than broad, and *vernus* Hd., which has the spines two to three times as long as the plate, the sixth antennal segment shorter than the fifth, and in the male has the glandular areas of the sterna small and only slightly elliptical, measuring about 14 X 8 μ.

OVIPOSITION HABITS AND EARLY STAGES OF ORASEMA SP.

By H. L. Parker.

Bureau of Entomology and Plant Quarantine U. S. Department of Agriculture.

In April, 1941, the writer observed a chalcid fly[1] ovipositing in the leaves of zarzaparilla colorado (*Muehlenbeckia sagittifolia* Meissn., Fam. Polygonaceae) at Reconquista, in the Province of Santa Fe, Argentina. A search on the leaves of other nearby plants revealed that similar egg punctures, probably of the same species, occurred on mburucuyo (*Passiflora coerulea* L., Fam. Passifloraceae), barba de viejo (*Clematis* sp., Fam. Ranunculaceae), and tripa de fraile (*Pithycoctinium cyanchoides* DC. *clematidium* Gris., Fam. Bignonaceae). Eggs were very abundant on these plants, literally millions being present, especially on *M. sagittifolia*, and it is to material from this plant that the observations refer. Eggs were found in great abundance on these plants in various directions for distances of 10 to 20 kilometers from Reconquista. None was found at Vera, however, about 60 kilometers away, but the searches in this place were limited to a few hours. On another occasion, at Puerto Tirol, near Resistencia in the Chaco Territory, similar egg punctures were noted on an unknown plant by Dr. A. Ogloblin, who stated that they were very similar to the egg punctures of *Orasema aenea* Gahan on *Ilex paraguayensis*, and that the latter species was common throughout the Chaco and Misiones on many species of plants.

The eggs of *Orasema* sp. observed by the writer are deposited in the tissue of the leaf on the underside. The punctures are made, for the most part, near the border of the leaf, but many leaves have the entire underside almost completely covered with punctures, which cause them after a few days to turn light brown. One can distinguish leaves heavily punctured from a distance of many yards. When only a few eggs are laid, they are usually in a row or rows, with the eggs more or less evenly spaced in the rows (fig. 1). Very often, however, so many eggs are laid near the outer edges of a single leaf that all semblance of order appears to be lost.

In ovipositing the female takes a position on the underside of the leaf with her body oriented more or less longitudinally with the leaf. She curves her abdomen somewhat underneath the body and gives a short, steady thrust downward and forward into the leaf tissue. This movement requires only a few seconds, and apparently an egg is laid during the process, only

[1] Adults of this fly were examined by A. B. Gahan, who stated that "this [species] runs directly to *Orasema aenea* Gahan in my key and agrees with that species except that it is distinctly less deeply sculptured. I am in doubt as to the identity."

one egg being placed in each puncture. The female then withdraws her ovipositor, straightens out her abdomen, and quickly takes a step or so forward and repeats the process. Arriving at the edge of the leaf she turns about and starts another row of punctures, more or less parallel to the first, but sometimes diverging.

The puncture is left open, the egg being placed rather far into the hole made by the ovipositor; it lies parallel to the surface of the leaf, with the anterior pole nearest the opening of the wound (fig. 2). The tissue above the egg (inverted view of the leaf) dessicates somewhat and turns brownish. In many cases the punctures become slightly scarified, undoubtedly after the hatching of the egg, and are partly closed up with a gall-like, or cancerous growth.

Some females were observed apparently in the act of oviposition on leaves bearing old oviposition scars. Close examination revealed no new punctures, however, although newly laid white eggs were noted in some of the old punctures, partially extruding and sometimes entirely outside the cavity. Other eggs were noted lying about on the leaf surface where no puncture had been made. The writer was thus led to assume that the females attempt to utilize the punctures more than once for egg laying.

The ovarian egg (fig. 3) is approximately oblong-oval, with a heavy stem, or peduncle, at the pole taken to be the anterior, for this is the end of the egg which apparently issues last from the abdomen and lies nearest the opening of the puncture (fig. 2). It is white and without sculpturing or other appendages. The deposited egg is similar except that the pedicel is more slender (fig. 4). There appear to be four or five thousand eggs in the ovaries of a female.

Leaves were collected and kept in cardboard and tin boxes. Larvae hatched in both these containers and died therein, but the majority of larvae were found in the following June dead within the egg in the puncture. The illustrations were made from this material by treating it in warm water and weak potash for 48 hours, which distends the larva considerably and separates the segments so that they can be observed.

The first-stage larva is of the well-known planidium type, being composed of the head and 13 body segments, of which the last is a fleshy lobe between the caudal cerci. It is dark brownish except for the fleshy parts between the sclerites. The head is somewhat heartshaped, slightly truncate posteriorly and anteriorly, with a fleshy portion around the mouthparts and an unsclerotized longitudinal strip ventrally. It bears two pairs of circular sensoria (probably the bases of setae) dorsally. The mandibles are of the usual comma shape. The body (fig. 5) is more or less spindle-shaped, being widest at the third thoracic

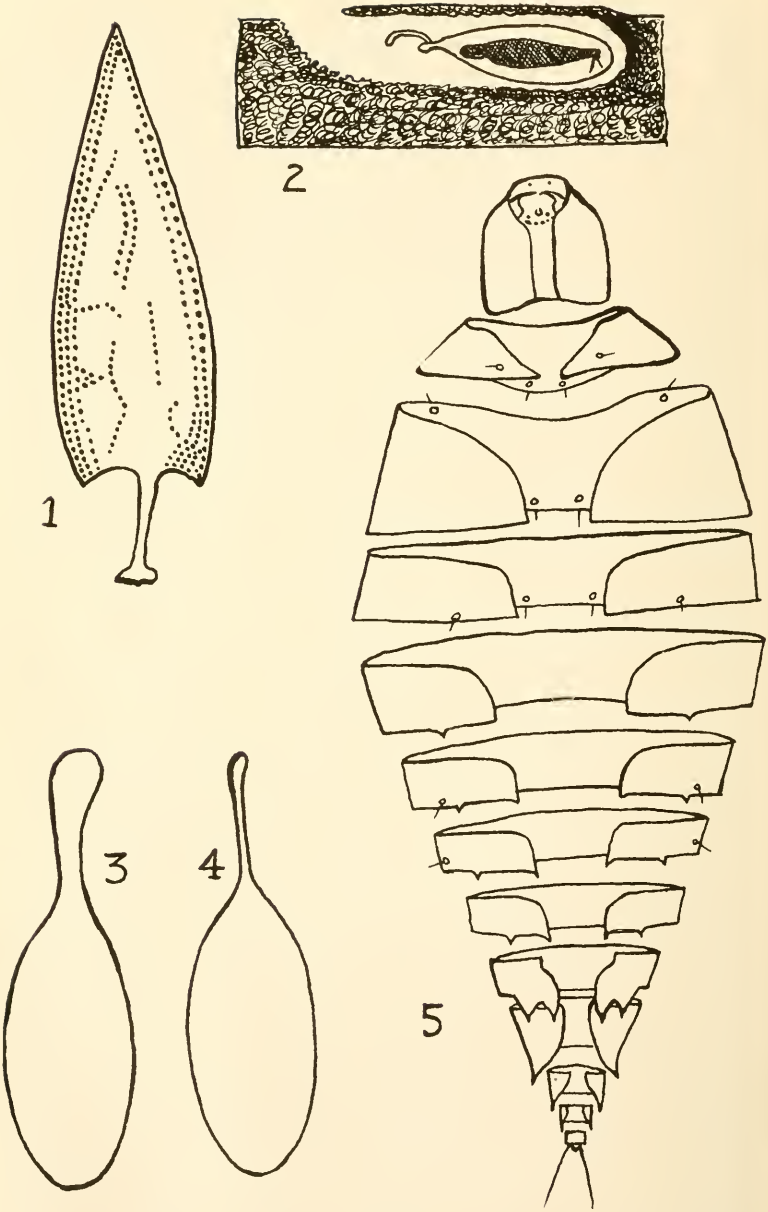


Fig. 1, leaf of *Muehlenbeckia sagittifolia* showing pattern of egg punctures on underside of leaf; fig. 2 egg *in situ* with a fully developed first-stage larva within it; fig. 3, ovarian egg; fig. 4, deposited egg; fig. 5, first-stage larva, showing sclerotized parts only.

and first abdominal segments. There are 12 sclerotized bands, or dorso-pleural plates, extending almost entirely around the body, as is usual with this type of larva. Setae are found in the following places. One pair dorsally on the first thoracic segment near the posterior border and one pair ventrally also posteriorly; one pair dorsolaterally on the anterior edge of the second thoracic segment and one pair dorsally on the posterior edge; one pair dorsally on the third thoracic segment and one pair ventrally, both near the posterior border; one pair ventrolaterally on each of the second and third abdominal segments near the posterior border; a pair of long caudal cerci apparently attached to the fleshy portion of the ninth abdominal segment, since no circular base can be discerned on the sclerotized part of this segment, whereas in the other cases the circular bases are quite distinct. The second thoracic segment is the longest medially, the thoracic plates terminating ventrally in a simple manner, the first to fourth abdominal segments each have a distinct tooth on each side posteriorly in a ventro-lateral position, and the inner angle of the posterior edge of the segments is somewhat pointed; the fifth abdominal segment bears two large teeth at its posterior-ventral margin; the sixth, somewhat wider than the preceding segments, is drawn out posteriorly in a long tooth that is obtuse before the apex but has a sharp-pointed apex; the seventh and eighth are slightly drawn out to a point posteriorly, otherwise simple; the ninth seems to be a simple plate without teeth.

NOTES ON THE SEASONAL HISTORY OF THE RABBIT TICK, HAEMAPHYSALIS LEPORIS-PALUSTRIS, IN OKLAHOMA.[1]

By Gaines W. Eddy.[2]

ECONOMIC IMPORTANCE.

Although the rabbit tick has been known for over seventy years, its importance in the dissemination and transmission of diseases has only recently come to light. It was shown to transmit spotted fever by Parker (1923) and was incriminated as a carrier of tularaemia by Parker, Spencer and Francis (1924). This tick is also a proved vector of tularaemia in British Columbia, according to Moilliet (1936), and was shown to carry that disease in Alaska by Philip and Parker (1938).

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[1] A contribution from the Oklahoma Agricultural and Mechanical College Department of Entomology, Stillwater.

[2] Now with the U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine.

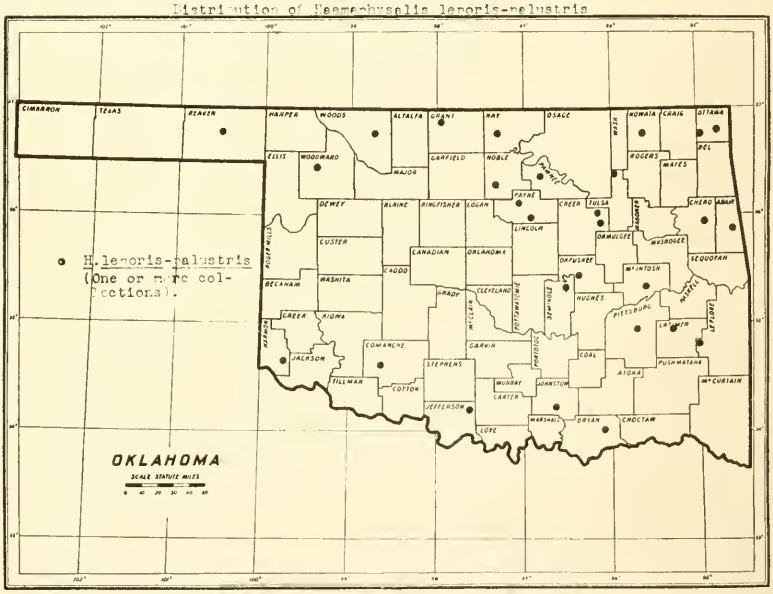
The rabbit tick likely plays an important role in the maintenance of both tularaemia and spotted fever in nature. It also meets in common with the American dog tick, *Dermacentor variabilis*, on cottontail rabbits. The importance of rabbits as hosts for the American dog tick will be brought out in a subsequent paper.

DISTRIBUTION.

The rabbit tick is known to occur in southern Alaska, Canada, throughout the United States and in Central and South America.

In Oklahoma, it probably occurs in every county but has been collected in only twenty-five of the seventy-seven counties as indicated on the accompanying map.

The tick is more prevalent in the wooded eastern half of the State. Numerous animals have been examined in the western part of the State but only a few specimens have been collected.



HOSTS.

Rabbits and hares are the principal hosts for this tick. Birds, however, play an important role as hosts for the immature forms. Peters (1936) lists forty-six species of birds that have been attacked by the rabbit tick. In only a few instances have the adult stages been known to attack birds.

Some of the more uncommon hosts, as listed by various

authors, are the horse, dasyure, cat, pine squirrel and man. According to Hearle (1938), chipmunks and ground hogs are commonly attacked in British Columbia.

In Oklahoma, the writer has collected larvae from the thirteen-striped ground squirrel (*Citellus tridecemlineatus bodius*); nymphs from the striped skunk (*Mephitis mesomelas varians*); nymphs from the fox squirrel (*Sciurus niger rufiventer*); larvae from the woodrat (*Neotoma floridana attwateri*); and larvae from the house cat. Many specimens have been taken from birds, including the eastern crow and domestic chicken. Field mice appear to be of little importance as hosts. At the time of this paper, a large number of mice (mostly *Peromyscus* spp.) have been examined in Iowa, but no rabbit ticks have been found. Rabbits and birds collected in the same locality have yielded many specimens.

SEASONAL HISTORY.

The rabbits killed, in obtaining information on the seasonal history, were taken in Payne county. Periodical collections were made from January 1, 1939, to January 1, 1940. Each month at least five and no more than thirty-two rabbits were collected, totalling 197. An attempt was made to examine a few animals each week, though in a number of instances this was impossible. For instance, more rabbits should have been examined during February and March than were in this case. Some of the animals taken in January were live-trapped. All the rest were shot, bagged in the field and taken to the laboratory for examination. Usually the animals were allowed to remain in the bags for a few hours before removal of the ticks, since a large per cent will detach after the animals become cold. However, females have been found attached after twenty-four hour periods.

The rabbit population on all areas where collecting was done, varied from one-tenth to five per acre.

It has been known for some time that the rabbit tick is active during the warmer seasons of the year. Hooker, Bishopp and Wood (1912) state that the three active stages of the tick may be collected during all seasons of the year. According to Cooley (1932), it is not a winter feeding species in Montana, probably hibernating between active seasons. He also states that no records of adults have been taken in March, which would appear necessary unless the larvae hibernate over winter. Green, Bell and Evans (1938) report the rabbit tick emerges from hibernation in Minnesota during the first part of April. The latter author (1940) states that the tick may be found during midwinter, but this is an unusual occurrence. Hixon

(1940) says all stages may be collected during the winter months in Florida, but there is a marked decrease in numbers.

In Oklahoma, both the larvae and nymphs were active during all months of the year. No males were collected in December and no females were taken in November or December.

The larvae showed a great increase in June, July and August, with the peak in July. They were fairly steady in September, October and November but showed a marked decrease in December. Even though the temperature went below freezing in January, both flat and replete specimens were taken. In fact, about sixty per cent of the larvae were replete. The larvae, as with the other stages, showed an increase in March. The sudden increase in June was no doubt due, in part, to the first ovipositing females.

No engorged nymphs were collected until the first part of March. They showed a steady increase until their peak in June. A fairly large number was present until December, at which time there was a marked decrease.

Thirty-one rabbits were examined during January and February and seven females were removed. All the specimens were flat. It was not until March 17 that an engorging female was found. They appeared in much greater numbers during June but decreased in a similar manner following that month. This increase was probably was due in part to molting nymphs. Few specimens were taken in October and none were removed from the thirty-six rabbits examined in November and December.

The seasonal fluctuations of the males were similar to those of the females. The males appeared in greater numbers in April, May and June but became gradually fewer in numbers through November. No specimens were collected from sixteen animals examined in December.

The above data indicate the immature stages of the rabbit tick are active during all months of the year, the females in all except the last two months, and the males in all except December. There was no direct correlation between the temperature and humidity and the number of ticks present. Temperature, however, appeared to be an important factor. The immature stages are more active during the colder months than are the adults.

This tick is almost inactive during the winter months in the more northern States, such as Minnesota or Montana, but apparently becomes more active as one goes farther south.

A Summary of a Year's Collection of the Rabbit Tick, *Haemaphysalis Leporis-Palustris*, from the Cotton Tail Rabbit, *Sylvilagus Floridanus alacer*, from January 1, 1939, to January 1, 1940.

DATE	NO. OF ANIMALS EXAMINED	AVERAGE NO. OF TICKS PER RABBIT EACH MONTH. MALES	FEMALES	NYMPHS	LARVAE	TOTAL
January	26	.15	.23	2.11	2.15	4.64
February	5	.40	.20	2.20	.40	3.20
March	6	4.66	1.66	4.33	8.16	18.83
April	32	12.03	5.87	6.81	.68	25.40
May	13	11.23	3.30	8.92	.53	24.00
June	19	25.72	18.84	22.05	48.94	115.56
July	17	6.88	5.41	21.35	78.70	112.34
August	11	5.90	3.81	8.27	27.45	45.43
September	15	6.66	3.33	15.33	10.86	36.18
October	17	1.47	.64	10.41	10.76	23.28
November	20	.40	.0	10.00	10.30	20.70
December	16	.0	.0	.62	2.18	2.80

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TWO NEW SOUTH AMERICAN SPECIES OF MEROTHRIPS HOOD (THYSANOPTERA, MEROTHRIPIDAE).

By J. C. Crawford,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

Although the genus *Merothrips* is widely distributed, having been recorded from North and South America, South Africa, and the Hawaiian Islands, the number of species appears to be small, and specimens apparently are not taken in large numbers. The finding of two new species in South America seems to be noteworthy, especially in view of the size of one of the series.

The following key will aid in identifying the species although, owing to the lack of detailed descriptions of two of them, it has been necessary to place these in a triplet rather than in the conventional couplets.

Key to the Species.

1. Pronotum posteriorly with only 1 pair of long bristles 2
   Pronotum posteriorly with 2 pairs of long bristles ..... *mirus*, new species.
2. Sensoria on antennal segments 3 and 4 small, appearing as lateral facetlike spots ..... *nigricornis* Hood.
   Sensoria on segments 3 and 4 bandlike, extending almost across segments 3
3. Eyes ventrally produced caudad to a point beneath dorsal margin of head; postocular bristles much less than one-half as long as interocellars ..... *cognatus* Hood.
   Postocular bristles somewhat shorter than interocellars; pronotum with many discal bristles; pronotum with about 5 pairs of posterior marginal bristles and with a pair of discal furrows on anterior half ..... *williamsi* Priesner.
   Eyes ventrally not produced; no furrows on disk of pronotum; postocular bristles about one-half as long as interocellars; 3 pairs of posterior marginal prothoracic bristles ..... *plaumanni*, new species.

Merothrips plaumanni, new species.

Female (macropterous).—Length about 1 mm. (distended, 1.4 mm.). Brown, with the head darkest and much darker in anterior half, prothorax about as dark as head posteriorly, pterothorax somewhat paler in color than prothorax and tinged with yellow, abdomen still lighter in color and palest in intermediate segments with terga I and IX-X almost as dark as pterothorax; fore legs yellow or very faintly tinged brownish, mid and hind legs light yellowish brown; antenna brown, with segment II brownish yellow, and extreme base of III, except the brown pedicel, colorless; sensoria of III and IV dorsally extending almost across segments; wings grayish brown, forewing pale at extreme base, and with a pale median area beyond anal lobe, the space between the veins paler; fringe of posterior margin of forewing on outer half with the hairs in pairs, of which one is longer, stronger, and straight, the other weaker and wavy; hind wing with a median darker stripe extending almost to apex; fore tibial

tooth small, nipplelike; hind tibial spurs well developed but the few bristles basad of them weak; line of fusion of terga IX and X showing only faintly.

Head from front of eye about as long as broad, with the produced portion between the eyes about 16 μ long; frontal costa with a wide shallow emargination; cheeks gently curved, subparallel, eyes somewhat protruding; a few very faint transverse lines near base of head; interocellar bristles just back of a transverse line tangent to the posterior margin of anterior ocellus and outside a line tangent to the outer margins of anterior and posterior ocelli; postocular bristles close to eyes, inserted 56 μ apart and about 9 μ from lateral margins of head; antennae elongate, slender, segments III-VIII pedicellate; pedicel of III apically with a sharp-edged ridge.

Prothorax widened posteriorly, much narrower at anterior margin than median length; furrows separating notum from pleuron only slightly divergent in anterior half, thence rapidly so; no furrows anteriorly on disk; base with a few widely spaced, transverse, anastomosing lines; well-developed strong, anterior angular bristles directed forward and on each side a pair of anterior marginals close to the angulars, all these on the extreme anterior margin of notum; posterior angles each with a single long thin bristle and between them 3 pairs of posterior marginals; about 16 minor discal bristles, most of which are near the edges of the notum; all prothoracic bristles light brown; propleura as seen from above showing medially a single short bristle in a small, pale, circular area; mesoscutum with a single long bristle at each lateral angle; pteronotum with very faint, widely spaced, transverse, anastomosing lines; dorsal margin of fore femur with a single moderately long (24 μ) bristle at about distal two-thirds, a long one at about middle on outer side, and one about as long farther basad and well ventrad of middle of femur, beyond this latter bristle with a row of 4 distinct short bristles; femur with other scattered, short, weak bristles as well as a row along dorsal surface; dorsal surface of fore tibia with a single long bristle distad of middle and one somewhat basad and farther ventrad of this on outer side; fore and hind femora very greatly swollen; veins of forewing setose their entire length, costa and fore and hind veins with about 21, 3+11–13, and 10 bristles, respectively, the outer bristle on hind vein basad of the next to last on the fore vein.

Abdomen normal in form, terga I-VIII with very faint, widely separated, transverse, very sparsely anastomosing lines; tergal bristles tinged brownish, on I-VIII, short, except those at lateral margins; four bristles on each lateral margin of II-VI similarly arranged, two on extreme margin, one of which is slightly in front of the middle, the other distinctly back of it, between them but more mesad the longest bristle of the group, the fourth bristle almost as far cephalad as the first mentioned but 28 μ mesad of it; bristles on IX-X long, thin, almost colorless, drawn out to very thin ends, dorsolaterals of X surrounded by a circular area about 10 μ in diameter, this being two and one-half times the diameter of the point of insertion of other setae.

Measurements (in microns, mostly from holotype): Head length 92, width across eyes 88, width just behind eyes 80, greatest width across cheeks 83.5, width at base 78.5; prothorax, median length 124, width anteriorly 96, greatest width including coxae 180; greatest width of pterothorax 208; wing length 605, width medially 37. Bristles, interocellar 68, postocular 30, anterior angular 25, posterior angular 68, lateral on mesoscutum 60, at middle of fore vein 30; on

tergum IX, median 48, dorsolateral 152, lateral 152, ventrolateral 172; on tergum X, median 140, dorsolateral 144, lateral 128.

Antennae:	1	2	3	4	5	6	7	8
Length,	19[1]	32	41	40	32	32	30	40
Width,	28	26	19	17	14	13	12	11

Male unknown.

Type locality.—Nova Teutonia, Santa Catharina, Brazil.

Type.—Catalog No. 56446, United States National Museum.

Described from 21 females collected on dead branches by Fritz Plaumann (to whom the species is dedicated) in 1941, 6 in May, 1 in June, and 14 in July (including holotype).

In addition to the characters given in the key, this species differs in many other details from the description of *williamsi* Pr., which is said to have the interocellars close in front of and somewhat mesad of the hind ocelli, hind tibia towards apex with many long rigid bristles, outer margin of fore tibia with one long bristle; head 127 μ long and 135 wide; prothorax 176 μ long and 181 wide, pterothorax 306 μ long and 238 wide, antenna VIII distinctly shorter than III, antennal segments much wider, especially III and IV, although of about the same length as in *plaumanni;* wing 748 long. The description of *williamsi* made no mention of any ventral production of the eyes, a character not likely to have been overlooked by Dr. Priesner, and in this it would be distinguished from *cognatus* Hd.

Merothrips mirus, new species.

Female (macropterous).—Length about 1 mm. (distended, 1.35 mm.). Deep brown; head, and at times prothorax, blackish brown, abdomen palest, pterothorax somewhat lighter than prothorax, fore femora as dark as prothorax, fore tibiae paler and shading to brownish yellow apically, mid and hind femora somewaht paler than pterothorax, their tibiae and all tarsi brownish yellow; antennae entirely blackish brown, except the extreme whitish base of III and its pale-brown pedicel; pronotum with a single, long, posterior, angular bristle but also a long midlateral bristle opposite posterior end of propleuron as seen from above; anterior angular bristles long, strong, directed cephalad, slightly removed from anterior margin, the three pairs of bristles mesad of them successively farther removed from anterior margin; sense areas of antennal segments III and IV extending dorsally almost across segments; body bristles brown, those of abdomen only faintly so; major body bristles thin and apically drawn out very thin.

Head narrowest just back of eyes, with cheeks slightly divergent to near base, from front of eye shorter than greatest width, between the eyes produced about 19 μ; frontal costa with a wide semicircular emargination; posterior half of head with a few widely spaced transverse lines strong enough to cause sides of head to appear to have 3 4 subserrations; eyes protruding; interocellar bristles

[1]Visible portion only.

almost one-half the distance forward from posterior to anterior ocellus and about on lines tangent to the outer margins of posterior and anterior ocelli; postocular bristles close to eyes, 88 μ apart and about 8 μ from lateral margins of head; head, in outline, with two short bristles just behind eyes; antennal segments long, slender; antennae III-VIII pedicellate, pedicel of III apically with a sharp-edged ridge.

Prothorax wide across anterior margin, the sutures separating notum from pleuron at first gently divergent to beyond middle, thence rapidly so caudad; with 3 pairs of strong posterior marginal bristles and a similar bristle between posterior angular and midlateral bristles, disk with about 10 more bristles of which 4 are in a transverse row at the front of the distinct transverse sculpture at rear of notum and 3 on each side some distance back of those near anterior margin (these at times are approximately in a transverse row) and occasionally a single bristle in front of midlateral; rear of pronotum with a few strong anastomosing lines; wings almost uniformly smoky brown, forewing with the extreme base, a line in front of fore vein extending outwardly about to apex of anal lobe, and line of demarcation of anal lobe almost hyaline; hind wing with a median dark streak extending almost to apex; forewing with about 25, 18, and 14 bristles on costa and fore and hind veins, respectively, outer bristle of hind vein basad of next to last on fore vein; fringe hairs of hind margin of forewing arranged as in *plaumanni;* fore and hind femora greatly swollen, the tooth at tip of fore tibia rather small, nipplelike; outer face of fore femur with 2 long bristles ventrad of median line, the first at about the middle, the other near base; also with many short bristles, some being in a row along dorsal surface, a row beneath this, and a row near ventral surface distad of the long bristle nearer base, as well as other scattered ones; fore tibia with 1 long bristle on outer side, distad of middle and well below dorsal margin.

Abdomen with distinct, somewhat wavy, transverse, anastomosing lines (those on tergum X faint), of which one near base is much stronger; base of dorsolateral bristle on tergum X surrounded by a circular area about two and one-half times the diameter of point of insertion of other setae; bristles on lateral margins of terga II-VI very similarly arranged; on III, a pair on extreme lateral margin, one in front of and one back of the middle of the segment, between them but slightly more mesad the longest of the group and opposite the most caudad bristle and about 8 μ removed a fourth bristle.

Measurements (in microns, mostly from holotype): Head, length from front of eye 104, width across eyes 120, width just back of eyes 106, greatest width across cheeks 110; prothorax, median length 141, width anteriorly 129, greatest width 168, width including coxae 226; pterothorax, greatest width 204; wing, length 664, width at middle 36. Bristles, interocellar, 88, postocular 36, anterior angular 25, posterior angular 70, midlateral 76, outer posterior marginal 22; lateral on mesoscutum 56; longest lateromarginal on tergum III 38; on middle of fore vein 40; on tergum IX, median 76, dorsolateral 188, lateral 200, ventrolateral 180; on tergum X, median 160, dorsolateral 172, lateral 160.

Antennae:	1	2	3	4	5	6	7	8
Length,	18[2]	36	54	50	48	55	48	58
Width,	32	30	21	20	16	15	13	12

Male unknown.

[2]Visible portion only.

Type locality.—Nova Teutonia, Santa Catharine, Brazil.

Type.—Catalog No. 56447, United States National Museum.

Described from eight specimens taken on dead branches by Fritz Plaumann in 1941, one in May, two in June, and five in July (including holotype).

A very distinct species, differing especially in the greatly elongated antennal segments and in the development of a second pair of long prothoracic bristles.

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NOTES ON SOME WEST INDIAN FLATIDAE.

By R. G. FENNAH,

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Stål described the genus *Ormenis* as having two more or less curved and regular rows of transverse venules towards the apex of the corium, distinct ocelli, and two spines before the apex on the posterior tibiae, and separated from it another genus *Petrusa* as having only one postibial spine. In view of the inconstancy of the recorded points of difference the status of *Petrusa* has been held in doubt, and the single species of this genus has in recent years been provisionally treated as belonging to *Ormenis*.

The writer has dealt with certain Lesser Antillean Flatids in an earlier paper (Proc. Ent. Soc. Wash. Vol. 43, No. 9), all of which were then referred to *Ormenis* (*s. l.*). On the basis of more extensive data he now considers that certain of these species, together with others described below, must be assigned to distinct genera. The genus *Petrusa* is quite distinct from *Ormenis* and is redefined below. *Ormenis contaminata* Uhler and its allies form a very compact genus, as also do *Ormenis septempunctata* Fennah and two new species described below.

Among females of species falling under *Ormenis* and *Petrusa* there are two types of ovipositor. In one the lateral styles (3rd valvulae) are broad, strong, and beset with tooth-like processes directed inwards. In all cases so far observed females with this type of ovipositor insert the eggs to a greater or less extent in the substratum, which is normally the outer-most tissues of a leaf or soft stem. In the other type the lateral styles are very much reduced, being narrow, bluntly pointed or rounded at the apex, and entirely devoid of tooth-like processes. Species with this type of ovipositor do not insert the eggs, but lay them upon the substratum which may be as above or of a woody texture.

The relative size of the anal segment of the female is apparently correlated with the quantity of waxy secretion which is deposited over or along with the eggs at the time of oviposition, as this substance is supported on the lower surface of the

segment. The amount of secretion is not closely correlated with the type of ovipositor, and on present data appears to be fairly constant among the species of each genus. The colour of this secretion is usually white, but in a few cases is brown.

The shape of the egg is variable and in its most elaborate forms offers a reliable means of distinguishing genera. The significance of some of the structures observed is very imperfectly understood. The eggs of *O. contaminata* and its allies are thick-walled and possess a well-marked operculum. They are not covered with waxy filaments but are merely sprinkled thinly with short greyish spicules. By contrast the eggs of *O. septempunctata* are thin-walled, not operculate, and when laid are covered with a thick layer of white waxy filaments matted together.

Instars of various species of the same genus have so far proved difficult to distinguish. Pigmentary differences are occasionally striking but are unreliable. As yet no careful search has been made by the writer for criteria by which genera can be distinguished in the immature stages but it is already clear that characters likely to be of value exist in the colour, shape and distribution of the various plates, flocculi or spicules formed by the epidermal secretion.

In the generic definitions given below stress is laid on the above characters, though it is recognized that in practice most workers are likely to have access only to those provided by the anal segment and the ovipositor. The step is taken partly to justify the erection of new genera and partly to indicate a promising means of testing some of the questionable groupings which, for want of better, workers at present must provisionally accept.

PETRUSA Stål.

Genotype, *Cicada marginata* Brunnich, 1767, in Linné Syst. Nat., i (2) p. 710, Stål, Hemipt. Fab. ii, p. 111.

Frons at widest part as broad as long, or very slightly broader, median carina distinct on basal two-thirds, obsolete on apical third, lateral carinae obsolete or indicated at base, lateral margins carinate; no carinae on clypeus; vertex very short; width of head (with eyes) equal to width of thorax. Pronotum with anterior margin convex, posterior margin concave; mesonotum without carinae or median carina indicated at apex. Hind tibia with one spine before apex. Tegmen 2.2 times longer than width at middle. Costal area about as wide as costal cell, granulate; Sc strong, simple to apex, R forking one-quarter from base, M forking about same level as R fork, Cu forking slightly basad of M fork. Base of R and M granulate. Nodal line parallel to apical margin of tegmen marked anteriorly by transverse veins and for most of length by an arcuate furrow. Apical line even and distinct. Anterior and posterior angles smoothly rounded, apical margin shallowly rounded.

Anal segment of male deflexed about 45 degrees in apical half, with lateral

margins produced downward into a point two-thirds from base; no median lobe ventrally. Genital styles with dorsal margin entire. Female anal segment long, rather more than three times as long as lateral styles of ovipositor. Lateral styles short, ovoid in side view, and devoid of tooth-like processes on posterior margin. Egg ovoid, approximately 2.2 times longer than wide, not operculate. Eggs not inserted, but laid in a low mound ovate in outline, densely covered with a felt of small white spicules. Epidermal secretion of instars white.

Petrusina Melichar is a synonymy, having been erected to contain the dark form of the type species. *Petrusa* was erected to contain *Cicada pygmaea* Fabr. (1794, Ent. Syst. iv, p. 30), which is the pale form of the above.

ANTILLORMENIS, n. gen.

Genotype *Ormenis contaminata* Uhler, Proc. Zool. Soc. Lond., 1895, p. 71.

Frons broader than long (about 1.4 to 1), median carina distinct on basal half, absent from apical half, lateral carinae indicated at base or absent, lateral margins carinate; no carinae on clypeus; vertex very short; width of head, with eyes, equal to width of thorax. Pronotum with a shallow depression on each side of middle line; mesonotum without carinae, or with median carina indicated at base and apex, lateral carinae at base. Hind tibia with two spines before apex. Tegmen 2.4 times longer than width at middle, costal margin narrower than costal cell near base, twice as wide in middle; costal area granulate, Sc strong, simple to apex, R forking about one-third from base of tegmen, M forking basad of R fork, Cu forking about level with M fork. Base of R and M granulate. Nodal line very feebly indicated by irregular cross-veins and an elongated depression along a curved line from node to apex of clavus; apical line fairly even and distinct. Clavus strongly granulate in basal two-thirds.

Anal segment of male strongly and abruptly deflexed in apical half, with a median ridge or lobe towards base on ventral surface; genital styles deep with an excavation near apex on dorsal margin; process of style a rather blunt peg, often twisted at tip. Anal segment of female very short, bluntly rounded in dorsal view, less than twice as long as lateral styles of ovipositor. Lateral styles short, small, somewhat ovate in side view, devoid of tooth-like processes on margin. Egg rectangular, pyramidally pointed at one end, with thick walls, operculate. Eggs not inserted, but laid on substratum in two interlocked rows with pointed ends directed inward, one layer in depth, very lightly sprinkled with short greyish-white spicules. Epidermal secretion of instars white.

This genus includes *A. albicostalis* Fen., *A. palicoureae* Fen., *A. barbadensis* Fen., *A. sanctaliciensis* Fen., *A. grenadensis* Fen., in addition to the genotype *A. contaminate* Uhler. To it are added below the following new species: *A. flaviclavata*, *A. cachibonae* and *A. sancti-vincenti*.

Antillormensis flaviclavata, n. sp.

Male. Length, 5.7 mm.; tegmen, 6.1 mm. Female. Length, 6.1 mm.; tegmen, 6.6 mm.

Pronotum pale clouded yellow, mesonotum very pale, sometimes clouded fuscous, yellow-orange laterally; frons very pale, slightly darker along the line of the lateral carinae; clypeus, genae and antennae very pale yellow, eyes red, sometimes darker in anterior half. Fore and middle legs testaceous, hind legs paler. Abdominal tergites pale yellow, sometimes fuscous, sternites pale yellow or whitish, pregenital plate, female genitalia, anal segment of male and female pale fuscous, male genitalia dark. Tegmina pale tawny, smoky at apical margins, or sometimes beyond middle, with veins pale; a broad very dark band overlying C at its base and lying between Sc and R to apex. Veins distad of apical line fuscous. Wings very pale, veins concolorous, or somewhat smoky, veins fuscous. Insects in life powdered pale fawn.

Anal segment of male with a short median ventral process; deflexed part of segment only slightly shorter than horizontal part. Aedeagus with a pair of dorsal apical spines half as long as aedeagus, and ventrally a pair of curved processes, short, and turned outwards in a minute hook at tip.

Described from 65 males and 77 females collected by the writer near Goodwill Estate, Dominica, B. W. I. (May 9, 1941), on *Coccoloba uvifera*. Type material deposited in the United States National Museum. This species superficially resembles *A. cachibonae*, *A. albicostalis*, *A. sanctaliciensis*, and *A. barbadensis*. It is readily separated from all by the absence of a fuscous area on the basal half of the clavus (the darkest specimens have only a suggestion of this), and by the shape of the ventrolateral process of the aedeagus, which is closest to that of *sanctaliciensis* but not so marked twisted on its axis, while the hooked tip is smaller. It is further distinguished from *sanctaliciensis* by its pale clypeus, frons, pro- and mesonotum.

Antillormenis cachibonae, n. sp.

Male. Length, 5.6 mm.; tegmen, 6.3 mm. Female. Length, 5.8 mm.; tegmen, 6.7 mm.

Pronotum pale fuscous, mesonotum fuscous darker basally and laterally with a paler line on each side of middle; frons pale yellow, slightly clouded with fuscous; clypeus pale, a dark curved line near each side, genae pale yellow, antennae light fuscous, eyes red. Legs pale testaceous, apex of hind femur and base of hind tibia, darker; abdominal tergites and genitalia fuscous, sternites slightly paler. Tegmina pale yellow, darkening into fuscous distad of middle; costal area pale, a very dark fuscous band overlying costal at base and lying between Sc and R to apex, clavus fuscous basally. Wings smoky, veins dark. Insect in life powdered fawn.

Anal segment of male with median ventral process, slightly recurved, deflexed part of segment nearly as long as horizontal. Aedeagus with a pair of

spines dorsally at apex directed anteriorly for nearly two-thirds length of aedeagus, and ventrally with a pair of stouter processes curving anteriorly and upwards, somewhat angularly curved outwards when viewed from ventral aspect.

Described from 12 males and 9 females collected near the mouth of the Melville Hall or Cachibona River, Dominica, B. W. I., by the writer (June 18, 1941) on *Coccoloba uvifera*. Type material deposited in the U. S. N. M. This species is close to *A. albicostalis*, but differs in having the tegmina usually pale, not dark. The ventral processes of the aedeagus of *cachibonae* when viewed from the ventral aspect are rather angularly curved, while in *albicostalis* they are smoothly curved. The posterior margin of the plate lying between these processes is sinuate in *albicostalis*, saw-toothed in *cachibonae*. The basad side of the excavation near the apex of the dorsal margin of the male genital style is straight in *cachibonae*, while in *albicostalis* it forms a curve steepening as it descends. In the female the notch in the pregenital plate is wider than in *cachibonae*, and the distal margin of the plate is much less sinuate.

Antillormenis sancti-vincenti, n. sp.

Male. Length, 6.5 mm.; tegmen, 7.2 mm. Female. Length, 6.8 mm.; tegmen, 7.8 mm.

Dark form: pronotum tawny, margined narrowly with fuscous; mesonotum ferruginous, a dark spot laterally, basal margin and scutellum very dark; frons tawny, darker near lateral margins; clypeus tawny, a pale band on each side of middle line; genae and antennae pale, eyes very pale grey. Legs fuscous yellow, abdominal tergites and sternites fuscous, paler laterally; female genitalia fuscous yellow, male genitalia dark. Tegmina tawny ferruginous, base of costa, middle of Sc, and apical part of R clouded fuscous, the tegmen dark fuscous distad of a line between apex of costal area and middle of claval suture, nodal line transparent in middle; clavus fuscous. Sometimes the whole tegmen is dark fuscous except for the ferruginous costal area (including a small area behind its tip) and a quadrangular area just basad of middle of tegmen. Wings smoky, veins dark. Insect in life powdered a leaden hue.

Pale forms: insect wholly pale yellow except for the eyes, which are purple, and the membrane of the tegmen distad of the apical line, which is dark fuscous. Insect in life powdered whitish.

Anal segment of male with a large median ventral process, over half as long as deflexed apical part of segment, and with a median lobe on its basal side; apical part scoop-shaped. Deflexed apical part of segment slightly shorter than horizontal part. Aedeagus with a pair of slender processes on dorsal margin directed anteriorly for two-thirds of its length; ventrally a pair of hook-like processes sweeping anteriorly outwards and upwards and then curving posteriorly. Ventral distad margin of periandrium shallowly excavated, pointed at each side.

Described from 26 males and 31 females collected by the writer in St. Vincent, B. W. I., in the following localities—Morne Garu, at 1,500 ft. (Aug. 20, 1941), Three Rivers, between 300 and 2,000 ft. (Sept. 3, 1941), and Mt. St. Andrews, at 2,000 ft. (Sept. 12, 1941). The insects were taken in forest on *Heliconia bihai*, banana, *Inga laurina*, cacao, mango, and *Tabernaemontana* sp. Type material deposited in U. S. N. M. This species superficially is not unlike *A. contaminate* Uhler, which also occurs in St. Vincent. It differs in detail, however, being larger, and having the dark areas of the tegmen sharply defined; other differences include the shape of the ventral process of the male anal segment, that of the ventral aedeagal process, of the apical border of the periandrium, and of the apical process of the genital styles. In the female the notch in the posterior margin of the pregenital plate is broader and more shallow than that of *A. contaminata*. *A. santi-vincenti* is a forest dweller and has not been taken in the coastal area, while *A. contaminata*, though found on the outskirts of rain forest (usually on *Cordia* sp.), occurs typically in the drier zones.

ILESIA, n. gen.

Genotype *Ormenis septempunctata* Fennah, Proc. Ent. Soc. Wash., 43, No. 9, p. 196.

Frons broader than long (1.4 or 1.5 to 1), median carina distinct on basal two-thirds, absent from apical third, though sometimes indicated at apex, lateral carinae scarcely indicated at base, otherwise absent, lateral margins carinate; no carinae on clypeus; vertex very short; width of head, with eyes, equal to width of thorax. Pronotum with a slight depression anteriorly on each side of middle line; mesonotum without carinae, or median carina slightly indicated at apex, lateral carinae at base. Hind tibia with two spines before apex. Tegmen 2.5 times longer than width at middle, costal margin as wide as costal cell near base, twice as wide in middle; costal area granulate, Sc simple to apex, R forking about one-third from base of tegmen, M forking about same level, Cu forking slightly basad of former two, base of R and M granulate. Nodal line fairly distinct, marked anteriorly by irregular crossveins, posteriorly by an elongated depression from near node to apex of clavus; apical line fairly even and distinct. Anterior apical angle of tegmen smoothly rounded, slightly acute, posterior angle more abruptly rounded and slightly obtuse; apical margin obliquely truncate, slightly rounded.

Anal segment of male not strongly and abruptly deflexed in apical half, and devoid of ventral ridge or process. Genital styles with dorsal margin entire, apical process in form of an inwardly curved plate with a broadly sinuate margin ending basad in a short point directed outward, distad in a broad point directed posteriorly. Anal segment of female very long, about three times as long as lateral styles of ovipositor. Lateral styles small, fusiform in side view, devoid of tooth-like apical processes. Egg ovoid, approximately 2.5 times as long as broad, not operculate. Eggs not inserted, but laid in a

low mound ovate in outline, densely covered with a matted layer of small white spicules. Epidermal secretion of instars white.

Ilesia anguillana, n. sp.

Male. Length, 4.0 mm.; tegmen, 4.8 mm. Female. Length, 5.2 mm.; tegmen, 5.6 mm.

Pronotum testaceous, fuscous basally; mesonotum ferruginous with two or three fuscous spots on basal margin on each side of middle line; frons, clypeus, and genae testaceous, antennae pale with black sensory pits, eyes orange, with a black spot bordered white antero-dorsally. Legs testaceous; abdominal tergites, anal segment and male genitalia fuscous, sternites, pygofer, and female genitalia paler. Tegmina testaceous, costal area and apical half of tegmen fuscous, veins pale, clavus sometimes fuscous. A fuscous elongated spot at base of costal vein, a small spot near junction of R and M, a large trapezoidal spot just distad of Cu fork, a small spot on clavus at apex. Wings smoky, veins dark. Insect in life powdered pale brown.

Anal segment of male devoid of ventral process; deflexed part of segment one-third length of horizontal part. Aedeagus with a pair of complex processes laterally, each consisting of a thin spine curved posteriorly, then upwards, anteriorly and outwards; attached to this a bifurcate spine below, directed anteriorly, the longer arm being half as long as aedeagus, the shorter one-fifth the length of the longer; a pair of minute blunt processes ventrally one-quarter from base of aedeagus. Anal segment of female 1.1 mm. long.

Described from 5 males and 6 females collected in Anguilla, B. W. I., by F. S. Delisle, Esq. (April 23, 1941) on *Coccoloba uvifera*. Type material deposited in the U. S. N. M. This species is allied to *I. septempunctata*, but differs in the male genitalia and in the pattern of spots on the tegmen. A long series of this species has more recently been taken by the writer in Nevis, B. W. I. (Jan. 14–20, 1942).

Ilesia benevolens, n. sp.

Male. Length, 5.6 mm.; tegmen, 6.0 mm. Female. Length, 5.9 mm.; tegmen, 6.4 mm.

Pronotum pale testaceous; mesonotum somewhat ferruginous, a pair of fuscous spots basally on each side of middle line, the outer large and triangular, the inner small and round. Frons, clypeus, and genae light yellow or yellowish-brown, antennae somewhat paler, eyes orange-red, a black spot bordered white antero-dorsally. Legs pale yellow to yellowish-brown. Abdominal tergites, male genitalia, and female anal segment fuscous, sternites and female genitalia very pale, but sometimes dull mottled brown bordered with orange. Tegimina dull stramineous, sometimes fuscous. Costal area fuscous at base, pale apically, basal half of tegmen usually pale, distal half fuscous, slightly paler beyond apical line, junction of R and M thinly clouded with fuscous, a small dark spot basad of this junction, a larger trapezoidal spot on Cu posterior to R and M junction, a still larger round spot on Cu posterior to M fork,

a small spot on clavus at apex, clavus fuscous basally posterior to anal vein. Wings, smoky, veins dark. Insect in life powdered pale fawn.

Anal segment of male devoid of ventral processes; deflexed part of segment only one-quarter of length of horizontal part. Aedeagus with a pair of spines just basad of apex directed ventrally and posteriorly; arising at the same level a pair of shallowly curved slender spines directed anteriorly below aedeagus for three-quarters of its length; a small process laterally, directed outwards. Anal segment of female long (1.5 mm.).

Described from 35 males and 48 females collected by the writer near Goodwill Estate, Dominica, B. W. I. (May 9, 1941), on *Coccoloba uvifera*. Type material deposited in U. S. N. M. This species differs from *I. septempunctata* in the shape of the spots on the tegmina, in the mode of forking of the veins distad of the apical line, and in having longer tegmina. The female has a longer telson on the anal segment, a narrower sclerotised strip behind the anal opening, longer genital styles, and a differently shaped apical margin on the pregenital plate. The male differs from that of *septempunctata* in the shape of the anal segment, in the direction in which the shorter aedeagal spine projects, and in the shape of the long shallowly curved aedeagal process. The writer assigns to this species a male and a female collected by him in St. Lucia, B. W. I. (March 21 and April 28, 1941), on *Tabernaemontana* sp. The notch in the pregenital plate of the female is a little wider than in the Dominican material, but otherwise the specimens agree perfectly.

ORMENIS Stål.

1862 Stål, Bidrag till Rio Janeiro-Traktens Hemipter-Fauna, II, p. 68.

Ormenis jamaicensis, n. sp.

Male. Length, 5.2 mm.; tegmen, 6.3 mm. Female. Length, 6.2 mm.; tegmen, 7.2 mm.

Frons broader than long (1.3 to 1), median carina distinct on basal two-thirds, absent from apical third, lateral carinae indicated at base, lateral margins carinate; no carinae on clypeus. Vertex short; width of head (with eyes) equal to width of thorax; pronotum smooth, a shallow depression on each side anteriorly; mesonotum with median carina scarcely indicated at base and apex, lateral carinae at base. Hind tibia with two spines before apex. Costal area slightly granulate, Sc strong, simple to apex, R forking less than one-third from base of tegmen, M forking slightly basad of R fork, Cu forking about level with M fork. Base of R and M granulate. Nodal line parallel to apical margin, scarcely indicated by a series of cross-veins more or less in line from node to near apex of clavus; apical line somewhat uneven but distinct; one or two rows of small irregular cells between the apical line and the even apical cells. Apical margin of tegmen straight, joining posterior margin in a clean-cut right angle. Basal two-thirds of clavus strongly granulate.

Head, thorax, legs, abdomen and tegmina uniformly pale green, parts of genitalia fuscous. Eyes purple. Wings transparent, veins stramineous. Insect in life powdered greenish white.

Anal segment of male with deflexed apical part nearly twice as long as horizontal part. Arising from the ventral middle line below the anal style, and deepening anteriorly, a vertical plate, terminated by a transparent, flat, subquadrangular lobe directed posteriorly. Aedeagus with a pair of short, stout spines apically on dorsal border; posterior to these a pair of thin filaments, somewhat angularly curved in side view, arising from side of periandrium and directed upwards to same height as dorsal spines. A pair of long processes ventro-laterally, each arising at the base of the thin periandrial filaments and directed anteriorly below the aedeagus for two-thirds of its length. Ventral border of periandrium (a keel-like plate) terminating posteriorly in a point. Genital styles with an elevation on dorsal border near apex, posterior to this a slight excavation; apical process a rather thin spine, smoothly curved backward, then upward and slightly forward.

Anal segment of female short, bluntly rounded, genital styles large and stout, toothed along posterior margin; ovipositor short. Egg narrowly oval, a long narrow operculum near one pole, in side view slightly pointed at one end, shell rather thick.

Described from 18 males and 22 females collected by the writer near Hope Gardens, Jamaica (Nov. 1–3, 1940), on *Lantana* sp., and "Jasmine." Type material in U. S. N. M., paratypes in British Museum. Writing of two specimens which were submitted to him for examination, Mr. W. E. China has indicated that they are close to *Ormenis herbida* Wlk., but differ in structural details of the aedeagus and of the anal tube. This species, according to Melichar's key, would fall under the oriental genus *Geisha* Kirk., but differs from it in the structure of the head and in the type of the genitalia. It is here provisionally placed in *Ormenis sens. lat.* as it does not appear to be congeneric with any of the more recent subdivisions of this old genus.

Ormenis perpusillus Walker.

Poeciloptera perpusilla Walk. List of Homopt., II, p. 467, 61 (1851).

The following are the principal characters of this species.

Tegmen with apical areoles evenly spaced, apical line even and distinct; subapical areoles evenly developed, but bounded irregularly at base, the nodal line being obscure. Hind tibia with two spines before apex.

Head, thorax, abdomen, legs and tegmina uniformly pale green, wings transparent, genitalia greenish-brown. Insect in life powdered greenish-white.

Anal segment of male with apex scarcely deflexed. Aedeagus with two pairs of thin spinose processes on dorsal border at apex, directed anteriorly. The anterior pair extends forward for two-thirds the length of the aedeagus, while the posterior pair is about one-third the length of the anterior. Laterally a

pair of processes on each side, the basal process thin, blade-like, rounded at apex, directed downward and forward; distal process thicker, sickle-shaped, terminating in a point, directed downward and forward. Genital styles with upper and lower borders parallel, apical process on dorsal border a vertical narrow lamina twisted inwards; posterior margin of style almost semicircular in side view.

Anal segment of female slightly longer than lateral styles, rather narrow. Lateral styles stout, tapering slightly toward apex; posterior margin with four strong tooth-like processes. Ovipositor relatively long, directed backward and upward.

The material in the writer's collection consists of one male and one female and two specimens with abdomen missing, collected in Jamaica, B. W. I., by A. H. Ritchie (May 23–26, 1917) on coffee. The figure of the male genitalia has been redrawn from a drawing submitted to Mr. W. E. China, and kindly compared by him with the dissected genitalia of the British Museum type. Melichar includes Venezuela, Bogota, Guadeloupe and Martinique in the distribution of this species, but it is most probable that the insect is confined to Jamaica.

Explanation of Plates.

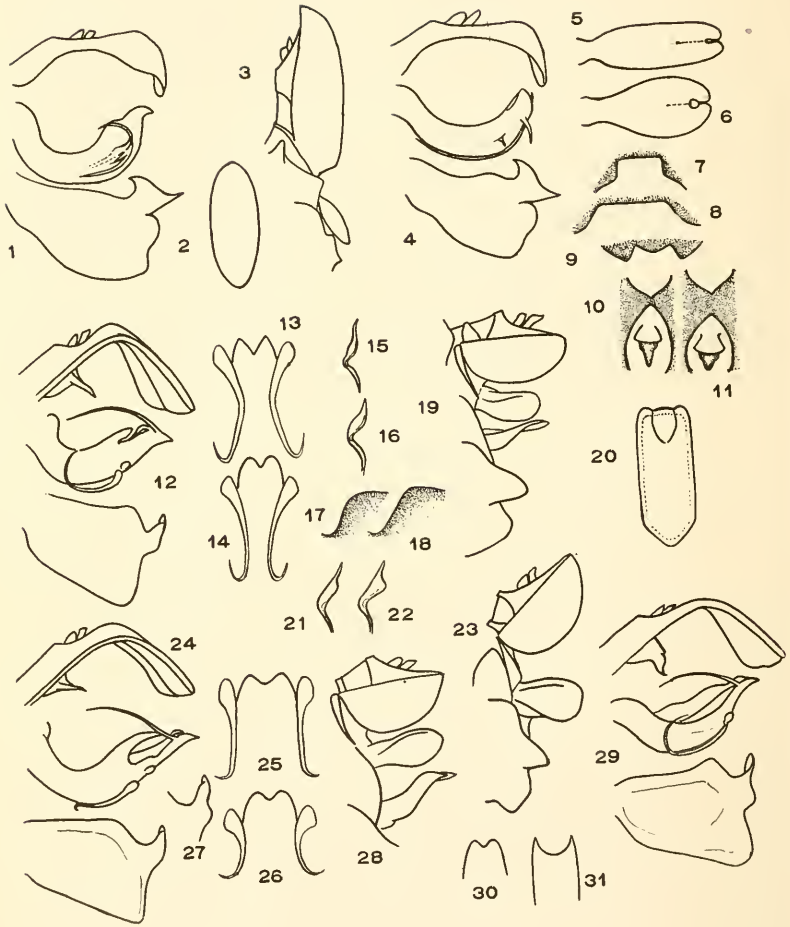
Plate 15.

1. *I. anguillana*, male genitalia.
2. *I. anguillana*, egg.
3. *I. anguillana*, female genitalia.
4. *I. benevolens*, male genitalia.
5. *I. benevolens*, dorsal outline of male anal segment.
6. *I. septempunctata*, dorsal outline of male anal segment (for comparison).
7. *I. anguillana*, median notch on posterior margin of female pregenital sternite.
8. *I. septempunctata*, median notch on posterior margin of female pregenital sternite (for comparison).
9. *I. benevolens*, median notch on posterior margin of female pregenital sternite (for comparison).
10. *I. benevolens*, telson and ante-anal sclerite of female anal segment.
11. *I. septempunctate*, telson and ante-anal sclerite of female anal segment (for comparison).
12. *A. cachibonae*, male genitalia.
13. *A. cachibonae*, ventral view of hooks and posterior margin of periandrium.
14. *A. albicostalis*, ventral view of hooks and posterior margin of periandrium (for comparison).
13. *A. albicostalis*, ventral view of hooks and posterior margin of periandrium (for comparison).
15. *A. cachibonae*, one of paired apical processes of periandrium.
16. *A. albicostalis*, one of paired apical processes of periandrium (for comparison).

17. *A. albicostalis*, basad side of subapical excavation on dorsal border of male genital style (for comparison).
18. *A. cachibonae*, basad side of subapical excavation on dorsal border of male genital style, (for comparison).
19. *A. cachibonea*, female genitalia.
20. Egg of *A. cachibonea*, *A. flaviclavata*, and *A. sancti-vincenti*.
21. *A. flaviclavata*, one of paired apical processes of periandrium.
22. *A. sanctaliciensis*, one of paired apical processes of periandrium (for comparison).
23. *A. sancti-vincenti*, female genitalia.
24. *A. flaviclavata*, male genitalia.
25. *A. flaviclavata*, ventral view of hooks and posterior margin of periandrium.
26. *A. sanctaliciensis*, ventral view of hooks and posterior margin of periandrium (for comparison).
27. *A. sanctaliciensis*, apical process of male genital style for comparison with 24.
28. *A. flaviclavata*, female genitalia.
29. *A. sancti-vincenti*, male genitalia.
30. *A. contaminata*, ventral view of posterior margin of periandrium (for comparison).
31. *A. sancti-vincenti*, ventral view of posterior margin of periandrium (for comparison).

Plate 16.

1. *A. albicostalis* (a) side view of female pregenital sternite; (b) median notch on posterior margin of female pregenital sternite.
2. *A. sanctaliciensis* (a), (b) as preceding.
3. *A. cachibonae* (a), (b) as preceding.
4. *A. flaviclavata* (a), (b) as preceding.
5. *A. grenadensis* (a), (b) as preceding.
6. *A. contaminata* (a), (b) as preceding.
7. *A. palicoureae* (a), (b) as preceding.
8. *A. sancti-vincenti* (a), (b) as preceding.
9. *A. barbadensis* (a), (b) as preceding.
10. *O. perpusillus*, male genitalia.
11. *O. perpusillus*, female genitalia.
12. Diagram showing relationship of the species of *Ilesia*.
13. *O. jamaicensis*, male genitalia.
14. *O. jamaicensis*, posterior margin of periandrium.
15. *O. jamaicensis*, female genitalia.
16. *O. jamaicensis*, egg, (a) front view, (b) side view.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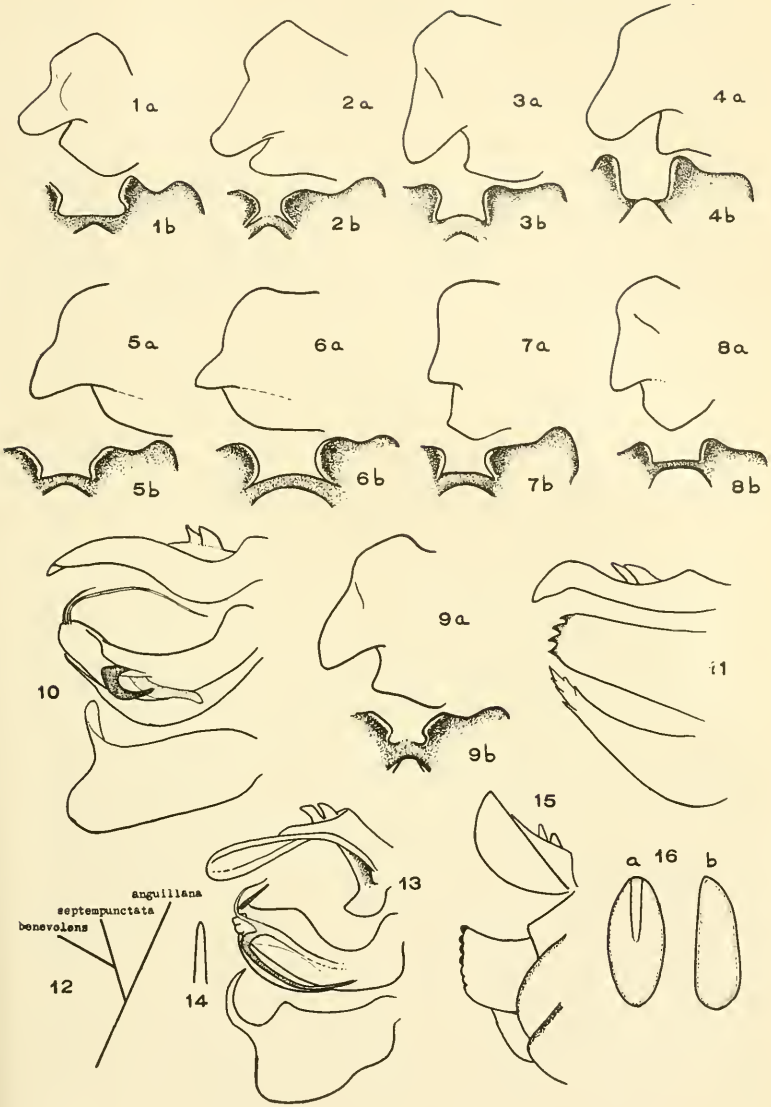
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DESCRIPTION OF A NEW SPECIES OF GONIOZUS FROM OREGON (HYMENOPTERA : BETHYLIDAE).

By Robert M. Fouts,

U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine.

During the course of investigations on insects affecting filberts in the western part of the United States several specimens of a new species of *Goniozus* were reared from the galls of *Cynips maculipennis* Gillette on oak. Preparation of a paper on the parasites of *Melissopus latiferreanus* (Wlsm.), among which this species is considered, makes it desirable that a name be assigned to it.

Goniozus gallicola, new species.

Female.—Length 3.3 mm. Head as wide as the thorax, one and one-fourth times as long as wide, truncated behind, the lateral angles rounded, moderately pubescent as are also the thorax and abdomen; eyes as long as the head behind them; clypeus with a sharp keel which extends back on the frons nearly as far as the eye; frons, pronotum, mesonotum, and scutellum with strong impressed reticulation, sparsely covered with shallow setigerous punctures several times their diameters distant from one another; genae similarly sculptured below and along the eyes, polished and impunctate medially and above; interocellar area closely and finely impressed reticulate; occiput finely reticulate; scape about twice as long as wide, flattened, much wider than any of the flagellar joints; pedicel 1½ times as long as thick, a little thicker and longer than the third joint; following joints gradually thickening to middle of antennae and then just as gradually diminishing in thickness to tip, all of them distinctly, but only slightly (except the last one), longer than thick; last joint a little over twice as long as thick, pointed at tip; thorax 1.7 times as long as wide; scutellum very slightly convex, with several large shallow punctures laterally; propodeum smoothly convex above, the superior face without sculpture medially, with a distinct but inconspicuous dorso-lateral ridge on each side from base to apex; except for the broad median polished area the superior face is reticulate, the fine raised lines having a lateral trend; the lateral face of the propodeum is irregularly reticulate, the lines having a longitudinal trend; inferior face of propodeum irregularly reticulate, the areas large; branch of basal vein straight, about as long as the upper abscissa of the basal vein; radius curved sharply upward at apex, distant by about its own length from the apex of the wing; abdomen 1.3 times as long as the thorax, depressed, sharply pointed at apex; black; tip of scape and basal half of flagellum bright yellowish-brown to reddish-brown; rest of antennae dark brown; tarsi and tips of tibiae brownish; venation very dark brown, the median, basal, and radial veins paler.

Type locality.—Dundee, Oreg.
Other locality.—Eugene, Oreg.
Type.—Cat. No. 56364, United States National Museum.
Six female specimens reared from galls of *Cynips maculipennis*

Gillette collected by S. M. Dohanian from leaves of *Quercus garryana*. The Dundee material was collected on August 14, 1940, and three dead specimens of *G. gallicola* were found in the retaining jars under the galls on May 9, 1941. The Eugene galls were collected on August 14, 1941, and three specimens of *G. gallicola* emerged from them on August 26 and 28 of the same year.

It seems probable, although positive evidence is lacking, that the wasps are parasitic on *Melissopus latiferreanus* (Wlsm.). All the galls from Dundee were broken open as soon as the specimens of the parasite were discovered and found to be heavily infested by *Melissopus* and by nothing else.

This species differs from *longinervis* Fouts in having the eyes about as long as the head behind (above) them and from *clarimontis* Kieffer in having all antennal joints longer than thick.

A REVISION OF THE GENUS TWININGIA IN AMERICA NORTH OF MEXICO (HOMOPTERA-CICADELLIDAE).

By R. H. Beamer.[1]

The genus *Twiningia* was erected by E. D. Ball (Bul. Brook. Ent. Soc. p. 93, 1931), to include a group of species formerly described in Scaphoideus. *Scaphoideus blandus* Ball was designated type. This paper treats ten old species and describes nine new ones.

Ball's characterization of the genus is as follows: "Resembling *Mesamia* but with a flat, acutely angled vertex, a narrow face as in *Scaphoideus* and long narrow elytra with the margins straight to the eyes. Pronotum slightly convex but little above the level of the vertex, slightly wider than the eyes but narrower than the closed elytra. Elytra long and narrow with the outer anteapical cell usually divided, the second cross nervure usually present but sometimes obscure. Venation similar to *Mesamia* but with less reticulations and numerous cross nervures to costa at right angles as in *Platymetopius* (sensu strictu). Genitalia of one general pattern: the female segment very broad at base, the lateral margin narrowed on posterior half, the posterior margin roundingly produced on the median half with a variable median notch. Male plates long triangular. Color usually tawny or smoky. Face much narrower than in *Mesamia* resembling *Scaphoideus*."

The females can be divided into two groups of species by the form of the last ventral segment, one having the posterior

[1] Contribution from the Department of Entomology, University of Kansas.

margin with a median notch (*T. blanda* and related species) and the other having this segment with a strap-like median process (*T. scrupulosa* and others). This might seem to suggest a generic distinction but external appearances and male genitalia characters will not bear this out.

The genus is western in distribution, occurring in the mountainous regions west of the great plains. The type species *T. blanda*, as well as *fumida* and *albacosta* occurs on Juniper. *T. bicolor* is swept from *Adenostoma sparsifolium* Torr., *T. tricolor* from *Arctostaphylos pungens* H. B. K., and *T. solitaria* from *Yucca brevifolia* Engelm. Other species have been taken from Oak, Madrono, and various species of Manzanita.

The genitalia, while characteristic for the genus and helpful in defining some of the species, are so much alike in others as to be of little value in specific separation.

Scaphoideus catalinus Ball, placed in this genus by some authors, belongs in the genus *Scaphytopius* Ball.

Types of the new species are in the Snow Collection, University of Kansas.

Key to Species of Twiningia.

1. Females with median strap-like projection on last ventral segment; elytra with cross-bands or ramose pigment lines 2
   Females without such a projection; color more or less solid, sometimes with numerous lighter areoles 7
2. Dorsum with three color cross-bands, white, brown, yellow ..... *tricolor* (1)
   Dorsum without three color cross-bands 3
3. Dorsum with light cross-band back of scutellum 4
   Dorsum without light cross-band back of scutellum 6
4. Light cross-band narrow and quite definite; pygofer hook more than half as long as apex of pygofer ..... *fasciata* (2)
   Light band broader, more or less indefinite due to dark veins in that area 5
5. Disc of vertex usually brown ..... *permista* (3)
   Disc of vertex with not more than transverse brown spot ..... *scrupulosa* (4)
6. Disc of elytra usually with rather small brown spot in contrast to general gray color ..... *reducta* (5)
   Disc of elytra with large brown saddle-shaped area ..... *pulla* (6)
7. Most of dorsum dark, vertex and costal margin light ..... *bicolor* (7)
   Most of dorsum not dark 8
8. Dorsum dark reddish brown, apices of elytra white 9
   Dorsum lighter or apices not light 10
9. Entire costal margin light ..... *albacosta* (8)
   Base of costa light remainder to apex dark ..... *fumida* (9)
10. General coloring mottled (to unaided eye); pygofer hooks heavy, bifid 11
    General coloring more uniform; pygofer hooks single 12

11. General appearance smoky gray; aedeagal shaft very long and tapering ..... *grandis* (10)
    General appearance buff; aedeagal shaft much shorter, in dorsal view sides almost parallel, slightly widened at apex ..... *malvastra* (11)
12. Vertex with apex distinctly less than a right angle, usually slightly longer at middle than width between eyes, often with red longitudinal stripes ..... *pellucida* (12)
    Vertex with apex forming a right angle, or usually wider between eyes than length at middle 13
13. Vertex margins usually lined with darker color 14
    Vertex not lined with darker on margins ..... *acuta* (13)
14. Dark brown in color, elytra with numerous areoles ..... *areolata* (14)
    Lighter in color, elytra with few or normal number of areoles 15
15. Almost without areoles in elytra 17
    With at most one areole to a cell 16
16. Elytra with vermiculate lines or spots ..... *solitaria* (15)
    Elytra without vermiculate lines or spots ..... *blanda* (16)
17. Dark colored, reddish brown, elytra with normal number of cells for genus 18
    Light colored; heavily reticulate ..... *reticulata* (17)
18. Smaller, usually not over 4.5 mm. in length ..... *rubrafusca* (18)
    Larger, usually 5.5 mm. or more ..... *magnata* (19)

Twiningia tricolor Beamer.

Twiningia tricolor Beamer, R. H., Jour. Kans. Ent. Soc., p. 27, 1939.

This beautiful three colored species is the most striking and easily separable in the genus. The cross-banding, light on head, dark on pronotum and bases of elytra, then broad yellow band over most of elytra with dark apices, makes its identification simple.

Numerous specimens at hand collected from *Arctostaphylos pungens* H. B. K.

Twiningia fasciata, n. sp.

Resembling *T. scrupulosa* (Ball), but anterior white cross-band of elytra narrow and definite and pygofer hook two-thirds as long as width of pygofer. Length 5–5.5 mm.

Vertex flat; margins straight; apex sharp about a right angle, about one-fifth wider between eyes than length at middle.

Color: Creamy white with brown markings. Vertex almost solid brown with median spots; margin usually lined with brown; pronotum flecked with brown; scutellum with basal angles darker; elytra dark brown made up of spots and vermiculate markings except narrow white cross-band just back of apex of scutellum and a semblance of two other light cross-bands, one near costal plaque and the other in region of cross-veins. Female is creamy on vertex, face and abdomen, darker on thorax and pygofer; in male face and abdomen lemon yellow, in male dark on thorax and genital sclerites.

Genitalia: Last ventral segment of female slightly longer than preceding, posterior margin roundingly bilobed, cut in middle more than half way to base, from this cut projects a strap as long as segment and notched at apex. Male pygofer more or less rectangular, apex rounded, hook straight about two-thirds as long as width of pygofer; aedeagus about one-third as wide at base as length, slightly curved dorsally with pair of processes arising ventrally at base of shaft, separating from it about mid-way of shaft, tapering to slender apices, more than twice as long as shaft.

Holotype male, Rochester, Wash., July 22, 1931, R. H. Beamer. Allotype female, Kalama, Wash., July 4, 1931, R. H. Beamer, and following paratypes: 3 females, Grants Pass, Ore., July 12, 1935; 1 male, 2 females, Canyonville, Ore., July 12, 1935; 1 male and 1 female, Klamath Falls, Ore., July 4, 1935; 2 females, Kerby, Ore., July 15, 1935; 1 male Underwood, Wash., July 9, 1935; 2 males and 1 female, Mt. Hood, Ore., July 3, 1935; 2 males and 1 male, DuPont, Wash., July 5, 1935; 2 males and 1 female, Kalama, Wash., July 4, 1935; 2 males, Siskiyou, N. F., Calif., July 14, 1935; 1 male, Lucerne, Calif., July 17, 1935; 1 female, Lockwood, Calif.; 1 female, Santa Rosa, Calif., Aug. 16, 1938, R. H. Beamer; 1 male and 1 female, Occidental, Calif., Aug. 16, 1938, L. W. Hepner; 1 female, same data, R. I. Sailer; 1 male and 2 females, Santa Rosa, Calif., Aug. 16, 1938, R. I. Sailer; 1 male and 2 females, same data, L. W. Hepner.

Twiningia permista, n. sp.

Resembling *T. fasciata*, but light band back of scutellum broader and less definite; pygofer hook very small, median strap of last ventral segment of female barely surpassing posterior margin. Length 5–5.5 mm.

Vertex flat; margins straight meeting at slightly less than right angle.

Color: Smoky; vertex usually fairly uniformly buff colored; margins lighter, lined with darker; pronotum mottled; scutellum with basal angles usually darker; elytra fairly evenly embrowned with ramose pigment lines and spots, a semblance of a lighter cross-band behind scutellum, tips darker; vertex with face and abdomen creamy white to bright yellow; thorax and genital segments dark.

Genitalia: Last ventral segment of female about twice as long as preceding segment; posterior margin with broadly rounded lobe either side of strap-like appendage which reaches barely beyond margin of segment, apex of strap with small notch. Male pygofer more or less triangular with very small hook on ventral outer point; aedeagus broad, curving dorsally with lateral processes about twice as long as shaft.

Holotype male and allotype female, and one female paratype, Boulevard, Calif., July 26, 1938, R. H. Beamer; other

paratypes, 2 males and 2 females, Mt. Springs, Calif., July 25, 1938, and 1 female, Mint Canyon, Calif., July 7, 1933, R. H. Beamer.

Twiningia scrupulosa (Ball).

Scaphoideus scrupulosa Ball, E. D., Can. Ent. XXXIV, p. 14, 1902.

Resembling other species of this group, but with the largest light cross-band and without a hook on the male pygofer.

Vertex flat, very slightly excavated; lateral margins straight, meeting at slightly less than a right angle.

Color: Creamy white marked with brown; vertex usually light with thin brown line along margins, and at least an indication of a pair of transverse spots on disc; elytra brown with rather broad indefinite light band back of scutellum and other light areas in region of plaque and cross-veins. Veins usually darker.

Genitalia: Last ventral segment of female a little more than twice as long as preceding segment; lateral margins deeply excavated at outer corners; posterior margin sharply excised either side of a broad median strap-like appendage, extending half its length beyond margin and with very small notch in apex. Male pygofer almost rectangular, hook reduced to a very small knob on ventral outer corner; aedeagus slightly enlarged at base curved dorsally with lateral processes scarcely as long again as shaft.

Numerous specimens at hand from southern third of Calif., many of them swept from *Arctostaphylos pungens* H. B. K.

Twiningia reducta Ball.

Scaphoideus scrupulosus reductus Ball, E. D. Can. Ent., p. 84, 1909.

Resembling *T. scrupulosa*, but without light cross-bands and usually with a more or less rectangular spot on disc of elytra composed of brown dots.

Vertex slightly excavated; margins straight, meeting at slightly less than a right angle.

Color: Cinereous with dark brown markings; vertex creamy, margins with thin brown line, disc with large pair of transverse brown, almost black, spots; pronotum and scutellum mottled; elytra cinereous, veins darker, semblance of brown saddle mark near middle of clavus, appearing to unaided eye as a brown spot on disc of elytra.

Genitalia: Last ventral segment of female about twice as long as preceding segment, lateral angles deeply excavated on outer corner, posterior margin slightly produced, sharply excised almost half length of segment either side a median strap-like appendage extending half its length beyond segment, usually not notched at apex. Male pygofer more or less rectangular, rounded on outer margin with medium long, slender hook on ventral outer portion; aedeagus slightly enlarged at base, curved dorsally, lateral processes about twice as long as shaft.

Specimens at hand from northern California.

Twiningia pulla, n. sp.

Resembling *T. reducta* (Ball), but more evenly dark brown rather than cinereous and without the rectangular brown spot on disc of corium. Length 4–5.5 mm.

Vertex flat; lateral margins very slightly curved out, meeting at slightly more than a right angle, just barely wider between eyes than length at middle.

Color: Cinereous heavily marked with dark brown; vertex with margins white, thinly lined with brown, pair of small spots at apex either side of median line, a larger transverse spot on disc, a small pair at anterior corner of each eye, and an indication of a larger basal pair, brown; pronotum mottled with brown, scutellum with basal angles darker; elytra quite heavily irrorate with brown with a few lighter areoles, apices almost black; venter yellow except thorax and genital segments darker.

Genitalia: Last ventral segment of female almost three times as long as preceding segment, lateral margins sharply excavated on outer corners, posterior margin sharply incised one-third depth of segment either side a broad bifid strap appendage projecting about one-third length of segment beyond margin. Male pygofer bluntly triangular with short sharp hook on ventral outer point; aedeagus bulbous at base, curving dorsally with lateral processes about twice length of shaft; styles with apices slightly enlarged, truncate at tips

Holotype male, allotype female, and 1 male and 3 female paratypes, Lompoc, Calif., Aug. 9, 1938, R. H. Beamer.

Twiningia bicolor (Ball).

Scaphoideus bicolor Ball, E. D., Ent. News, pp. 166, 1909.

Form of *T. blanda;* very dark brown in color, almost black with head and costal margins of elytra lemon yellow. Easily distinguished from all other species by this color.

Genitalia: Last ventral segment of female more than twice as long as preceding; deeply excavated on lateral margins; posterior margin with middle third extended with sharp notch in middle either side of which is a short, sharp tooth. Male pygofer almost rectangular with long, slender hook on outer ventral corner, often longer than pygofer width. Aedeagus with base rectangular, very large and heavy; shaft short, curved dorsally with pair of short lateral processes near base of shaft, not more than one-third as long as shaft.

The genitalia of this species would seem to indicate a very close relationship with *Mesamia*.

Numerous specimens at hand swept from *Adenostema sparsifolium* Tarr.

Twiningia albacosta, n. sp.

Resembling *T. fumida*, but with the costal border of elytra white throughout. Length 4–4.5 mm.

Vertex flat, slightly concave, margins slightly curved meeting at a little more than right angle, barely wider between eyes than length at middle.

Color: Reddish brown except margins of vertex, pronotum, costal margin, apex of elytra, and usually most of scutellum creamy white. Venter stramineous, ovipositor darker.

Genitalia: Last ventral segment of female more than twice as long as preceding; lateral angles rounded, posterior margin slightly sinuately produced, roundingly excavated at middle with a small sharp median notch. Male pygofer triangular with typical Twiningia hook on ventral outer point. Aedeagus enlarged on basal half, lateral processes of shaft slender, much longer than shaft.

Holotype male, allotype female. 13 females and 12 males paratype, Mountain Springs, California, July 25, 1938, R. H. Beamer. The collections were made five miles east of Jacumba, California, from Juniper.

Twiningia fumida (Ball).

Scaphoideus fumidus Ball, E. D., Can. Ent., XXXIII, p. 8, 1901.

Resembling *T. blanda*, dark reddish brown in color with apex of elytra, and base of costa, light, usually without areoles.

Genitalia: Almost identical with *T. blanda;* processes of aedeagus possibly slightly longer, and apices of styles more curved.

Specimens at hand swept from Juniper.

Twiningia grandis, n. sp.

Resembling *T. malvastra* Ball, but smaller, nearer true gray in color with vertex much shorter and blunter and shaft of aedeagus more slender and about half as long again as in that species. Length 5 mm.

Vertex short, flat, not excavated, margin meeting at more than a right angle.

Color: General color cinereous with darker markings often in semblance of cross-bands; vertex with margin light, bordered with fuscous above and below, usually a semblance of a darker spot on disc either side of light median line. Pronotum darker mottled on disc. Elytra with ramose pigment lines and spots often giving a semblance of cross-banding; recurrent veins to costa and apex of elytra dark. Venter stramineous with some dark marking.

Genitalia: Last ventral segment of female about as in *T. malvastra*. Pygofer more or less triangular with a heavy bifid process on ventral outer point. Aedeagus in lateral view long and slender, curved dorsally near base with pair of long slender lateral processes arising near apex of shaft, curving dorsally for half their length than anteriorly to end almost at base of shaft.

Holotype male, allotype female, 2 male paratypes; Silver City, New Mexico, July 22, 1936, R. H. Beamer. 1 male paratype, same data, D. R. Lindsay.

Twiningia malvastra, Ball.

Twiningia malvastra Ball, E. D., Bull. Brook. Ent. Soc., p. 94, 1931.

This is one of the larger species of the genus. Superficially it resembles *Platymetopius vittellina* or *Norvellina mildredae* Ball more than it does other species of this genus.

Genitalia: Male pygofer more or less triangular with strong, bifid hook on ventral outer point. Aedeagus with short shaft and heavy base, sides of shaft almost parallel, diverging slightly just at dividing of shaft into two parts, each of which is as long or longer than shaft, and curves dorsally and apically to almost meet base of shaft.

Paratypes from Glen Oaks and Granite Dell, Ariz., and additional specimens from Silver City, New Mexico, at hand for study.

Twiningia pellucida, (Ball).

Scaphoideus pellucidus Ball, E. D., Can. Ent., XLI, p. 83. 1909.
Playmetopius planus Van Duzee, E. P., Proc. Calif. Acad. Sci., p. 414, 1925 (New synonymy).

Resembling *T. blanda* (Ball), but with a much longer, sharper vertex.

Genitalia: Like that of *T. blanda*, but the processes of aedeagus scarcely reaching the tip of shaft which is often somewhat enlarged.

Numerous specimens from many hosts examined with a lot of variations in size and color.

Twiningia acuta, n. sp.

Resembling *T. blanda*, but vertex shorter and sharper; elytra almost free of areoles except in region of cross-veins, and male aedeagus with base quite enlarged and process much longer than shaft and projecting at right angles to it. Length 5–5.5 mm.

Vertex with margins straight, meeting in slightly less than a right angle; about one-fifth wider between eyes than length at middle.

Color: Almost evenly light brown throughout; margins of vertex light and sometimes the scutellum. Areoles few, confined usually to area of cross-veins.

Genitalia: Last ventral segment of female about twice as long as preceding, posterior margin sharply excavated on lateral edges, median third strongly produced with rounded median notch. Male: basal half of shaft of aedeagus broad, almost three times as wide as apex, pair of quite slender lateral processes bend abruptly in at right angles just before apex of shaft, extending away from shaft almost two-thirds its length. Pygofer almost triangular with hook on outer ventral point, projecting dorsally and slightly out with outer margins slightly concave and distinctly serrate.

Holotype male, Huachuca Mts., Arizona, July 8, 1932, R. H. Beamer. Allotype female same place, July 18, 1938, L. W. Hepner; 2 male, and 2 female paratypes, August 22, 1935; 1 female, July 8, 1932, Huachuca Mts., Arizona, R. H. Beamer. Additional specimens on hand, Silver City, New Mexico, and Miami, Arizona, R. H. Beamer.

Twiningia areolata, n. sp.

Resembling *T. blanda*, but much darker in color with numerous whitish areoles scattered over elytra and median notch in last ventral segment of female about one-third as deep as segment.

Vertex flat, slightly concave; margins almost straight, forming about right angle; width between eyes slightly longer than length at middle.

Color: Dark brown; vertex margins and an indication of median line light; pronotum with numerous minute flecks of white. Scutellum mottled lighter and darker brown. Elytra generally darker with numerous small white areoles. Venter evenly buff colored.

Genitalia: Last ventral segment of female more than twice as long as preceding; lateral margins deeply excavated on outer corners; posterior margin roundingly protruding on median third with deep vase-shaped excision at middle reaching one-third to base. Pygofer of male more or less triangular in shape with usual hook on ventral outer point. Aedeagus with shaft broad throughout, lateral processes reaching tip.

Holotype male, allotype female, 3 males and 2 female paratypes, Arroyo Seco River, California, August 8, 1938, R. H. Beamer; 1 male and 1 female, Lompoc, California, August 9, 1939, and 1 female, Topango Canyon, California, August 5, 1938, R. H. Beamer, are also paratypes.

Twiningia solitaria Ball.

Twiningia solitaria Ball, E. D., Bull. Brook. Ent. Soc., p. 18, 1936.

Resembling *T. malvastra* externally and *T. pellucida* in genitalia. It may be separated from the former by processes on aedeagus ending at tip of shaft, and the latter by notch in last ventral segment of female extending half way to base.

Genitalia: Last ventral segment of female with straight sided, round bottomed median notch extending half way to base. Pygofer of male almost rectangular with short stout hook on ventral outer corner; aedeagus of normal type, slightly curved dorsally, lateral processes ending near apex of shaft.

Four male paratypes and 23 specimens from Joshua trees near Palmdale, California, P. W. Oman, 1935, have been studied.

Twiningia blanda (Ball).

Scaphoideus blandus Ball, E. D., Can. Ent., XXXIII, p. 7, 1901.

Pale buff in color with numerous clear areoles scattered over the elytra about one to each cell.

Vertex medium in length; wider between eyes than length at middle, margins meeting at about right angle.

Genitalia: Pygofer rather triangular in shape with a short stout dorsally directed tooth on the outer ventral point. Aedeagus with shaft widest at base, curved slightly dorsally and with process arising on either side about one-third distance from base and extending parallel with shaft to distance beyond shaft of about shaft's basal width.

A cotype female from Rifle, Colorado is at hand as well as numerous specimens of both sexes from Mesa Verda and Durango, Colorado.

Twiningia reticulata, n. sp.

Resembling *T. pellucida* (Ball), but vertex broader with margins arcuate; color of male lemon yellow, with elytra reticulate veined, and aedeagus with processes much longer than shaft. Length 5–5.5 mm.

Vertex broad at base and long, slightly longer than width between eyes in male and about same in female; disc with a semblance of a median longitudinal sulcus; margins curved out meeting in a rather sharp point. Elytra with more cross-veins than any species I have seen.

Color: Light buff with some individuals, at least, lemon yellow; margins of vertex light, margined with darker, also a semblance of a lighter median longitudinal line on vertex; elytra with very few lighter areoles.

Genitalia: Last ventral segment of female about two and one-half times as wide as preceding segment; lateral margins excavated at outer corners. Posterior margin roundingly produced on middle third with median round-sided incision one-fourth as deep as width of segment. Male pygofer triangular in shape with small semblance of hook on outer ventral corner. Aedeagus about typical, narrowing on basal third; lateral processes extending beyond shaft about half its length.

Holotype male, allotype female, and 2 female paratypes, Red Bluff, California, June 27, 1935, R. H. Beamer.

Twiningia rubrafusca, n. sp.

Resembling *T. areolata*, but not so dark and elytra practically without areoles. Length 4.5 mm.

Vertex flat, slightly excavated; margins straight, meeting in slightly less than a right angle, somewhat wider between eyes than at middle.

Color: Reddish brown, vertex and pronotum often lighter; areoles in cells almost lacking.

Genitalia: Last ventral segment of female twice as long as preceding segment; lateral margins excavated on outer corners, posterior margin with short broad lobe on each side and a much stronger median lobe sharply notched at middle. Male pygofer more or less triangular with a somewhat bifid hook on ventral outer point. Aedeagus with shaft quite broad, not much more than twice as long as wide; apex slightly enlarged just before tip; lateral processes narrow in comparison to width of shaft, extending beyond apex of shaft and distinctly sinuate where they pass apex of shaft. Apex of styles almost straight.

Holotype male, allotype female, and 1 female paratype, San Antonio Canyon, California, August 4, 1938, R. I. Sailer.

Twiningia magnata Ball.

Twiningia magnata Ball, E. D., Bull. Brook. Ent. Soc., p. 94, 1931.

This is one of the larger pale brown species, with very few areoles in the elytra. Length 5.5–6 mm.

Genitalia: Last ventral segment of female more than twice as long as preceding; lateral angles broadly rounded; posterior margin roundingly produced medianly, shallowly excavated with two sharp teeth near middle of excavation. Male pygofer more or less triangular with rather heavy avicephaliform process on ventral outer point; aedeagus in dorso-ventral view, broad, about four times as long as wide, curved dorsally, lateral processes arising near base, sheath-like, each one about as broad as true shaft, narrowing beyond basal half, widening again to end in sharp bifid apices beyond apex of shaft.

One female from Santa Rite Mts., Arizona, and a pair from Chiricahua Mts., Arizona, compared with type were studied.

A NEW NAME FOR ODONTOMERUS GRAVENHORST, A NEW SPECIES AND TAXONOMIC NOTES (HYMENOPTERA : ICHNEUMONIDAE).

By R. A. Cushman,

Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture.

The receipt of specimens representing a remarkable new species of the genus heretofore called *Odontomerus* Gravenhorst has been the means of bringing to my attention the fact that the generic name is preoccupied. Accordingly, I propose a new name for *Odontomerus* Gravenhorst and describe the new species. Also, I take this occasion to publish some corrections to my revision of the North American species.[1]

[1] Proc. U. S. Nat. Mus. 77 (Art. 3): 1–15, 1930.

ODONTOCOLON, new name.[2]

Odontomerus Gravenhorst, Ichneum. Europ. 3: 851, 1829 (preoccupied by *Odontomerus* Leach 1819).
Genotype.—*Ichneumon dentipes* Gmelin. Autobasic.

Odontocolon polymorphum, new species.

Differs from all other North American species of *Odontocolon* by its almost uniform light-brown color and hairy eyes, and from all but *bicolor* (Cresson) in lacking the twist to the middle tibia in the female. In its hairy eyes and nontwisted middle tibia it resembles the European *O. quercinus* (Thomson). Includes subapterous forms in both sexes.

Female.—Length 5–7 mm., antenna 4–5.5 mm., ovipositor sheath 5–7 mm.

Fully winged female (holotype) (Fig. A).—Head fully three-fourths as thick as broad; occiput shallowly concave; temple broader than short diameter of eye, evenly convex and rounding slightly beyond outside tangent of eye; malar space nearly as long as basal width of mandible; eye shortly hairy, nearly twice as long as broad, its lower margin acutely rounded; ocelli slightly imbedded, diameter of a lateral ocellus less than half as long as ocellocular line and much shorter than postocellar line; temples, vertex, and frons polished, vertex and frons sparsely punctate, frons with a median carina; face rugosopunctate; clypeus arcuately transversely rugoso-striate; antenna shorter than body, slender filiform, 28-jointed. Thorax about 2.5 times as long as broad and as deep as broad, fully as broad as head, flattened dorsally, especially the disk and lateral lobes of mesoscutum; pronotum rugose, especially in the scrobes; prescutum only moderately convex, lateral lobes polished, notaulices rather shallow, bordered by narrow rugulose areas on prescutum and lateral lobes, disk longitudinally rugose, scutellum rather flat, polished, scarcely punctate, mesopleuron obsoletely rugulose, striately so in humeral angle, speculum shining, fovea deep; metapleuron and sides and apical slope of propodeum irregularly rugose, areola and basal area transversely striate, basal lateral areas punctate; dorsal face of propodeum fully twice as long as petiolar area, apophyses short. Legs very stout; middle tibia not twisted; hind femur barely twice as long as deep at tooth, which is short and obtuse with only a weak crest apicad of it and is situated near middle of femur; hind tarsus rather slender, subequal in length to tibia, second and apical joints about equal. Wings rather narrow, forewing reaching to apex of abdomen; basal abscissa of radius little longer than breadth of stigma, apical abscissa, discocubitus, and second recurrent nearly straight; nervellus reclivous, upper abscissa perpendicular. Abdomen broader than thorax, first tergite entirely and second mostly longitudinally striate, third transversely aciculate in middle at base; intermediate tergites subpolished, apical ones finely punctate and with denser, short, appressed pubescence; ovipositor sheath as long as body.

Light brown, mesoscutum laterally darker brown, abdomen, beyond first

[2] From ὀσούς, tooth, and κῶλου, leg, in reference to the toothed hind femur.

tergite, and legs paler; wings subhyaline, venation blackish; ovipositor sheath tipped with blackish.

Females with vestigial wings (Fig. C).—Like fully winged female except that thorax is narrower than head; with mesoscutum, especially prescutum, scutellum, and mesopleura flatter; wings reduced to minute twisted vestiges; tegulae much reduced.

Brachypterous females (Fig. B).—Like females with vestigial wings in thoracic structure except that wings on right side are partly developed and fully veined, the hind wing virtually normal in size, the forewing in one specimen equal in length to the hind wing and in the other specimen somewhat shorter, and the right tegular somewhat larger than the left; frenuum normal, although, because of the shortness of the fore wing, it can not function.

Male.—Length 4.75–6.0 mm.; antenna 4.5–5.5 mm.

Fully winged male (allotype).—Like female except with eyes and ocelli slightly larger, malar space shorter, diameter of ocellus as long as postocellar line and more than half as long as ocellocular line, temple and short diameter of eye subequal in length; first tergite about three times as long as broad apically; abdomen darker, especially apical tergites dark brown or margined with brown.

Male with vestigial wings.—Differs from normal male in same way as the corresponding female differs from winged female.

Type locality.—Seattle, Wash.

Type, allotype, and *paratypes.*—No. 56,436, U. S. National Museum.

Paratypes.—Canadian National Collection.

Eight females and five males reared March 3 and April 11, 1942, from a dead branch of alder infested by anobiids.

The 13 specimens were received recently from the Seattle, Wash., office of the Bureau of Entomology and Plant Quarantine. They were reared during March and April, 1942, from a dead branch of alder infested by an anobiid beetle. The series includes 1 fully winged female, 5 females with vestigial wings, 2 females brachypterous on the right side and with vestigial wings on the left side, 4 fully winged males, and 1 male with vestigial wings. Accompanying the atrophy of the wings is great reduction in the thorax, especially of those areas to which the flight muscles are attached, that is, the mesoscutum and the mesopleura, and also in the tegulae. Some of the apterous females and the subapterous male show a slight degree of atrophy of the ocelli.

Whether the tendency to apterism is inherent in the species or is due to some special ecological or genetic factor influencing this particular lot of material is a question that can be answered only by further rearing. The strange asymmetrical intermediate forms suggest the plausibility of the latter explanation. On the other hand, the consistent concurrence of thoracic and

alar atrophy, together with the apparent association of the parasite with a host, colonies of which may persist for long periods of time, strongly supports the theory that the species is in the process of becoming apterous.

Odontocolon canadensis (Provancher), new combination.

Odontomerus canadensis Provancher, Nat. Canad. 9: 16, 1877.
Odontomerus tibialis Cushman, Proc. U. S. Nat. Mus. 77 (Art. 3): 11, 1930. New synonymy.

Since the publication of my revision[3] I have had an opportunity to examine the type of *canadensis*. As pointed out by Townes[4] in his correction to Gahan and Rohwer's list of lectotypes of Provancher's species, the type female bears no labels, while the yellow label 426 is on the male.

Comparison of a female specimen from Quebec with the types of both *canadensis* and *tibialis* shows the two to be synonymous. The type of *canadensis* is slightly smaller than the specimen compared with it, but aside from some fading of the legs is very similar to it.

The above synonymy makes another name necessary for the species that I treated under the name *canadensis* Provancher. Henry K. Townes, who has examined the type of *albotibialis* Bradley, tells me that it is conspecific with this species. The following synonymy is therefore indicated.

Odontocolon albotibialis (Bradley), new combination.

Odontomerus albotibialis Bradley, Bull. Brooklyn Ent. Soc. 13: 103, 1918; Cushman, Proc. U. S. Nat. Mus. 77 (Art. 3): 14, 1930.
Odontomerus canadensis Provancher; Cushman, Proc. U. S. Nat. Mus. 77 (Art. 3): 13, 1930, not Provancher.

For complete synonymy see the reference above to my previous treatment of *canadensis*.

Odontocolon aciculatus, new name.

Odontomerus striatus Cushman, Proc. U. S. Nat. Mus. 77 (Art. 3): 14, 1930. Preoccupied by *O. striatus* Brullé, Hist. Nat. Ins. Hym. 4: 123, 1846.

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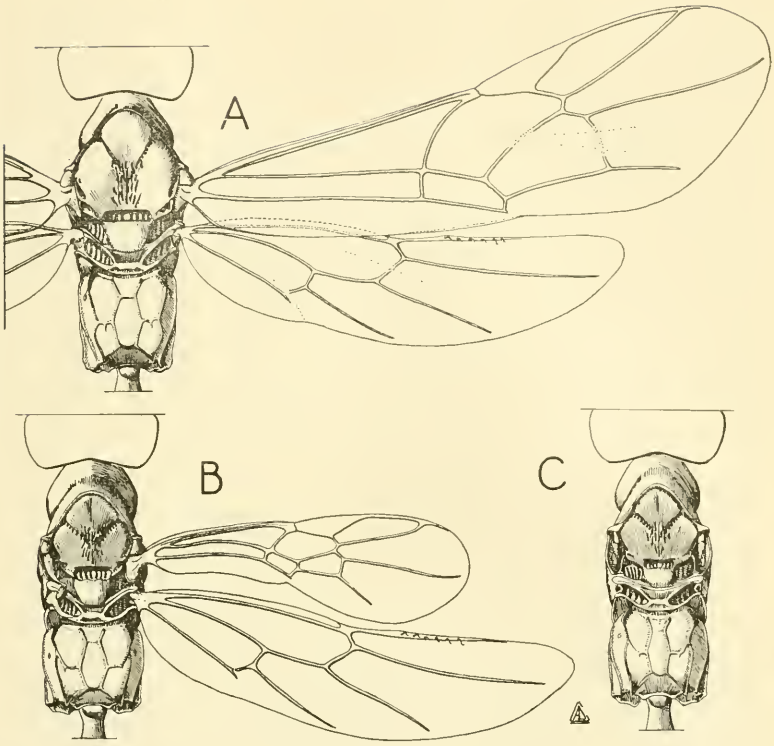
[3] Proc. U. S. Nat. Mus. 77 (Art. 3): 1–15, 1930.
[4] Canad. Ent. 71:94, 1939.



LEGEND FOR FIGURES.

Odontocolon polymorphum Cush., showing comparative thoracic and wing development in (A) fully winged female, (B) female with partly developed wings on right side and vestigial wings on left side, and (C) female with all wings vestigial. Drawings by Arthur D. Cushman.

MINUTES OF THE 529TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, JUNE 4, 1942.

The 529th regular meeting of the Society was held at 8 P. M., Thursday, June 4, 1942, in Room 43 of the National Museum. President Cory presided and 27 members and 4 visitors attended. The minutes of the previous meeting were read and approved.

J. C. Holton of Memphis, Tennessee, a member of the Bureau of Entomology and Plant Quarantine, was unanimously elected to membership in the Society.

R. A. Cushman exhibited two of three cocoons found by J. M. Hollister in spider webs at Melbourne, Fla. The cocoon makers had emerged, but the cocoons were identified as those of a species of psammocharid wasp by comparison of the larval exuviae from one of them with that of *Pseudagenia architecta* (Say). This peculiar habit of a psammocharid wasp parasitizing the spider prey in the web has been noted only twice before, first by Emery (quoted by Sharp, Cambridge Natural History, vol. 6, p. 106; original reference not found) and later by Hartman ("Pompilid that does not bury its prey," in Bull. Univ. of Texas, No. 65, 1905, p. 54). Hartman did not identify either the spider or the wasp. In the present instance Mr. Hollister was unable to identify the spider host, stating merely that the web appeared to him to be more like a sheet-web than a funnel-web. In structure the cocoons are very peculiar in that they are covered, except where they were in contact with the web, by densely set, vertical hair-like strands. Each hair tapers from the base to the very fine apex, which is frequently hooked. Otherwise the cocoon is composed of four layers, outside a coarse golden-brown mesh, then a dense finer tangle, next a very thin dark brown layer and last a slightly thicker somewhat less dense layer with the inner surface almost polished. How the larva can, from inside the cocoon, spin the hairs on the outside is perhaps explainable as follows: As the outer mesh of the cocoon is spun the larva reaches over the edge and spins the hairs, this process continuing until the final completion of the mesh at the end of the cocoon, where the larva reaches through the mesh to apply the final hairs. This note was remarked upon by A. H. Clark.

Cushman also exhibited specimens of an undescribed species of the ichneumonid genus *Odontomerus*. The series includes fully winged and wingless individuals of both sexes, and females brachypterous on the right side and wignless on the left. His remarks will appear elsewhere in connection with the description of the species. Remarks followed by A. H. Clark and M. D. Leonard.

The regular program included three talks by members of the Bureau of Entomology and Plant Quarantine.

1. A recently introduced beetle *Amphimallon majalis* (Razoum). A. S. Hoyt.

The larvae of an European chafer were collected in 1940, near Newark, N. Y. It was not until 1942, however, that they were identified. It was realized that a potentially serious pest had become established and surveys and other investigations were begun immediately by members of the Bureau of Entomology and Plant Quarantine and by members of the Experiment Station staff of New York. The larva feeds on the roots of grass principally and its attacks resemble those of the Japanese beetle larva. The adults apparently do no feeding or at least only a negligible amount. (Secretary's abstract.) Remarks followed by Leonard, Cory, Cushman, Muesebeck and Böving.

2. A restudy of the white-fringed beetle. L. L. Buchanan.

(Mr. Muesebeck read some notes prepared by Mr. Buchanan, who was unable to attend the meeting.)

The common name "white-fringed beetle," as used in these notes, refers to any member of the subgenus *Graphognathus* of the curculionid genus *Pantomorus*. *Graphognathus* includes an as yet undetermined number of forms

which live naturally in the temperate portion of South America, chiefly between 25° and 40° South, in Chile, Argentina, Uraguay, and southeastern Brazil. A very few more northern specimens, from Peru, have been seen. The first record of the occurrence of a white-fringed beetle in North America is based on specimens collected in the vicinity of Svea, Fla. (near Florala, Ala.) in 1936. These were identified as *leucoloma* Boh., a species originally described from Tucuman, Argentina. Field work in southeastern United States during the past 5 or 6 years has disclosed the presence there of 5 additional forms of the weevils. The infested area is a strip bordering the Gulf, in Florida, Alabama, Mississippi, and Louisiana, and extending from De Funiak Springs, Fla., and Florala, Ala., on the east to several miles west of New Orleans, La., on the west. Among thousands of specimens of all the forms examined no male has ever been found and it is believed that only females are produced by any of the white-fringed beetles. The evidence now available indicates very strongly that the various distinguishable populations are neither species, subspecies nor varieties, as these categories are commonly interpreted in bisexual genera, but are of some other and lower rank. The term "microspecies" is suggested for designating the smallest taxonomically recognizable unit among the white-fringed beetles; and where, as seems to occur not infrequently, several microspecies fall into a more or less clearly definable larger segregate (resembling the species-group of bisexual genera) the term "mascrospecies" might be used. (Author's abstract). Comments and questions followed by Cushman, Harned, Cory, Leonard, Rohwer and Hoyt.

3. Research developments in white-fringed beetle control. C. M. Packard. Biological investigations on the various species of *Graphognathus* are being carried on at Florala, Ala., Gulfport, Miss., and New Orleans, La. In most cases the life cycle is completed in one year, although a few individuals have required three years for development. Three factors which demonstrate the serious potentialities of these pests are: the large numbers of eggs laid by each beetle, in one species as many as 3200 with an average of approximately 700; the fact that the species are parthenogenetic; and that they attack some 250 species of plants. The best control measures are spraying or dusting with calcium arsenate or cryolite and the rotation of crops. The only parasite which has been found so far is a nematode, but investigations thereon are only in the experimental stage. (Secretary's abstract.) Remarks followed by Muesebeck, Cory, McGovran, Weigel, Richardson, Cushman, Harned and Leonard.

President Cory announced the interim appointment, by the Executive Committee of the Society, of Hahn W. Capps as Acting Treasurer and W. H. Anderson as Acting Recording Secretary. These men will serve until the Annual Meeting in December at which time new officers will be elected.

Adjournment at 9:45 P. M.

W. H. Anderson,
Acting Recording Secretary.

MINUTES OF THE 530TH REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, OCTOBER 1, 1942.

The 530th regular meeting of the Society was held at 8 P. M., Thursday, Oct. 1, 1942, in Room 43 of the National Museum. President Cory presided, and 37 members and 26 visitors attended. The minutes of the previous meeting were read and approved.

The following two men were unanimously elected to membership in the Society.

Austin W. Morrill, Jr, Bur. Ent. and Pl. Quar., Beltsville Research Center, Beltsville Md.

Z. P. Metcalf, Prof. of Zoology, University of North Carolina, Raleigh, North Carolina.

F. M. Wadley reported on an obituary in memory of L. G. Baumhofer which had been prepared for publication in the Proceedings. It was voted to publish the obituary

The program consistedof a moving picture, in color, entitled Tucura Control in the Argentine, presented by Carl J. Drake of Iowa State College. Some conception of the tremendous numbers of grasshoppers present in areas of Argentina was given. Methods of mixing and spreading poison bait were shown as well as placing of fences to stop migration.

The following visitors were called on for comment or introduction: M. T. James, F. L. Campbell, J. L. Horsfall, T. T. Haack, C. S. Harris, John Porter, C. A. Sheffield and A. Wetmore.

Adjournment at 9.20 P. M.

W. H. ANDERSON,
Acting Recording Secretary.

Actual date of publication, November 30, 1942.

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The regular meetings of the Society are held in the National Museum on the first Thursday of each month, from October to June, inclusive, at 8 P. M.

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WILLIAM SCHAUS

PROCEEDINGS OF THE

ENTOMOLOGICAL SOCIETY OF WASHINGTON

VOL. 44 DECEMBER, 1942 No. 9

WILLIAM SCHAUS.

Doctor Schaus died peacefully on June 20 in the presence of his friend and constant companion, Jack Barnes. For the past year, failing health, due to his advanced age, had kept him confined to his home and from any active work in his chosen field. His passing removes one of the last of the elder lepidopterists and the one who has probably contributed most to our knowledge of the neotropical fauna. An active member of our society since 1914, he was a frequent attendant at its meetings when his health permitted and a substantial contributor to our Proceedings. His chief interest throughout his life has been the Lepidoptera and during the past forty years he has devoted his labor and means consistently to make the National Collection of tropical American Lepidoptera the most complete and representative in the world. He contributed generously to other institutions, notably the British Museum of Natural History, the Carnegie Museum at Pittsburgh and the American Museum of Natural History; but the bulk of his collection and his valuable library were given to the U. S. National Museum, and there he worked for the last twenty years of his active life. He described over five thousand new species, mostly from tropical America. With few exceptions the types of these are deposited in the National Collection.

Dr. Schaus was born in New York City on the 11th of January, 1858. His father was the well-known art collector and dealer, William Schaus, Sr., proprietor of the Schaus Galleries, born in Germany and naturalized as an American citizen in 1854. His mother (born Margaret Connover) was from an old American family. Young Schaus was born to affluence and it was intended that he should carry on the business of his father. He received his early education at Exeter Academy and was sent abroad to finish his education in France and Germany. His principal training was in art, music and languages; but as a young man he came under the influence of Henry Edwards and found his real vocation. He decided, despite patental opposition, and at the sacrifice of a promising career as successor in his father's business, to devote

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his life to the study of Lepidoptera. He made his first collecting trip into Mexico in 1881. Thereafter he made frequent and extended trips with his companion and friend, Jack Barnes, to Mexico, Costa Rica, Guatemala, Panama, Cuba, Jamaica, Dominica, St. Kitts, the Guianas, Colombia and Brazil and collected over 200,000 Lepidoptera. From 1901 to 1905 he lived at Twickenham, England. He visited England and the continent again in 1910 and in 1925 he again visited the continent and brought back the Dognin collection of tropical American Lepidoptera, purchased for the National Collection by funds which he had raised and to which he had contributed substantially. From 1919 until his retirement in July, 1938, he was on the staff of the Bureau of Entomology of the U. S. Department of Agriculture, first as specialist in Lepidoptera and later as entomologist. In 1921 he was made honorary assistant curator of insects of the U. S. National Museum.

Besides being an active member of the Entomological Society of Washington he was an honorary fellow of the Royal Entomological Society of London; fellow of the Zoological Society, London; honorary correspondent of the Societe Entomologique de France; honorary member of the Entomological Society of Brazil; fellow of the American Entomological Society; fellow for life of the Metropolitan Museum of Art; member of the American Association for the Advancement of Science, and of the Biological Society of Washington; corresponding member of the Philadelphia Entomological Society, and correspondent of the Academy of Natural Sciences, Philadelphia. In 1921 he received the honorary degree of master of arts from the University of Wisconsin and in 1925 that of honorary doctor of science from the University of Pittsburgh.

Few lepidopterists, even of his generation, have had such a wide and intimate knowledge of the world fauna as he. While his main interest centered in the American tropics, he worked with and described many Old World Lepidoptera. He was an accomplished linguist, a lover of art and music, a charming host and the most generous of friends. His long life was a comfortable and happy one. He had achieved his ambition and his end was such as he would have chosen.

A bibliography [1] of his published works follows:

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[1] Compiled by Miss Mathilde Carpenter, Librarian, Insect Division, U. S. National Museum.

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—Carl Heinrich and E. A Chapin.

ANOPHELES CLARKI, A NEW SPECIES OF NYSSORHYNCHUS OF WIDE DISTRIBUTION IN SOUTH AMERICA. (DIPTERA: CULICIDAE).

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The observations of many workers in South America, particularly those of Gabaldon (1, 2), Ayroza Galvão (3), and Rozeboom and Gabaldon (4), have shown that the species of *Anopheles* of the subgenus *Nyssorhynchus* are much more numerous than has hitherto been suspected. The purpose of this paper is two-fold, first, to describe a new species of this complex, and second, to re-emphasize the necessity for careful systematic work in separating the many closely similar species of this subgenus.

The description of the new species is based on material received from several widely separated localities, indicating either a wide over-all distribution of the species, or the existence of peculiar ecological conditions which favor its propagation. Many years ago a single male was obtained from Bahia, State of Bahia, Brazil, through the kindness of Dr. Mark F. Boyd of the Rockefeller Foundation, unfortunately without data as to time of collection. Four males and four females were received from Dr. Carlos A. Alvarado, Director of the anti-malaria campaign in northern Argentina, from Monteros, which is a town of about 5,000 lying south of Tucuman, the capital of the province of that name, in northern Argentina. Two males of this species, which were sent for identification, were obtained through the kindness of Dr. O. R. Causey, at the time with the Rockefeller Foundation in Fortaleza, Ceará, Brazil, which were collected in Guaramiray, Ceará, and Maceio, Alagoas, Brazil, respectively. These were labeled "oswaldoi?". Lastly, a single male terminalia of the new species was found in the slide collection of the late F. M. Root, at the School of Hygiene and Public Health of Johns Hopkins University. The slide is labeled "'*A. tarsimaculatus*,'' Concepción, Argentina. Dr. N. C. Davis." This slide has three male terminalia mounted under one cover-glass. The terminalia farthest from the label are those of *A. clarki*. Concepcion is a town some miles south of Monteros, in the province of Tucuman, Argentina.

The adult females from Monteros, Argentina, are apparently very similar in appearance to most of the other species of the series *tarsimaculatus* of Edwards (5). The males are likewise indistinguishable from other members of this series, except on the basis of the terminalia. The short, straight, truncate,

[1] From the Gorgas Memorial Laboratory, Panama City, Rep. de Panama.

heavily sclerotized mesosome of the terminalia of this species is quite distinct from that of any other known species, and so far is the best means of distinguishing it from its congeners. It is hoped that more abundant material may be obtained from South America, so that all stages of this interesting, widespread and hitherto overlooked species may be described.

Description of **Anopheles (Nyssorhynchus) clarki,** new species.

(Here described.)

Adult female: Of the usual facies of the series *tarsimaculatus* of Edwards The palpi have the last two segments white, with narrow black rings at the apex and base of the penultimate segment, and a white ring at the apex of the ante-penultimate segment. A few white scales are mixed with the dark brown scales of the antepenultimate segment, and there is an indistinct white ring at the joint between the antepenultimate segment and the next basal segment. The mesonotum has three dark spots in the integument, two on each side behind the lateral fossae, and one larger spot covering the antescutellar space. The dorsum of the abdomen is clothed with creamy scales, more numerous along the median line, and there are prominent lateral scale tufts on the second to sixth segments. The cerci are clothed with brown and white scales, the white scales predominating.

The fore legs have white apical bands on the first, second, and third tarsal segments, broadest on the third segment. The fourth and fifth segments are all dark. The mid legs are likewise with white rings on the first, second, and third tarsal segments, much narrower than on the fore legs. The first hind tarsal segment is dark, with a narrow white apical ring. The second hind tarsal segment is variable in amount of white, specimens from Argentina having this segment about 25 per cent black, while the two specimens from northeastern Brazil have the black portion much reduced, to about one-sixth the length of the segment, therein approaching the condition found in *A. oswaldoi.* The third and fourth hind tarsal segments are all white, and the fifth segment is white with a narrow black basal ring. On all legs there is a small white spot at the tip of the femora, and a narrow white apical ring on the tibiae.

Wings. Of the usual *Nyssorhynchus* facies, with no apparent distinguishing features. Spot B 2 of Root is larger than the preceding black spot, and the light wing scales vary in color from white to creamy.

MALE: With the coloration of the female, the wing-markings similar, but with the scaling much reduced.

Male terminalia: Of the usual *Nyssorhynchus* type, with fused ventral lobes of the claspette produced to form two long hairy basal lobules (Fig. 3). The terminal hairs of these lobules are long, sometimes recurving upwards over the lobules, as in *A. oswaldoi.* The hairs on the median portion of the lobules are shorter, and show a tendency to radiate. On the inner aspect, between the lobules, the long hairs are seemingly considerably more dense, and recurve upwards toward the preapical plate. These inner long hairs are curved, not straight as in the similar hairs of *A. rangeli* Gabaldon,

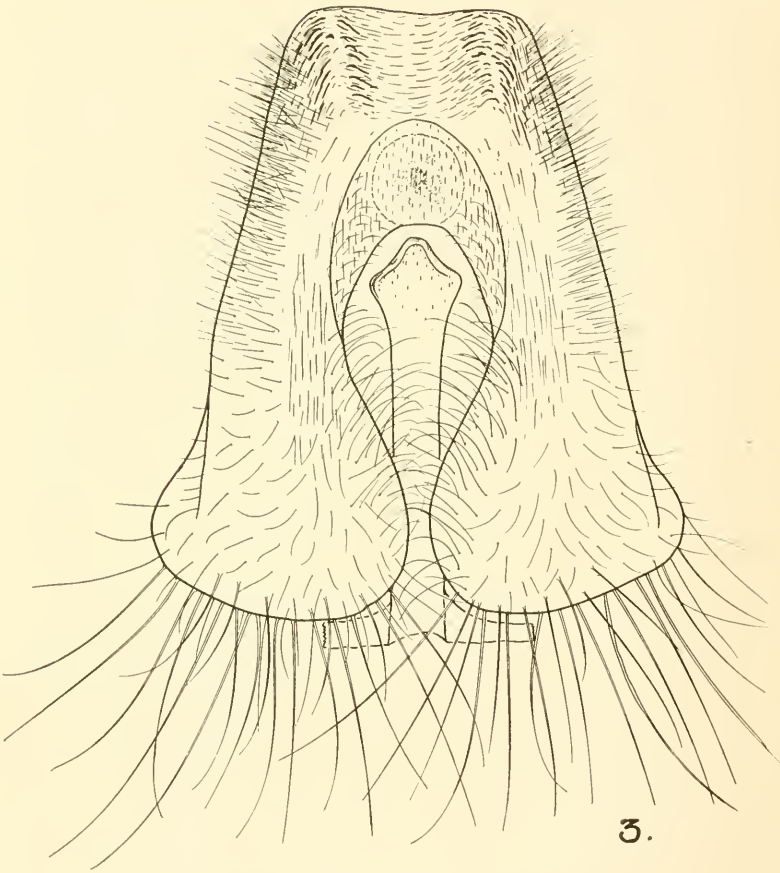

Fig. 3, Claspette lobes of *A. clarki.*

et al., and form a less dense tuft. The preapical plate is very large and nearly circular. The apex of the fused claspette lobes is rugose, with long laterally-directed hairs on the sides. The apex is somewhat narrowed, not being as wide as the basal lobules.

The mesosome (Figs. 1 and 2) is very characteristic, and forms the most easily accessible character to differentiate the species. The mesosome is short, slightly curved, incompletely tubular, and the sides (lateral faces) are nearly straight, and very heavily sclerotized. A cross-section of the mesosome below the tip would be approximately square. The apex of the mesosome departs greatly from the appearance as found in the other species of *Nyssorhynchus*, as it is very short, almost square, and blunt. In the great majority of the other species, the apex of the mesosome is somewhat spoon-shaped, with a rounded tip. In *A. clarki* the apex of the mesosome

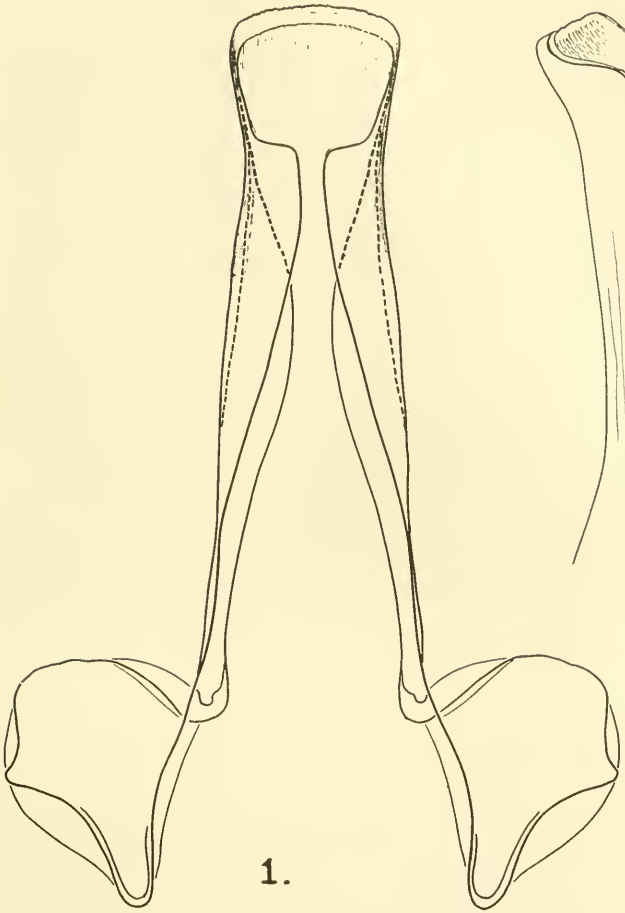

Fig. 1, Mesosome of *A. clarki*, n. sp.
Fig. 2, Lateral view of mesosome of *A. clarki*, showing short, truncate tip.

appears to be beveled off, giving a truncate appearance, and is heavily sclerotized (Fig. 4). The mesosome is entirely dissimilar to that of *A. goeldii* Rozeboom and Gabaldon, in which the apex is short and rounded, and in which small spinelike mesosomal leaflets are usually present.

Larvae.—The larvae of *A. clarki* will not be described at this time, as the material from Monteros, Argentina, is not definitely known to be associated with the males. However, these larvae are similar to the others of the subgenus, resembling closely those of *A. oswaldoi* observed in the Canal Zone.



Fig. 4, Micrograph of mesosome of type male.

Type.—One male, the terminalia dissected and mounted on a separate slide.

Type locality: Monteros, Prov. of Tucuman, Rep. of Argentina.

Date of collection: June, 1940. Obtained through the courtesy of Dr. C. A. Alvarado. Type No. 56476 deposited in the U. S. National Museum.

Paratypes: 1 male, 1 female, from Monteros, Argentina, July 1940. 1 female from Monteros, Argentina, June 1940.

Additional material deposited in the U. S. National Museum, Washington, D. C.: 1 male from Guaramiray, Ceara, Brazil, through Dr. O. R. Causey (no date of collection). There is also one male terminalia from Concepción, Tucumán, Argentina, N. C. Davis, collector (no date), in the collection of the late F. M. Root, now in the School of Hygiene and Public Health of Johns Hopkins University Baltimore, Maryland, U. S. A. The writer has retained the remainder of the material mentioned in his private collection. He takes pleasure in naming the new species in honor of Dr. H. C. Clark, Director of Gorgas Memorial Laboratory, Panama, Republic of

Panama, with whom his long association has been pleasant and profitable.

Discussion.

The new species here described is a distinct species of the subgenus *Nyssorhynchus* of *Anopheles*. It is apparently of widespread distribution in South America, material being available from two localities in northwestern Argentina, and from three localities in northeastern Brazil.

All studies of the vector ability, biology, and ecology of the *Nyssorhynchus* species in these and other areas of South America should be reconsidered in the light of the presence of this new species. The excellent work of N. C. Davis on the variability of the species of *Nyssorhynchus* is invalidated to a large degree, owing to his failure to recognize accurately the species with which he dealt. Present conclusions as to the vector ability of the numerous species "lumped" under the name "*tarsimaculatus*" by uncritical workers must be revalidated, taking into consideration the possible role of *A. clarki*.

The discovery of this new species again calls attention to a fact which should now be well known, but is often neglected by field workers. Any investigation of malaria and its Anopheline vectors, which pretends to have scientific accuracy, must have as its firm basis a sound knowledge of Anopheline taxonomy.

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NOTES ON CERTAIN SPECIES OF BEMBICIDS.

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In my paper dealing with the tribes Stizini and Bembicini, published in 1929, in Vol. 75 of the Proceedings of the U. S. National Museum, among other new species described therein were two from South America, *Selman angustus* and *Bicyrtes bradleyi*. Each of these was described from a single female and the former species was designated as the type of the genus *Selman*. Since that paper was published two males and two females of *B. bradleyi* and a male of *S. angustus* have been sent to me by Mr. Richard Dow from the Museum of Comparative Zoology at Cambridge, Mass., for study and description.

Bicyrtes bradleyi Parker.

Allotype (male).—Black: labrum; clypeus; mandibles, except tips; lower part of frons, continued upward in a stripe on the midline that widens and ends at the anterior ocellar cicatrice; narrow posterior orbits; tubercles, continuous with broad fascia on posterior border of pronotum and also with a broad spot covering almost the whole side of the prothorax; pair of ovate discal marks on scutum; broad lateral lines on scutum not reaching anterior margin; broad lateral spots on scutellum not reaching posterior border of sclerite; fascia on metanotum; the entire sides of propodeum; large anterior spot and small posterior spot on mesopleura; prominent interrupted fascia on tergites 1–5; continuous fascia narrowed at midline on tergite 6; apical line on sternites, most evident on sternites 2 and 3; spot on coxae; femora distally and almost entirely on lower surface; tibiae, except narrow line below; and tarsi, except dusky spots below on all and apical segment of hind pair, *yellow*.

The flagellum is marked with ferruginous below and all segments are plain, lacking specific modifications of any kind. The second sternite bears a prominent median process; the sixth is plain. The seventh tergite bears a pair of prominent lateral spines (Figs. 1, 2) while the seventh sternite is of normal form, ending in three spines. The posterior surface and the lateral angles of the propodeum are the same in form as those of the type. The wings are clear. The pubescence is short and sparse, in fact, almost lacking. The form of the spatha of the genitalia (Fig. 3) differs radically from that characterizing the males of this genus. This character, the form of the seventh tergite, and the form of the propodeum, taken together, distinguish this species from all others described thus far for this genus. Length 15 mm.

I have before me at this time, in addition to the allotype, a male and two females, all of which bear the label "Cordova, Argent. Davis." Allotype in the Museum of Comparative Zoology, Cambridge, Mass.

As was pointed out in the description of the type of *Bicyrtes bradleyi*, the character of the posterior-lateral angles of the propodeum and of its posterior surface differs from the normal for species of this genus. In this species the posterior-lateral angles of the propodeum are decidedly rounded and the posterior surface is, therefore, not so markedly concave. The difference in form of the distal part of the spatha of the male genitalia of *bradleyi* from that of other species of the genus is even more marked. Despite these differences, however, the fact that the ocelli, the mouth parts, and the general habitus of the species are normal, would seem to warrant its retention in the genus Bicyrtes. Perhaps when we know more about the life-history and habits of this species it may be necessary to make it the type of a new genus.

Selman angustus Parker.

Allotype (male).—Black: labrum; mandibles, except tips; clypeus; frons below and between antennae; broad anterior orbits shortened above; scape, except broad line on inner side; posterior orbits, narrowed above; broad fascia on posterior border of prothorax, including tubercles and united with broad lateral spot on either side; dorsal anterior median spot on prothorax; pair of ovate discal spots on scutum; lateral lines on scutum; broad fascia on scutellum; fascia on metanotum; curved fascia on dorsum of propodeum, interrupted at midline on posterior surface; lateral angles of propodeum and broad vertical line on anterior lateral surface; metapleura and mesopleura almost entirely; large lateral spots and pair of small, narrow, widely separated discal spots on first tergite; fasciae, interrupted at midline dorsally on tergites 2–6, the more anterior ones narrowed toward the midline; pair of apical spots on tergite 7; fasciae, narrowed at midline on sternites 2–5; legs, except more or less of coxae and trochanters, a black line above on all femora, and black spot below on middle tibia, *yellow*.

The flagellum, of which the proximal segments and the tip of the terminal segment are testaceous, is without spines or pits (Fig. 5) although segments 6–12 below show specialized areas. As in the female, the maxillary palpus is composed of six segments and the labial of four. The middle femur below at the distal end bears a circular notch and short spine (Fig. 6). Wings are hyaline, narrow, and relatively short as on the type. The second sternite along the median line is somewhat swollen and distinctly carinate. The sixth sternite is plain. The seventh tergite is roundly emarginate at the apex and bears a pair of lateral spines (Fig. 7). The eighth sternite ends in a spear-pointed spine (Fig. 8). The pubescence is very sparse, almost lacking. Length 18 mm.

Described from a single specimen bearing the label "Cordova Argent. Davis." Allotype in the Museum of Comparative Zoology, Cambridge, Mass.

The genus *Selman*, for which the female of *S. angustus* Parker, was designated as the type, is closely related to the

genus *Stictia*. It differs from *Stictia* in having the ocelli functional, or at least without complete obliteration of the lenses; in having the middle of the vertex elevated instead of depressed; in having the wings relatively shorter; and in having the body slender instead of robust. The male, like the male of *Stictia*, has a notch and tooth at the distal end of the femur, but it lacks the specialized area found on the sixth sternite of the male of *Stictia* and the modification of the second sternite is also different. Genital structures as in Figs 9 and 10.

Bembix insularis (Dahlbom).

The discussion of this species in my paper referred to above was based wholly upon my study of specimens from Jamaica. Since the publication of that paper I have had opportunity to study specimens of Bembix from Cuba and Haiti. Dahlbom described his species, which he placed in the genus Monedula, from two females from the Virgin Islands. Cresson's specimens came from Cuba as did those studied by Handlirsch. Handlirsch states, however, that he had access also to Dahlbom's types. Since Dahlbom's material did not include a male it follows that Handlirsch based his figures and description of the male of this species on specimens from Cuba.

Now, the males before me from Cuba show the characters ascribed to this species by Handlirsch in his figures of the antennae and the male genitalia. The stipites of males before me from Cuba, as shown in figs. 11 and 12, closely resemble those shown in Handlirsch's illustration of the genitalia of this species. The genitalia of males from Jamaica (Figs. 13, 14) differ somewhat in form from those of Cuba while showing a similar pattern. Since, however, all these specimens are quite similar in all other respects it seems best to regard them as variants of a single species. The fact that all these males bear a pair of lateral processes on the sixth sternite, a character that neither Handlirsch nor Cresson mentions in their discussions of *insularis*, indicates that these specimens belongs to a single species and at the same time raises the question as to whether we are here dealing with the *insularis* of Dahlbom.

Zyzzyx chilensis (Eschscholz).

In the same paper referred to above I erected a new genus, *Therapon*, based upon the species, *Stictia chilensis* Eschscholz, which was designated as the type of the genus. Unfortunately the generic term, *Therapon*, was preoccupied in the field of Ichthyology. In his paper entitled "The Generic Names of the Sphecoid Wasps and Their Type Species", published in the Memoirs of the American Entomological Society, No. 9, 1937, page 68, Pate corrects this error and proposes for *Therapon* Parker the generic term *Zyzzyx*.

Bembix tenebrosa Parker and **Bembix refuscata** Parker.

In his paper, "The Sphegidae of South Africa," Part XV, published in 1931 in the Annals of the Transvaal Museum, Vol. XIV, Part II, Dr. George Arnold takes exception to the validity of some of the new species described in my paper. On page 214 of his paper Dr. Arnold reduces my species, *Bembix tenebrosa*, to synonomy with *Bembix diversipennis* Smith and on the following page he does the same thing for my *Bembix refuscata*. Had Dr. Arnold been a bit more thorough in examining my paper he would not have made this blunder. For some unexplained reason the figures (figs. 201–203) accompanying the description of *tenebrosa* were not cited in connection with the text of the description of this species and, I take it, Dr. Arnold failed to see them. Fig. 201 represents the male genitalia of *B. tenebrosa* and fig. 170 those of *B. refuscata*. If it is maintained that genitalia so widely divergent in form as are these, are nevertheless representative of a single species, then the use of genital characters in the determination of species might as well be thrown overboard entirely. That we have here two distinct species is beyond question.

From what Dr. Arnold states in his discussion of my *tenebrosa* I am very much of the opinion that this form and his *diversipennis* var. *Johnstoni* Turner are one and the same species, and I am further convinced that neither of them is synonymous with *B. diversipennis* Smith. Dr. Arnold states that in making his description of the male of *diversipennis* Smith he "omitted to mention" the black spots on the underside of the anterior tibiae, which leads one to suspect that he did not know they were there until he read my description of *tenebrosa*. Smith in his description of *diversipennis* does not mention these black spots and neither does Handlirsch. It is quite possible that Smith might have overlooked them but if these spots had been present on the specimens described by Handlirsch as *diversipennis* Smith, I am convinced that he would have discovered them and reported their presence. I have invariably found Handlirsch's figures exact and reliable and his figure of the flagellum of *diversipennis* Smith does not fit the flagellum of my *tenebrosa* (fig. 202). Neither does the figure of the male genitalia of *diversipennis* as given by Handlirsch fit the male genitalia of *tenebrosa*. There is no doubt in my mind whatsoever that the *diversipennis* of Handlirsch and my *tenebrosa* are distinct species, and that my *refuscata* is distinct from both of them. Furthermore it is my conviction that Turner's *Bembix johnstoni* is a valid species and that Arnold's variety *Johnstoni* and my *tenebrosa* must be reduced to synonomy.

Bembix recurva Parker.

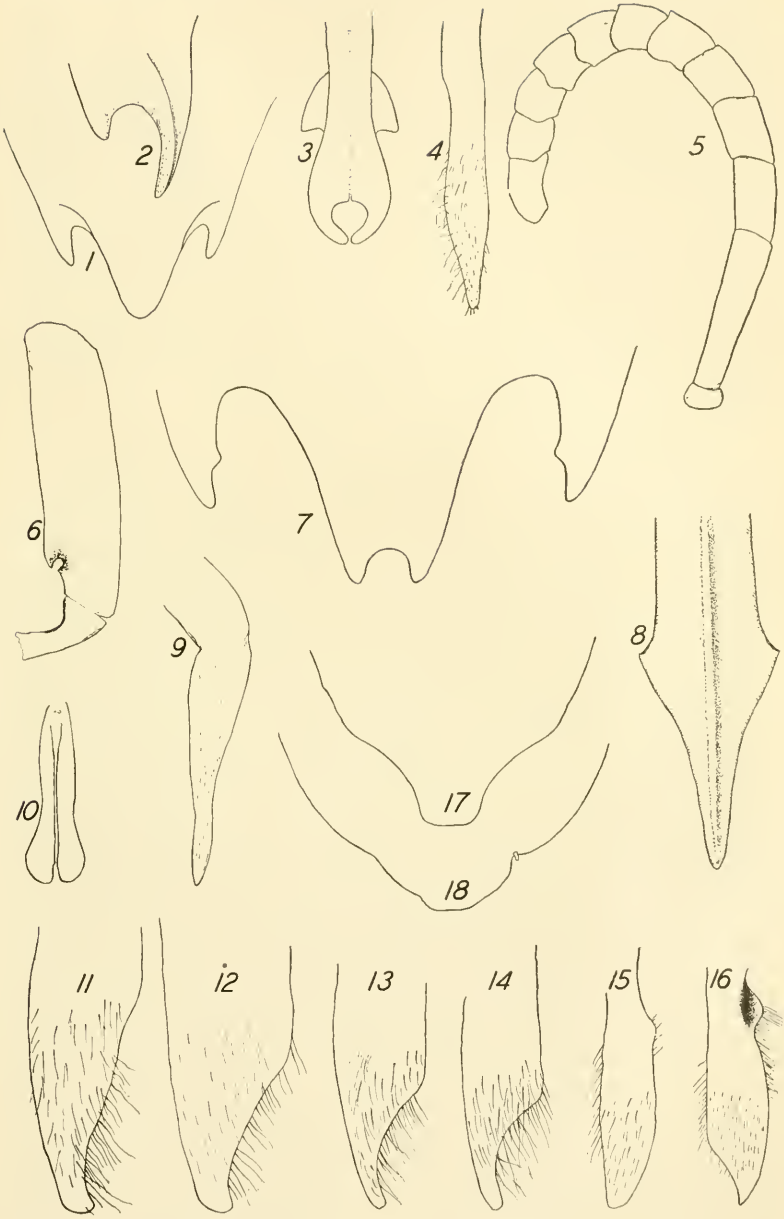
In commenting on my *Bembix recurva* Parker Dr. Arnold says "it is probable that it is a synonym of *ugandensis* Turner. Until the two types can be compared, it is perhaps best to treat *recurva* Parker as a synonym." Just why is it best to do this? To reduce a newly described species to synonomy on nothing better than an opinion based on a mere probability is a procedure that has little to commend it.

Bembix opinabilis Parker.

Dr. Arnold's sinking of my species *B. opinabilis* as a synonym of *B. stadelmanni* Hdl. is wholly unwarranted. The statement by Dr. Arnold that "the figures in Parker's work of the seventh tergite and genitalia agree very well with those in Handlirsch's monograph" warrants the assumption that Dr. Arnold did not trouble himse f to make a careful comparison of my figures with those given by Handlirsch. The genital stipites of the two species are fundamentally different. The inner border of the stipes of *stadelmanni* as shown by Handlirsch is entire, without incision or emargination, whereas that of *opinabilis* is strongly emarginate toward the apex. On the lateral border of the seventh tergite of each species there is a slight but distinct lateral ridge. On *stadelmanni* this ridge is continuous with the apical portion of the lateral margin of the tergite, whereas on *opinabilis* it is continuous with the basal portion of the margin. Here we have a fundamental morphological difference, which Dr. Arnold either overlooked or chose to disregard, a difference that cannot be explained away on the ground of variation within a species. Before describing *opinabilis* I spent hours in an endeavor to make this form fit *stadelmanni* as described and figured by Handlirsch, but the longer I pursued my study the firmer became my conviction that I was here dealing with a different species.

Bembix stevensoni Parker.

In his curt remarks concerning my species, *B. stevensoni* Dr. Arnold makes it quite clear that he is a bit superficial in evaluating characteristics. Along with these comments I am submitting a camera lucida illustration of the genital stipes of *B. fuscipennis* Lep. (fig. 15) and of *B. stevensoni* Parker (fig. 16) drawn at the same angle and to the same scale of magnification. The illustrations of the seventh tergites of the two species (figs. 17, 18) were drawn under the same conditions and from the same specimens. In the case of *fuscipennis* the specimen used in making the illustration was identified by R. H. R. Stevenson, and in the case of *stevensoni* the specimen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used was identified by Arnold himself as identical with my species but referred by him to *fuscipennis*. The illustration of the stipes of *fuscipennis* is in all essentials identical with that given for this species by Handlirsch, and the illustration of the stipes of *stevensoni* is the same as that accompanying my description of the species, save that in the present illustration the view is latero-dorsal whereas in the original illustration the view is strictly dorsal. The difference in the pattern of the genital stipites of these two forms is too great to be ignored or to be explained on the ground of variation within a species. When we add to this the difference in the development of the seventh tergites, and the difference of the infumation of the wings we have here a combination of characteristics that warrant the separation of these two forms as distinct species.

Bembix laeta Parker.

Whether my species, *B. laeta*, is synonymous with a previously described species narrows down to a matter of opinion. Dr. Arnold insists that it is synonymous with *B. intermedia* Dahlb. Handlirsch regards *B. intermedia* Dahlb. as synonymous with *B. olivata* Dahlb. In his discussion of *B. olivata* Handlirsch remarks that this species (*olivata*) is as much like *B. mediterranea* as one egg is like another. Before making my description of *B. laeta* I carefully compared my specimen with a number of others in the collection of the U. S. N. Museum identified as *B. olivata* Dahlb. by other entomologists and also with a number of others similarly identified as *B. mediterranea* Hdl. I also checked against Handlirsch's descriptions, but I found myself unable to assign my specimen with certainty to any of those species. In a situation such as this I could follow any one of three courses: 1) I could send the specimen back to Berlin unidentified; 2) I could assign it to one of the above species with the serious risk of returning to Berlin a misidentified specimen; 3) I could describe it as new. I chose the last course, realizing that when a new species of Bembix is based upon a female, unless the specimen shows some striking morphological character, there is always a risk of adding to synonym. In Arnold's opinion I have done so, but he has not seen the specimen on which I based my description. I have; that is the difference.

EXPLANATION OF PLATE 18.

Fig. 1–2.	*Bicyrtes bradleyi* Parker.	Seventh tergite.
Fig. 3	*Bicyrtes bradleyi* Parker.	Spatha.
Fig. 4	*Bicyrtes bradleyi* Parker.	Stipes.
Fig. 5	Selman angustus Parker.	Antenna.
Fig. 6	Selman angustus Parker.	Femur of leg II.
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Fig. 18	Bembix fuscipennis Lep.	" "

A NEW NORTH AMERICAN SOLENOPSIS (DIPLORHOPTRUM) (HYMENOPTERA: FORMICIDAE).

By Marion R. Smith,

U. S. Department of Agriculture, Bureau of Entomology and Plant Quarantine.

The ant here described is so distinct from the 14 previously known forms of *Solenopsis* subgenus *Diplorhoptrum* (Mayr) that it should be recognized immediately. Since the North American ants belonging to this subgenus have not been treated in a comprehensive review and since at least some of them are exceedingly difficult to classify, a key for the identification of the workers of all the described species is presented. No attempt has been made to treat the following subspecies or varieties because types of none of them are available to me: *S.* (*D.*) *texana* subsp. *carolinensis* Forel, *texana* subsp. *truncorum* Forel, *texana* var. *catalinae* Wheeler, *molesta* var. *castanea* Wheeler, *molesta* var. *validiuscula* Emery, and *picta* var. *moerens* Wheeler. I have seen types of *pilosula* Wheeler, *krockowi* Wheeler, and *picta* Emery, but I have not been able to examine types or authentically determined specimens of *salina* Wheeler, *rosella* Kennedy, and *texana* Emery. The characters used in placing *salina* and *rosella* in the key have been taken from the original descriptions and those for *texana* from Wheeler's brief characterization (Amer. Mus. Nat. Hist. Bul. 24: 531, 1908). Wheeler was probably in aposition to judge the distinction between *texana* and *molesta* since he lived in Texas for many years and doubtless saw specimens of *texana* on many occasions.

The species of *Diplorhoptrum* are of economic importance. The common *molesta* (Say) is well known for its predacious habits, which include the destruction of both beneficial and injurious insects. The workers of this species also attack the seeds of certain germinating grains, infest houses, destroy young birds at the time of hatching, and attend honeydew-

excreting, subterranean aphids and mealybugs. Their exact relationship with the aphids and mealybugs is not fully known and may be more important than is realized.

Solenopsis (Diplorhoptrum) longiceps, new species.

Worker.—Length 1.2–1.3 mm.

Head, not including mandibles, approximately one and one-third times as long as broad, subrectangular, with very gently convex, subparallel sides, and distinctly emarginate posterior border. Antennal scape, exclusive of pedicel, approximately three-fifths as long as head. Antennal club remarkably large, at least one and one-third times as long as remainder of funiculus; first funicular segment at least as long as combined lengths of the next four segments; last antennal segment three or more times as long as the preceding segment. Clypeus strongly projecting, the anterior border with two prominent teeth and two very much smaller and indistinct lateral teeth. Mandible with four teeth. Eye very minute, with only one or two distinct facets. Thorax, not including the pronotal collar, approximately as long as head, with rounded humeri, and a distinct mesoepinotal constriction. Epinotum, in profile, rounded, the base and declivity merging into each other without any indication of an angle. Petiolar node, in profile, larger and higher than node of postpetiole, with abruptly declivous anterior surface and more convex posterior surface, peduncle with a very small ventral tooth; summit of petiolar node approximately one and one-half times as wide as long. Summit of postpetiolar node of about the same width as that of petiolar node but differently shaped, appearing subglobular, but distinctly broader than long and also broader posteriorly than anteriorly. Gaster elongate, with weakly convex, subparallel sides and rather distinct basal angles.

Head, except for the median longitudinal area between the clypeus and the posterior border of the head, with distinct but well scattered piligerous punctures.

Body, especially the head, and appendages with rather abundant, suberect to erect hairs.

Color a sordid light brown or yellowish browh.

Type locality.—Hamilton County, Tenn., 4–24–39, W. F. Turner; Turner No. 13795.

The holotype and 33 paratype specimens have been placed in the United States National Museum under U. S. N. M. No. 56344.

To this species I have also referred 16 specimens collected in Lincoln County, Miss., on July 14, 1936, by W. F. Turner, of the Bureau of Entomology and Plant Quarantine. These came from the soil of a peach orchard and bear Turner No. 351.

This minute ant is characterized by its remarkably long, subparallel sided head; extraordinarily large antennal club; minute eyes; short but rather abundant pilosity; and the somewhat subglobular postpetiole, which is of approximately the same width as the petiole.

KEY FOR SPECIFIC IDENTIFICATION OF NORTH AMERICAN SOLENOPSIS (DIPLORHOPTRUM) (WORKERS ONLY).

1. Head remarkably slender, with subparallel sides; eyes minute, with only 1 or 2 distinct facets; (antennal club unusually large, at least one and one-third times as long as remainder of funiculus; length 1.2–1.3 mm.; post-petiole appearing subglobular from above). Tennessee, Mississippi....*longiceps*, new species.
   Shape of head and size of eye not as described above..... 2
2. Postpetiole appearing subglobular from above..... 3
   Postpetiole not appearing subglobular from above..... 4
3. Head robust, subquadrate, its dorsal surface with coarse, piliger-ous punctures; color varying from whitish to a sordid pale yellow, or yellow; length 1.8–2 mm. North Carolina, South Carolina, Georgia, Alabama, Mississippi, and Louisiana..... *pergandei* Forel.
   Head distinctly longer than broad, its dorsal surface without such numerous or coarse punctures; color deep yellow; length 1.8–2 mm. Southwestern Texas.....*salina* Wheeler.
4. Head and gaster deep brown and usually much darker than thorax; (punctures on head sparse, inconspicuous; antennal club large, at least one and one-third times as long as remainder of funicu-lus; body slender and of a *Monomorium* appearance; length 1.55–1.66 mm.); petiole, from above, with a narrow, compressed appearance, the sides of the node not noticeably extended (laterally) over the peduncle. Florida.....*picta* Emery.
   Color of body and shape of petiole not as above..... 5
5. Epinotum, in profile, with at least the basal half flattened; length 2–2.7 mm..... 6
   Epinotum in profile, rounded; length 1–1.8 mm..... 7
6. Punctures on head exceedingly coarse; body very robust; color deep yellow; (basal surface of epinotum much flattened); length 2–2.7 mm. Southwestern Texas.....*pilosula* Wheeler.
   Punctures on head not exceedingly coarse; body less robust; color yellow; (antennal club slender, as long as or longer than remain-der of funiculus); length 2.25–2.5 mm. Southern New Mexico.. *krockowi* Wheeler.
7. Postpetiole, from above, noticeably wider than petiole; (the node very distinctly wider anteriorly than posteriorly); length 1.5–1.8 mm..... 8
   Postpetiole scarcely wider than petiole; (color pale yellow); length 1–1.2 mm. Texas.....*texana* Emery.
8. Funicular segments 2, 3, and 4 of approximately the same length; body length 1.8 mm. Distributed over most of the United States but especially common in the eastern half.....*molesta* (Say)
   Funicular segment 2 approximately as long as the combined length of segments 3 and 4; body length 1.75 mm. Ontario, Canada.....*rosella* Kennedy.

MINUTES OF THE 531ST REGULAR MEETING OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON, NOVEMBER 5, 1942.

The 531st regular meeting of the Society was held at 8 P. M., Thursday, Nov. 5, 1942, in Room 43 of the National Museum. President Cory presided and 24 members and 20 visitors attended. In the absence of the Acting Recording Secretary, Dr. Alan Stone acted a Recording Secretary and the minutes of the previous meeting were read and approved.

Mr. Reece I. Sailer, Associate Entomologist, Bureau of Entomology and Plant Quarantine, Washington, D. C., was unamiously elected to membership in the Society.

Mr. Charles C. Hill, Entomologist, Bureau of Entomology and Plant Quarantine, Beltsville, Md., was reinstated as a member of the Society by a unanimous vote.

President Cory appointed a nominating committee, which consisted of R. A. Cushman, Chairman, and H. H. Richardson.

The President spoke of the recent death of W. S. Abbott and appointed E. H. Siegler and L. J. Bottimer as a committee to prepare an obituary.

The regular program consisted of two papers as follows:

1. Observations on Hawaiian Ecology, by Howard P. Barss, Office of Experiment Stations.

Dr. Barss discussed the great concentration of diverse ecological factors in the Hawaiian Islands. He showed, by means of maps, the topography of Oahu, Maui and Hawaii and discussed the ecological factors that restricted the growing of certain crops to limited areas. The amounts of rainfall and sunlight show a great range over a comparatively small area; for instance on the island of Maui the rainfall varies from 8 to 10 inches at one location to 300 inches at another. Dr. Barss made particular mention of the Mediterranean fruit fly in coffee and star apples. (Secretary's abstract)

This talk was commented on by E. N. Cory and F. L. Campbell.

2. Ticks and Disease, by Major C. B. Philip, Sanitary Corps, United States Army.

Major Philip discussed the important role that ticks have played in disease transmission from early times and mentioned many of the diseases and the species of ticks that carry them. He showed a series of kodachrome slides of a number of species of ticks. (Secretary's abstract)

Major Philip's talk was commented on by F. C. Bishopp and M. D. Leonard.

The following visitors were introduced to the Society: C. C. Hill, Captain C. E. Peres, Lt. Irving Rappaport, L. S. Henderson, W. T. Haude, B. K. Pancoast, Max Day and M. D. Leonard.

Adjournment at 10:00 P. M.

W. H. Anderson,
Acting Recording Secretary.

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