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THE GENITALIA AND TERMINAL STRUCTURES OF THE MALE OF THE ARCHAIC MECOPTERON, *NOTIOTHAUMA REEDI*, COMPARED WITH RELATED HOLOMETABOLA FROM THE STANDPOINT OF PHYLOGENY

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For the rare privilege of studying the hitherto undescribed male of the intensely interesting archaic Mecopteron *Notiothauma reedi*, McL. (which is in some respects a "living fossil"—the last remnant of a primitive relict fauna, representing as closely as any living form, the type ancestral to the rest of the Mecoptera) I am deeply indebted to Professor Dr. C. E. Porter, who has done so much to advance the study of Entomology in Chile, and to Dr. E. P. Reed, the distinguished Chilean surgeon, who has been more than generous in supplying me with a wealth of material for morphological study. To both of these gentlemen I would express my profound gratitude for their aid in enabling me to carry out this investigation.

The abdominal structures of the male of *Notiothauma* are the most remarkable and primitive to be found within the order Mecoptera, and could readily serve as the archetypes of these structures for the rest of the order. The primitive character of these structures is thus in harmony with the evidence of the archaic character of *Notiothauma* indicated by other features such as the wings, which have been discussed in Psyche, Vol. 37, p. 83, for 1930, where the male here described was designated as the allotype of *Notiothauma reedi*, McL.

The greater portion of the abdomen of the male of *Notiothauma* is of a castaneous color, but segments eight and nine (see fig. 1), and the gonopods labelled *cx* and *st* in fig. 1, are somewhat fulvous hued. The abdomen is rather broad and is somewhat flattened, and does not taper as the abdomen does in the Panorpidæ (*sensu stricto*), being more like the abdomen in the closely related family Meropidæ in this respect, although the genitalia are much more primitive than those of *Merope* (which are elongated and rather highly specialized), and the genitalia of *Notiothauma* might readily serve as the archetype of the genitalia of the Panorpidæ. On the other hand, the abdominal structures of *Notiothauma* present some remarkable modifications, which, with the general archaic character of *Notiothauma*, make it the most interesting and striking representative of the Mecoptera. Starting with the structures of the third abdominal segment and taking up the structures of the following segments in turn, I shall briefly describe the striking features of the abdomen, and point out wherein the structures of *Notiothauma* may serve as the starting point for tracing the evolutionary developments occurring in the other Mecopterous families.

In the posterior region of the third abdominal tergite of the male of *Notiothauma* there occurs a median unpaired structure labelled *n* in figs. 1 and 5, which, for the sake of convenience, may be referred to as the notorganus or notal organ. A conical median tergal structure labelled *po* in figs. 1 and 5, borne on the following (i. e., the fourth) tergite, abuts against the notorgan *n*, on the third tergite. I have followed Felt, 1896 (Rept. N. Y. State Entomologist for 1894, p. 463) in regarding the notorgan *n* as an alluring organ which gives out an exudate licked up by the female prior to mating. The notorgan *n* (and the posterior structure *po*) is not developed in other primitive Mecoptera such as *Merope, Chorista* and *Panorpodes*, (and it is likewise absent in the Bittacidæ, Nannochoristidæ and Boreidæ), so that *Notiothauma* furnishes the only starting point for tracing the development of these structures in the Panorpidæ, in which the structures in question may become hugely developed. In *Panorpa stigmalis* (fig. 27) the notorgan *n* has become elongated and extends posteriorly to the cone *po,* which is located further back in segment four, while in *Neopanorpa cornuta* (fig. 26) the orthogenetic tendency for the notorgan *n* to become further elongated becomes more pronounced, since in the latter insect (fig. 26) the notorgan *n* projects posteriorly over the fourth tergite and nearly reaches the middle of the fifth tergite. In such Panorpids as *P. takenouchii* (fig. 29) the orthogenetic tendency for the notorgan *n* to become more and more elongated, reaches its culmination. Since *Notiothauma* furnishes the only starting point, among the lower Mecoptera, for the development of such a notorgan (*n* of fig. 1 and 5) this very clearly indicates that *Notiothauma* is the most like the ancestor of the Panorpidæ.

On the fifth tergite of *Notiothauma* there occurs a remarkable median unpaired tergal process labelled *mo* in figs. 1 and 5. This process is apparently peculiar to *Notiothauma,* although a shorter process, resembling it in some respects, is borne on the sixth (instead of the fifth) tergite of *P. cornigera,* shown in fig. 32. This process of the sixth tergite of *P. cornigera,* abuts against the dorsal portion of the seventh abdominal segment, when the end of the abdomen is turned forward on top of the abdomen, while in *Notiothauma,* the tips of the genital styles *st* of figs. 1 and 5 apparently lie on each side of the median process *mo* when the tip of the abdomen is turned up over the top of the abdomen of the male insect.

The sixth abdominal tergite of *Notiothauma* bears a pair of lateral tergal processes labelled *bc* in fig. 1, which are somewhat suggestive of the paired lateral tergal processes borne on the sixth tergite of *Neopanorpa cornuta* shown in fig. 26. Dorso-mesad of the processes *bc* on the sixth tergite of *Notiothauma* shown in fig. 1, are two smaller processes (paired) which may have developed as enlarged "setigera" or seta-bearing protuberances of the segment. These setigera bear dinotrichia or powerful bristles like those shown on the seventh and eighth tergites in fig. 1, but most of the setæ and bristles have been omitted in fig. 1, to avoid making the figure too complicated to show the more important structures readily.

The seventh tergite in *Notiothauma* bears a pair of remarkable tergal processes labelled *bc* in fig. 1, which appear to correspond in a general way to the structures called the "bicornua" in the male Plecopteron shown in fig. 17, plate 2, of vol. 13 of the Bulletin of the Brooklyn Ent. Society for 1918, and this term has therefore been applied to the structures labelled *bc* in fig. 1 of *Notiothauma.* The "bicornua" of the seventh tergite in *Notiothauma* (*bc* of fig. 1) apparently serve to support the genital structures when the tip of the abdomen is turned forward over the top of the abdomen in the male insect. Since there are no such structures on the seventh tergite of the other Mecoptera I have examined, it is possible that these remarkable processes are peculiar to *Notiothauma* among the Mecoptera.

The abdominal segments (with the exception of the first) as far back as the eighth segment, in *Notiothauma,* are "discleritous"—i. e., the tergal and sternal sclerites are distinct and separate (the tergites are denoted by the letter *t* and the sternites by the letter *s* in fig. 1)—and the spiracles labelled *sp*) are located in the pleural or lateral membrane between the tergites and sternites. The fulvous-colored eighth and ninth abdominal segments, however, are "synscleritous"—i. e., the tergites and sternites have united to form a complete ring or continuously sclerotized surface from dorsal to ventral sclerite, and the spiracle of the eighth segment (which is larger than the preceding ones) is surrounded by the sclerotized surface, instead of being located in a pleural membrane.

In *Panorpodes* the eighth and ninth segments are synscleritous (tergites and sternites fusing completely) and the seventh segment is partially synscleritous, the fusion of the tergite with the sternite being complete in the anterior half of the segment, but the posterior half retains a partial division between tergite and sternite. *Panorpodes* thus presents an intermediate stage between *Notiothauma* (in which only the eighth and ninth segments are synscleritous) and the Panorpidæ in which the seventh, and sixth segments also, are synscleritous. *Panorpodes* likewise presents an intermediate condition between the posterior abdominal segments of Notiothauma, which are broad and flattened, and the narrow more cylindrical segments of the postabdomen (narrowed region) of the Panorpidæ, since the segments in *Panorpodes* are somewhat narrower than those of *Notiothauma* but are not as narrow as those of the Panorpidae, in the postabdomen. As was mentioned above the sixth, seventh, eighth and ninth segments are synscleritous in the Panorpidæ; the sixth is discleritous, the seventh partially so, the eighth is synscleritous and the ninth is synscleritous in Panorpodes; the sixth and seventh abdominal segments are discleritous and the eighth and ninth are synscleritous in *Nannochorista* and *Notiothauma.* In *Chorista* and *Merope* the sixth and seventh abdominal segments are discleritous and the eighth and ninth are weakly so. In *Boreus* and *Harpobittacus* the sixth, seventh, eighth and ninth (reduced in *Harpobittacus*) abdominal segments are discleritous.

The ninth segment of the male has been termed the andromere (since it is the genital segment "par excellence") and the ninth segment together with the genitalia constitute the androecium, or as the Dipterists term it, the hypopygium. The andromere or ninth segment presents some intensely interesting modifications in *Notiothauma.* Its tergal region or epiandrium labelled *ep* in fig. 1, bears a remarkable median dorsal process (labelled *g* in fig. 1 and fig. 4) which is turned slightly forward. The lateral portions of the epandrium on each side of the median process *g* are produced posteriorly to form two lobe-like projections labelled *e* in figs. 1, 4, 5 and 37, and these epandrial processes bear lesser lateral projections as is shown in figs. 1 and 4 of *Notiothauma.* These epandrial processes are apparently homologous with the processes and lobes of the ninth tergite variously termed the surgonopods, surstyli, epivalvæ, epiprocessi, etc., in different insects. The condition exhibited by *Notiothauma,* in which the epandrium is produced posteriorly to form the epandrial lobes *e* above the anus-bearing structures *pg* of fig. 37, apparently represents the starting point of the development of the epandrial processes and lobes of other Mecoptera.

In *Merope* the epandrial processes *e* of fig. 36 are broad, flat, pointed plates clearly demarked from the tergite behind them. In the Bittacidæ represented by *Harpobittacus* (fig. 35) the epandrial lobes become highly developed, and in some Bittacidæ they are extremely large and are provided with roughened areas suggesting that they may play a part in mating (as claspers), and on this account they were referred to as the "copulalobi" in the Bittacidæ, but it is preferable to designate all of these lobes and processes of the ninth tergite as the epandrial processes (or lobes). In *Harpobittacus* the first abdominal segment (which is provided with a huge spiracle) is very small, so that the ninth segment might be counted as the eighth if the true first segment were overlooked, but by counting the eight pairs of abdominal spiracles one can determine the corresponding segments, even when the first segment has fused with the metathorax as in *Boreus,* and when there has been a fusion or suppression of segments, the spiracles furnish the clews for determining whether the fusion has been in the anterior or posterior region of the abdomen, since if there are eight distinct, spiracle-bearing segments in the abdomen when the number of segments has been reduced, it is evident that the fusion has occurred posterior to the eighth segment. In the Boreidæ, the epandrial lobes *e* of fig. 33 are rather densely beset with small protuberances giving a roughened appearance to their dorsal surfaces. The epandrial processes are not developed in *Chorista* (fig. 34) or *Panorpodes* (fig. 31) or most Panorpidæ (fig. 31), and the character of the epandrium *ep* of *Chorista* and *Panorpodes* (figs. 34 and 31) points to a rather close relationship between these insects, and *Panorpodes* is apparently closely related to the ancestral Panorpidæ among the Mecoptera. In *Chorista* and *Panorpodes* (figs. 34 and 31) the anus-bearing structure *pg* is not covered by the epandrium *ep,* but in the Panorpid shown in fig. 28, the epandrium *ep* is produced posteriorly and completely hides the proctiger beneath it.

The hypandrium or sternal portion of the ninth segment (andromere) is extremely interesting in *Notiothauma* (i. e., *ha* of figs. 7 and 21), and its condition in *Notiothauma* might be taken as the starting point for tracing the modifications of the hypandrium of other Mecoptera (see *ha* in the different figures), although the hypandrium *ha* of *Chorista* shown in fig. 18 might also be taken as the starting point in tracing the development of the hypandrium in other Mecoptera. The hypandrial processes labelled *h* in figs. 18, 21, etc., have been termed the hypovalvæ, hypoprocessi, etc., but in the following discussion they will be referred to simply as the hypandrial processes. In *Notiothauma* (figs. 1, 7 and 21) the hypandrium *ha* (which is divided into a basal and distal area) bears an unpaired median process and two lateral processes, while in *Chorista* (fig. 18) the median process is not developed, and there are small secondary mesal processes on the lateral hypandrial processes labelled *h* in fig. 18. In *Merope* (fig. 19) and *Boreus* (fig. 17) the hypandrial projections *h* are very slightly developed. In *Panorpodes* (fig. 20), however, the hypandrial processes *h* are well developed (and are provided with peculiar outgrowths, as shown in fig. 20), and in the development of its hypandrial processes, *Panorpodes* approaches the Panorpidæ more closely than any other lower Mecoptera do. In most Panorpidæ, such as the one shown in fig. 22, the hypandrial processes are well developed and in the Indian Panorpid shown in fig. 23, which has the most peculiar hypandrium of any Mecopteron I have seen, the hypandrial processes *h* curve about a somewhat circular basal opening, and are produced posteriorly into elongated processes which are modified apically to form the peculiar distal structures shown in fig. 23. The hypandrium is not prolonged posteriorly in the Bittacidae or Nannochoristidæ.

The male genitalia proper consist of the gonopods *cx* and *st* of fig. 13 and the structures comprising what the Dipterists call the phallosome, made up of the valvæ and other projections about the penis or the genital opening—i. e., the central structures labelled *ps* in fig. 13. It is very difficult to interpret the homologies of the male genitalia in the different orders of insects, and the homologies of the parts in Diptera, Mecoptera, etc., are still in dispute.

In a discussion of the male genitalia of Diptera, Mecoptera, and related forms, published in Vol. 25, p. 47, of Psyche for 1918, the structures labelled *st* and *cx* in figs. 3, 7, 8, etc., were designated as the gonopods; but in attempting to homologize the gonopods of sawflies (which are fundamentally like those of Diptera and Mecoptera, but are of a more primitive type) with the gonopods of male Ephemerids, etc., which have retained the parts in practically the original condition for insects in general (see Canadian Entomologist, Vol. 52, p. 178, for 1920), I was misled by the fact that the bilobed basal plate (called the "cardo" by Hymenopterists) of some sawflies' genitalia resembles the fused coxites in the male genitalia of certain mayflies and the two-segmented forceps of these sawflies resemble the styli of certain mayflies, in which the styli are composed of two or more segments. Using the condition exhibited by these sawflies as the basis for determining the homologies of the parts in Diptera and Mecoptera, I consequently homologized the segment labelled *st* in figs. 3 and 7, of the Diptera and Mecoptera with the distal segment of the stylus (i. e., with the dististyle) and homologized the basal segment labelled *cx* with the basal segment of the stylus (i. e., with the basistyle), and interpreted the demarked basal areas of these basistyles as the reduced coxites in Diptera and Mecoptera (see also Vol. 48, p. 207, of the Transactions of the American Ent. Soc. for 1923). In his review of Dr. Alexander's "Craneflies of New York," however, Walker, 1920 (Canadian Entomologist, Vol. 52, p. 190), states that in the Diptera the distal portion of the claspers (i. e., *st* of fig. 3, represents the entire stylus, while the basal portion *cx* of fig. 3 represents the coxite instead of the basal segment of the stylus, and Eyer, 1924, (Annals Ent. Soc. of America, Vol. 17, p. 275) applies this interpretation to the Mecoptera and other Holometabola. Mr. R. E. Snodgrass, who has been making a detailed study of the musculature of the genital claspers, etc., of male insects, informs me that the musculature bears out the view that the basal segment of the gonopods (labelled *cx* in the different figures) is the coxite, and the distal portion (*st* in the different figures) represents the entire stylus, so that I have provisionally adopted this view of the interpretation of the parts of the gonopods in the present paper. Mr. Snodgrass is inclined to regard the basal collar called the "cardo" in the genitalia of Hymenoptera, as a detached basal portion of the coxites, which has united with its fellow from the opposite side to form a basal collar-like sclerite in these insects, while the basal segment of the (outer) claspers represents the remainder of the coxite, and the outer claspers themselves represent the styli, in the Hymenoptera, and this view seems to be as reasonable as any, since it is in accord with the evidence of the musculature of the structures in question. It should not be forgotten, however, that Emery, Wheeler, and other students of the ants, interpret the basal and distal portions of the outer claspers (i. e., the gonopods) as parameres, and the question of the homologies of the parts of the gonopods is by no means settled as yet. In the following discussion, I shall refer to the claspers *st* of figs. 3, 7, 8, etc., as the gonostyles, and shall designate the basal portions *cx* as the gonocoxites, terming them both together, the gonopods.

The gonopods *st* and *cx* of *Notiothauma* (figs. 1, 5 and 7) not only furnish the prototypes from which the gonopods of the Panorpidæ and other Mecoptera could be derived, but they are also surprisingly like the gonopods of primitive Diptera such as *Trichocera* (fig. 3), suggesting that the ancestors of the Diptera were very like *Notiothauma* in the character of their genitalia. Thus, the gonostyle *st* of *Trichocera bituberculata* Alex., shown in fig. 3, has a mediotubercle *m* and a basitubercle *b* astonishingly like the meditubercle *m* and the bastitubercle *b* of the gonostyle of *Notiothauma* shown in fig. 7, but I have not found any Dipteron in which the gonostyle (*st* of fig. 3) bears a peculiar stylorganus (or stylar organ) like that labelled *o* in the gonostyle *st* of *Notiothauma* shown in fig. 7, although such a stylar organ is not found in all of the Mecoptera either, being apparently absent in *Chorista and Panorpodes* (figs. 12 and 13) and in all of the Panorpidæ and Bittacidæ that I have examined. A stylorgan *o* is present in *Notiothauma* (figs. 1, 5 and 7), in *Merope* (fig. 13), in *Nannochorista* (fig. 10) and in *Boreus* (fig. 9), however, and this may indicate that *Notiothauma* is very like the common ancestors of all of these Mecoptera, since the ancestors of these forms must have had a stylorgan, if this structure is developed in these families.

Aside from the presence of stylorgans *o* in both *Notiothauma* (fig. 7) and *Merope* (fig. 16) the gonostyles *st* themselves are not very similar in the Notiothaumidæ and Meropidæ, since the gonostyli of Merope (fig. 16) are long and slender and resemble those of certain Chironomid Diptera in contour, while the gonostyli of Notiothauma are more like those of the Dipteron *Trichocera bituberculata* in contour, and it is amazing that the gonostyli of these closely related famiiles of Mecoptera (the Notiothaumidæ and Meropidæ, should resemble the gonostyli of Diptera more than they resemble each other.

The gonostyli *st* of *Notiothauma* (figs. 5 and 7) are more normal, and therefore furnish better starting points for tracing the development of the gonostyles of other Mecoptera than is the case in other primitive Mecoptera such as *Chorista* (fig. 12) in which the basitubercle *b* and the meditubercle *m* are modified in a peculiar manner, and the gonostyle is not as much like those of *Panorpodes* (fig. 13) and the Panorpidæ (fig. 23) as the gonostyle of *Notiothauma* is.

The gonostyle *st* of the Indian Panorpid from Mysore, shown in fig. 23, is so astonishingly hairy that this remarkable Panorpid should be called "Panorpa hirsuta" if it should prove to be new to science, and an appropriate name is desired for it! The Panorpid shown in fig. 8 has remarkably "thin," leaf-like gonostyli *st* with a peculiar basitubercle *b* and meditubercle *m*, and with a very peculiar mesal process *en* or "endostyle" which may represent the inner branch of the divided gonostyli in Diptera (i. e., the so-called inner basistyle in certain Diptera). In comparison with the size of the coxites which bear them, the gonostyli *st* are rather short in the Boreidæ (fig. 9) and Nannochoristidæ (fig. 10); and in the Bittacidæ represented by *Harpobittacus* (fig. 11) the gonostyli *st* become tremendously reduced—a feature which serves to set apart the Bittacidæ from the rest of the Mecoptera very sharply.

In *Notiothauma,* the gonocoxites *cx* of figs. 5 and 7, are more like the prototypes of the gonocoxites of the Panorpidæ (figs. 8, 23, etc.) than is the case in Chorista (fig. 12), although *Chorista* and *Panorpodes* are not sharply set off from the Panorpidæ in this respect. In *Notiothauma* (fig. 5) there is an intercrater *cc* or intercoxal region which is hollowed out and sclerotized in a fashion suggesting the prototype of the condition met with in primitive Diptera, and all of the features of the genitalia of Notiothauma suggest that the ancestors of the Diptera resembled *Notiothauma* in many respects.

In *Boreus* (fig. 9) the gonocoxites *cx* are quite large in proportion to the size of the gonostyles *st,* and there is a wide posterior, or ventral, intercoxal area *ic* of membrane between the gonocoxites *cx.* In *Nannochorista* (fig. 10) the gonocoxites *cx* are likewise very large in proportion to the length of the gonostyli *st,* but the intercoxal area has become sclerotized and the gonocoxites appear to be quite solidly united. In the Bittacidæ (fig. 11) the intercoxal area has likewise become sclerotized, but a partial suture remains to demark the distal region of the gonocoxites, which are hugely developed in proportion to the size of the gonostyli *st.*

In the Panorpid shown in fig. 8, the posterior intercoxal area contains a pair of membranous lobe-like valves, the postvalvæ labelled *p* in fig. 8. These are apparently homologous with the posterior valve-like structures labelled *p* in fig. 12 of Chorista and a similar pair of valves labelled *p* in fig. 15 of *Notiothauma.* The function and significance of these postvalvæ is not clear.

In the Panorpid shown in fig. 8, the intercoxal area contains a pair of ventral phallic valves labelled *v,* which are received in a flanged groove of the gonocoxite *cx,* and the Panorpid shown in fig. 8 likewise has a pair of dorsal phallic valves labelled *d,* which lie on each side of the meatus or gonopore, as the genital opening of the male is called. These valves may represent the penis valves of sawflies which form the ædeagus or chitinous parts about the penis in higher insects. The penis valves have been homologized with the endopodites of the genital limbs of the ninth segment, while the gonostyli have been homologized with the exopodites of the genital limbs (gonopods) whose protopodites are represented by the gonocoxites, but the homologies of the genital valves of the male insect have not been definitely determined, and it is preferable to refer to them as parts of the phallosome, as is done by the Dipterists. The ornate valves labelled *d* in fig. 15 of *Notiothauma,* lie on each side of the gonopore and apparently represent the dorsal valves *d* of the Panorpid shown in fig. 8, while the ventral valves *v* of fig. 15 of *Notiothauma* may represent the ventral valves *v* of the Panorpid shown in fig. 8, although the ventral valves *v* of *Notiothauma* are poorly developed, and were difficult to make out in the dried specimen available to me for study.

In such Panorpids as *Panorpa lugubris,* shown in fig. 25, the dorsal valve *d* of each side is not divided, but the ventral valve of each side is divided into an upper ventral valve labelled *u* and a lower ventral valve labelled *l* in fig. 25. The ventral valves of *Notiothauma* are not thus divided into an upper and lower branch, but in *Chorista* (fig. 12) one of the branches of the lower valves forms one of the penisfilum valves labelled *pv* in fig. 12, and this pair of valves becomes greatly elongated to form the so-called penisfilum *pf* of the Bittacidæ (fig. 11), so that in this, and certain other respects, *Chorista* is more like the ancestor of the Bittacidæ, while *Notiothauma* is more like the ancestor of the Panorpodidæ and Panorpidæ. The phallosome *ps* of *Nannochorista* shown in fig. 10 is much reduced and in *Boreus* (fig. 9) the parts are usually retracted, although in the specimens shown in figs. 31 and 34 of plate 10, in Vol. 48 of the Transactions of the Amer. Ent. Soc. for 1923, a large eversible membranous penis was visible, being apparently extruded at the time of mating. The parts are as much alike in the Boreidæ and Nannochoristidæ as any, but the resemblance is not very marked in these two families, and it is difficult to determine where they branched off in the phylogenetic tree of the Mecopteran families.

Following the usage proposed in Vol. 13, p. 60, of the Bulletin of the Brooklyn Ent. Society for 1918, the terminal abdominal segments may be referred to as the terminalia, and the anus-bearing portion may be termed the proctiger, while the set-off papilla with the anal opening at its tip, may be called the anal papilla. In *Notiothauma* (figs. 1, 2 and 5) the anal papilla *ap* is surmounted by a process labelled *sr*, and below it is a lower process labelled *sb*. The condition exhibited by *Notiothauma* (fig. 2) suggests the beginning of the development of the parts of the proctiger and its processes exhibited by the Bittacid shown in fig. 24. in which the dorsal process labelled *sr* may have developed from one like that labelled *sr* in fig. 2, while the ventral process labelled *sb* in fig. 24 may have developed from a ventral process like that labelled *sb* in fig. 2. Although the cerci *ce* and proctiger of the Bittacasid shown in fig. 24 are hugely developed, these features are more normal in such primitive Bittacids as *Harpobittacus* (fig. 35), in which the tenth tergite appears to be well developed and sclerotized, and in such a highly specialized Mecopteron as *Nannochorista*, the tenth segment (or the tenth and eleventh together) is remarkably well developed and sclerotized. The cerci are apparently lost in *Boreus*, and the peculiar character of the proctiger *pg* of fig. 33 bears out the view that the Boreidæ are rather isolated Mecoptera. The proctiger *pg* of Merope (fig. 36) is long and slender, and is not as much like that of *Notiothauma* (figs. 1, 2 and 5), as would be expected from the fact that the Meropidæ and Notiothaumidæ are very closely related, and the character of these parts is therefore of no great significance in attempting to determine the closest affinities of the Mecopterous families. The proctiger *pg*, short cerci *ce* and other features are quite similar in *Chorista* (fig. 34) and *Panorpodes* (fig. 31), and this may possibly indicate that *Panorpodes* is related to *Chorista* as well as to *Notiothauma* among the primitive representatives of the Mecoptera. In the Panorpid shown in fig. 28, the epiandrium *ep*, or ninth tergite, is produced posteriorly and hides the proctiger, etc., which lies rather far back beneath the epiandrium.

In general, the abdominal structures of *Notiothauma* would indicate that this remarkable insect is a remnant of the ancestral Mecoptera, and is the nearest living representative of the ancestors of the Panorpidæ. The Panorpodidæ, however, are somewhat nearer the immediate ancestors of the Panorpidæ, occupying a position intermediate between the Notiothaumidæ and Panorpidæ, and they are also related to the Choristidæ. The Choristidæ occupy a position at the base of the lines of descent leading to the Bittacidæ. Certain features suggest a relationship between the Boreidæ and Nannochoristidæ, but these insects are too highly modified to determine their closest relatives among the other Mecopterous families, although the Panorpidæ may represent the types from which the Boreidæ were descended, judging from characters other than the male genitalia, and the Nannochoristidæ exhibit some affinities with the Panorpodidæ.

ABBREVIATIONS

a Apical portion of genital style (stylapex).

ap Anal papilla (anopapilla).

b Basal tubercle of genital style (basotuberculus).

bc Paired tergal processes (bicornua).

bs Basal portion of phallus (basiphallus).

c Dorsal and ventral stylocondyles, or pivotal processes of genital styles.

cc Coxal hollow (coxocrater).

ce Cerci.

cx Genital coxites (gonocoxites or gonocoxæ).

d Dorsal phallic valves.

e Epiandrial processes or lobes (surgonopods, surstyli, epiprocessi, etc.)

en Endostyle.

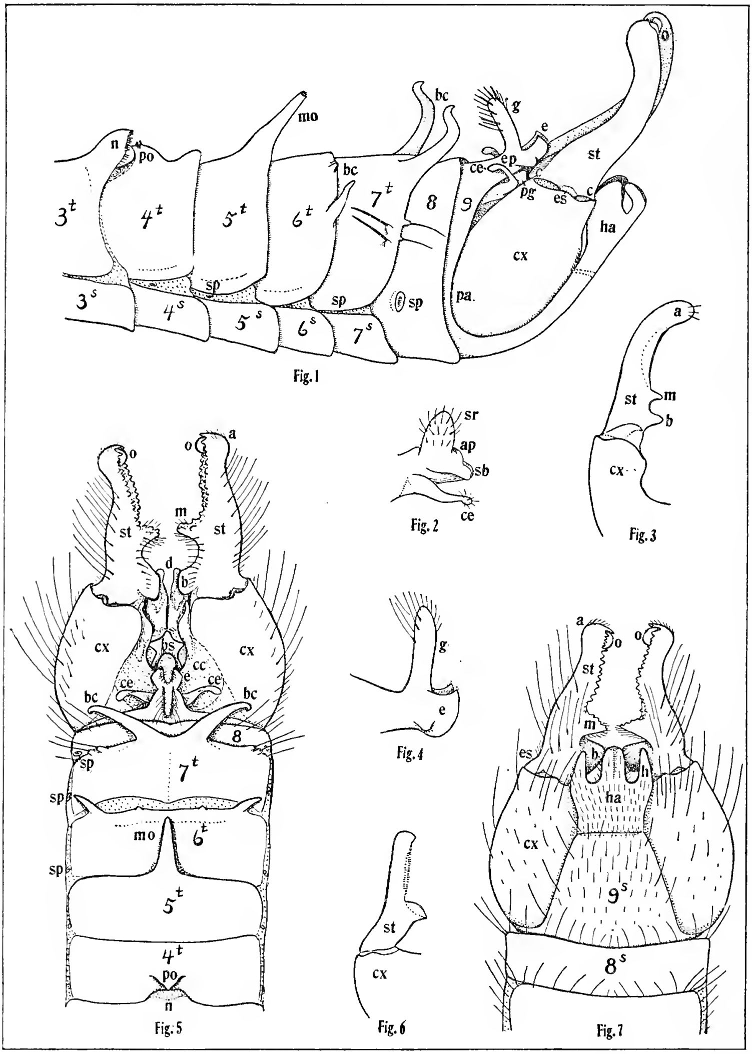
ep Epiandrium or ninth tergite.

es Epistyle, or process of genital style to which the extensor muscles are attached.

g Dorsal epiandrial process.

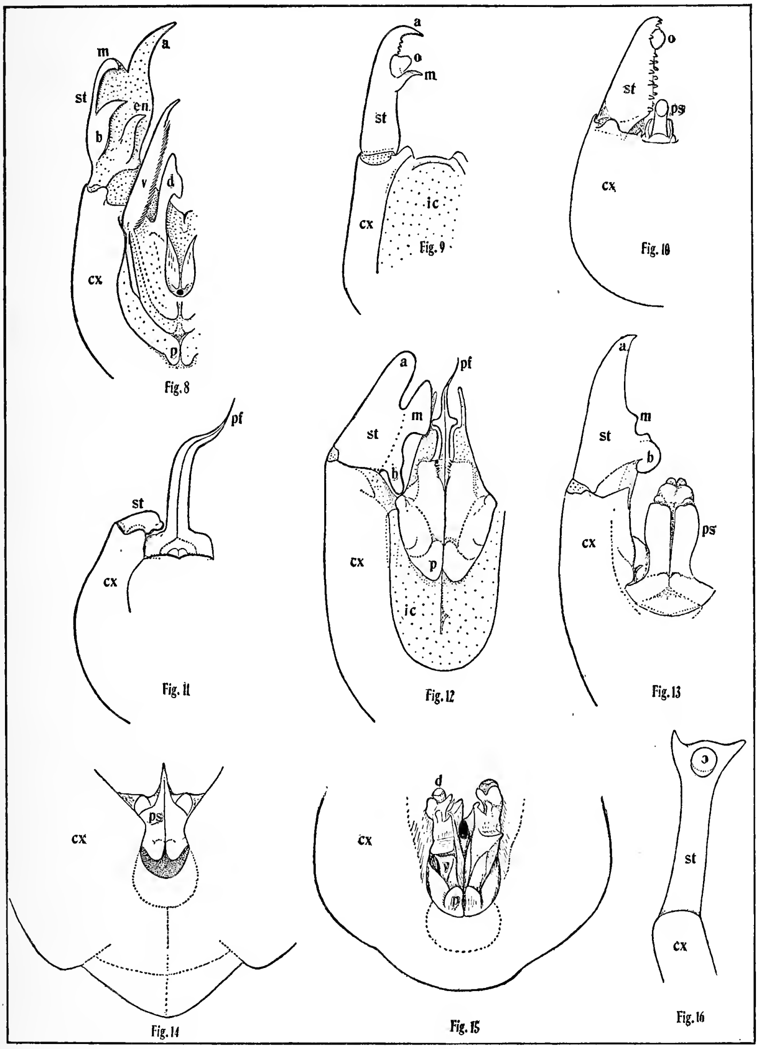
h Hypandrial processes (Hypoprocessi, hypovalvæ, etc.).
ha Hypandrium or tenth sternite.
ic Intercoxal area.
l Lower ventral phallic valves.
m Median stylar tubercle (medituberculus).
mo Unpaired median tergal process (monocornus).
n Notoörganus or notal alluring organ of male.
o Styloörganus or organ on genital style.
p Posterior phallic valves and lobes.
pa Parandrium.
pf Penisfilum valves, forming penisfilum in Bittacidæ.
pg Proctiger (anus-bearing region).
po Conical posterior tergal process (postorganus).
ps Phallosome or parts about genital opening.
sb Subpapilla.
sp Spiracles.
st Genital styles (gonostyli).
sr Surpapilla or suprapapilla.
u Upper ventral phallic valves.
v Ventral phallic valves.

Psyche, 1931. Vol. 38, Plate 1.



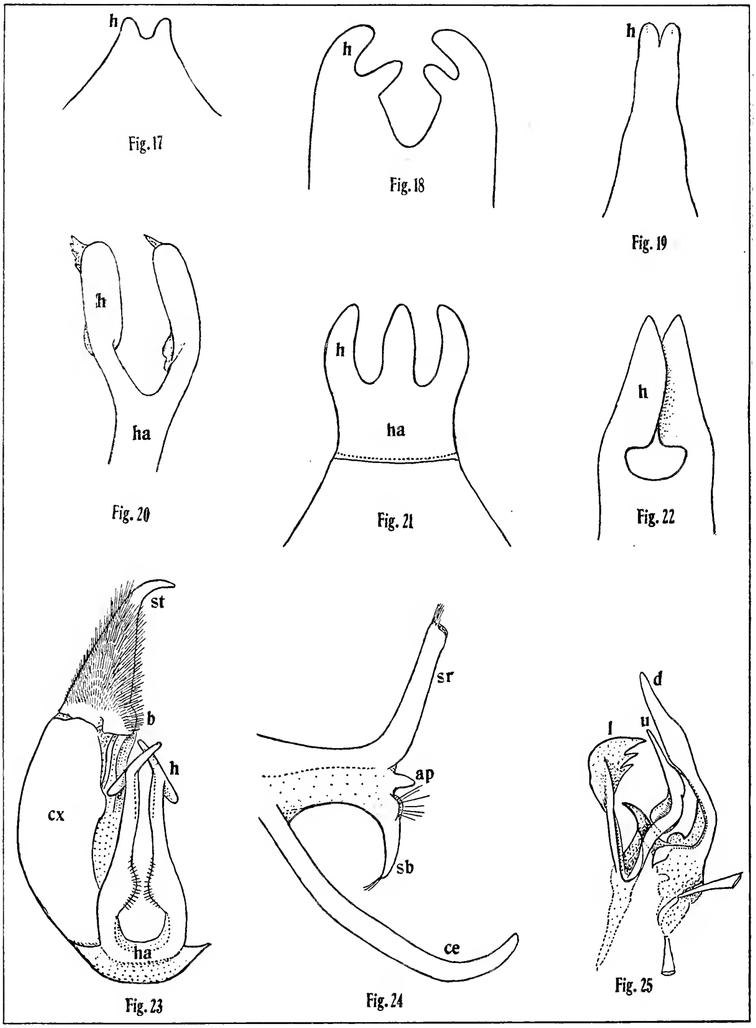
Crampton—Notiothauma.

Psyche, 1931. Vol. 38, Plate 2.



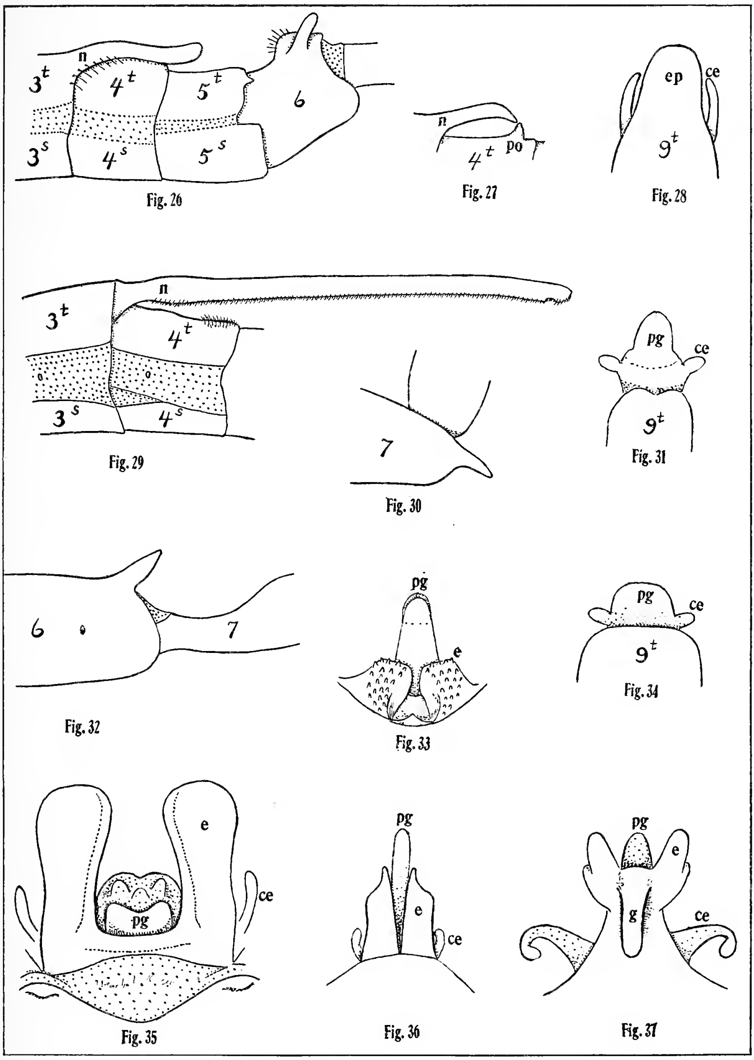
Crampton—Notiothauma.

Psyche, 1931. VOL. 38, PLATE 3.



Crampton—Notiothauma.

Psyche, 1931. Vol. 38, Plate 4.



Crampton—Notiothauma.

EXPLANATION OF PLATES I—IV

Fig. 1. Lateral view of abdomen of male *Notiothauma reedi,* McL.

Fig. 2. Lateral view of terminal structures (terminalia) of *Notiothauma.*

Fig. 3. Ventral view of genital style and coxite of the Dipteron *Trichocera bituberculata,* Alex.

Fig. 4. Lateral view of epiandrium of male *Notiothauma.*

Fig. 5. Dorsal view of abdomen of male *Notiothauma.*

Fig. 6. Dorsal view of genital style and coxite of Dipteron *Trichocera garretti* Alex.

Fig. 7. Ventral view of terminal structures and genitalia of male *Notiothauma.*

Fig. 8. Ventral view of sinistral genital style, coxite and phallosome of a Panorpid.

Fig. 9. Same of *Boreus* sp.

Fig. 10. Same of *Nannochorista dipteroides,* Till.

Fig. 11. Same of *Harpobittacus* sp.

Fig. 12. Same of *Chorista australis,* Tillyard.

Fig. 13. Same of *Panorpodes* sp. from Japan.

Fig. 14. Ventral view of phallosome and basal coxites of *Merope.*

Fig. 15. Same of *Notiothauma.*

Fig. 16. Mesal view of genital style of *Merope.*

Fig. 17. Ventral view of end of hypandrium of *Boreus.*

Fig. 18. Same of *Chorista.*

Fig. 19. Same of *Merope.*

Fig. 20. Same of *Panorpodes* (from Japan).

Fig. 21. Same of *Notiothauma.*

Fig. 22. Same of *Neopanorpa opthalmica* (redrawn from Miyaké).

Fig. 23. Ventral view of sinistral half of genitalia of *Panorpa* sp. from India.

Fig. 24. Lateral view of proctiger of *Bittacus strigosus.*

Fig. 25. Lateral view of phallic valves of *Panorpa lugubris.*

Fig. 26. Lateral view of segments three to six of *Neopanorpa cornuta,* after Miyaké.

Fig. 27. Lateral view of notal organ and conical process of *P. stigmalis,* after Miyaké.

Fig. 28. Dorsal view of epandrium of *P. lugubris.*

Fig. 29. Lateral view of third and fourth abdominal segments of a Panorpid related to *P. takenouchii.*

Fig. 30. Lateral view of terminal region of seventh segment of *P. bicornuta,* after Miyaké.

Fig. 31. Dorsal view of epandrium and proctiger of Japanese *Panorpodes.*

Fig. 32. Lateral view of terminal region of sixth segment of a Panorpodid related to *P. cornigera.*

Fig. 33. Dorsal view of epandrium and proctiger of *Boreus.*

Fig. 34. Dorsal view of epandrium and proctiger of *Chorista.*

Fig. 35. Same of *Harpobittacus.*

Fig. 36. Same of *Merope.*

Fig. 37. Same of *Notiothauma.*

TWO NEW SPECIES OF FUNGUS GNATS OF THE GENUS APEMON

By Charles W. Johnson

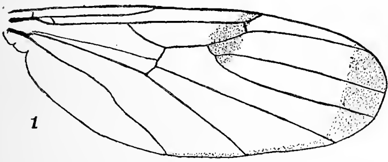
Boston Society of Natural History

Early in June, 1930, in company with Mr. Stuart K. Harris, a trip was made to Storrs, Connecticut. While collecting along the Willimantic River, a handsome specimen of a fungus gnat, representing a new species of Apemon, was taken. For some time I have not been satisfied with the determination of the eastern specimens referred to *Apemon maudæ* Coq., although one female from Franconia, N. H., was determined by the author of the species. I therefore take this opportunity to correct this error.

Apemon similis sp. nov.

A. maudæ Johnson (not Coquillett) Fauna of New England, List of Diptera, p. 77, 1925.

Head and antennæ black, with the under side of the first and second antennal joints yellow, palpi yellow with a black spot on the upper side of the second joint. Thorax shiny black, with subdorsal and lateral rows of fine yellow hairs, a triangle back of the humerus and dorso-pleural suture yellowish, scutellum and pleura black. First and second abdominal segments entirely black, the others reddish, the third and last segments having a blackish posterior margin. In the males only the fourth segment is reddish in one, and in another (Holotype) the base of the third and fifth segments are also reddish. Femora bright yellow with only a small black spot at the base of the posterior coxæ and also on the under side of the tips of all the trochanters, tibiæ and tarsi brown, tibial spurs and halteres yellow. Wings yellowish gray, a brown spot extending from R1, before its apex to the posterior branch of the media near its base, apex of the wing from near the tip of R4+5 to the anal cell grayish brown; other characters are shown in fig. 1.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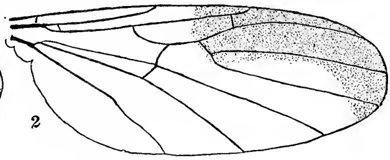
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Fig. 1. Wing of *Apemon similis* sp. nov.
Fig. 2. Wing of *Apemon manteri* sp. nov.

Length of male 9.5 mm; female 9 mm.

Represented by two males and two females. Holotype, Bretton Woods, N. H., June 28, 1913 (C. W. Johnson). Allotype Franconia, N. H. (Mrs. Slosson). Paratype Tuckerman Ravine, Mt. Washington, N. H., July 8, 1914 (C. W. J.) in the collection of the Boston Society of Natural History. Paratype Oquossoc, Rangeley Lake, Maine (C. W. J.) in the Museum of Comparative Zoology.

Apemon manteri sp. nov.

Head black, palpi yellow, antennæ black with a dull yellow spot on the under side of the first and second joints. Thorax black, subshining with subdorsal and lateral rows of fine yellow hairs more conspicuous above the base of the wings, a triangle back of the humerus and the dorsopleural suture yellowish, pleura above the front coxæ with yellow hairs, the rest of the pleura and metanotum naked and subshining, scutellum black with fine yellow hairs. Abdomen black, hairs on the first and second segments entirely black, the second segment about double the length of the first, the other segments with indistinct bands of yellow hairs at the base of each segment, the anterior angles of the fourth segment and the ventral surface of the fourth and fifth segments brownish. Genitalia black. Coxæ and femora bright yellow, a small black spot at the base of the middle and posterior coxæ and on the under side of the tips of all the trochanters, tibiæ and tarsi dark brownish, becoming black on the outer half of the tarsi, tibial spurs yellow, halters yellow. Wings with the basal two-thirds hyaline, yellowish at the base, the rest of the wing deep black, which extends along the anterior from forks of the radius to beyond the end of R5 as shown in fig. 2. Length 9 mm.

One male collected on the west side of the Willimantic River near Mansfield Station, Conn., June 6, 1930. Type in the collection of the Boston Society of Natural History. This species was taken while collecting with Prof. Jerauld A. Manter of the Connecticut Agricultural College, Storrs, Conn., to whom I have dedicated this interesting species.

A NEW NAME FOR *NEBRIA VANDYKEI* DARLINGTON

By P. J. Darlington, Jr.

It is my painful duty to announce that the name *Nebria vandykei,* used by me in Psyche 37, 1930, p. 104, for a species from Paradise Valley, Mt. Rainier, is preoccupied. The preoccupying name is *Nebria vandykei* Bänninger (Koleopterologische Rundschau 14, 1928, p. 5), which has been applied to a species quite different from mine, although from the same locality. I therefore propose the name *Nebria paradisi,* nom. nov., for the species described as *N. vandykei* Darlington. I am indebted to Dr. M. Bänninger and Dr. M. H. Hatch for calling my attention to Dr. Bänninger's paper.

AN INTERESTING COPY OF WIEDEMANN'S DIPTERA EXOTICA

About 1893 I purchased a copy of Wiedemann's "Diptera Exotica" from a European dealer. I did not examine it carefully at the time, and it was not until about 1915 that I discovered that pages 39 to 42 were missing. Comparing it with the copy in the Boston Society of Natural History, I find that the title page is quite different and reads as follows:

DIPTERA EXOTICA

Sectio I. antennis multiarticulatis

Munus Decani Fac. Med. deponens
edidit

Dr. C. R. G. Wiedemann

Kiliæ 1820

Following page 38 instead of page 39 is the usual title-page of the work:

C. R. G. WIEDEMANN

Med. Doctoris, in Acad. Kiliensi Prof. Med. P. O.

DIPTERA EXOTICA

Pars I

TABULIS ÆNEIS DUABUS

Kiliæ 1821

Following this and in place of page 41 is the sub-title page

Dipterorum exoticorum

Sectio II

Antennis parumarticulatis

which is placed in front of page 43, "Supplementum ad sectionem I." It should have been placed in front of page 45, "Section II. Antennis parumarticulatis."

The text on page 38 ends some distance from the bottom, with a ———. Evidently whoever compiled the book lacked pages 39-42, and, thinking that the two leaves containing the title page of 1821 and the sub-title of Sectio II, filled the gap, bound them accordingly. All references to this work bear the date 1821. However, from the copy here described, it is very evident that the first 38 pages and probably pages 39-42, and the supplement to Section I, pages 43 and 44, were published in 1820 and not in 1821. Pars I on the title page of 1821 would indicate that the author contemplated other volumes.

It would be of interest to know if there are any other copies giving 1820 as the date of publication of the first section. This copy has been presented to the library of the Boston Society of Natural History.

Charles W. Johnson.

SOME PRELIMINARY NOTES ON THE GENUS EPHEMERELLA

By Anne Louise Steger

Cornell University, Ithaca, N. Y.

In an attempt to fill in some of the gaps left by Miss Anna H. Morgan in her study of the Mayflies of Fall Creek in 1911 (Ann. Ent. Soc. Am. 4:93-119), some rearing and collecting work was carried on during the summer of 1930 at Cornell University under the direction of Dr. Needham with the genus Ephemerella. As a result I was able to obtain stages of several of the local species which had not as yet been taken or described. Following is a table of the local species taken, indicating those stages which had already been described (*D*) and those which had not, and which were collected last summer (*U*):

Species	*Nymph*	*Subimago*		*Imago*	
		♂	♀	♂	♀
E. cornuta	D	D	U	U	U
E. deficiens	D	D	D	D	D
E. dorothea	D	U	U	D	D
E. rotunda	D	U	D	U	D
E. septentrionalis	U	U	U	D	U

The rearing of the nymphs to the subimago and imago stages was carried on in a deserted pump house on Beebe Lake, where it was possible to have a constant supply of fresh water running through the troughs. The nymphs were collected in streams by means of a small wire hand screen, brought home and put into wire cages in the troughs, after having been properly identified and separated according to species. The cages were labelled with name of species and collecting data, and were visited once or twice a day in order to catch the subimagos as they crawled out of the water onto the part of the cage above water. The subimagos were then put into paper bags, which were labelled as to species, date of collecting and date of subimago transformation. The paper bag, because of the roughness of its surface, offers an excellent place for the imago to crawl out of its subimago skin. The paper bags were investigated each day, also, in order to get the imago as soon after transformation as possible. As a result, all stages of the above-listed species were obtained, and some observations made on the relative length of time of subimaginal transformations. For the most part, the males in all species reared seemed to require slightly more time than the females for this last molt.

The collecting was done in the streams around the general vicinity of Ithaca. Fall Creek borders the campus on the north and collections were made in it at various points from the campus to Freeville, a small town about eight miles northeast of Ithaca. Cascadilla Creek borders the campus on the south, collecting being done in it upstream over a distance of about three miles. Further collecting was done in Salmon Creek ten miles northeast of Ithaca, in Van Buskirk's Glen ten miles to the south, in Slaterville Wild Flower Preserve fifteen miles to the east, in Six Mile Creek two miles to the south, in North Harford Brook (Cortland County) twenty to twenty-five miles to the northeast, in North Spencer Stream about fifteen miles south, in Enfield Glen seven miles to the south, and in Otter Creek which borders on the southwest of Cortland, N. Y.

Ephemerella cornuta Morgan

Male imago:

Measurements: body 10 mm., tails 11 mm., fore leg 9.5 mm., fore wing 9 mm., hind wing 2.5 mm. Eyes and ocelli dark brown; antennæ light-brown. Thorax a uniform dark brown. Abdomen a rather light gray-brown. Wings hyaline, brownish at the bases. Axillary cords of the fore

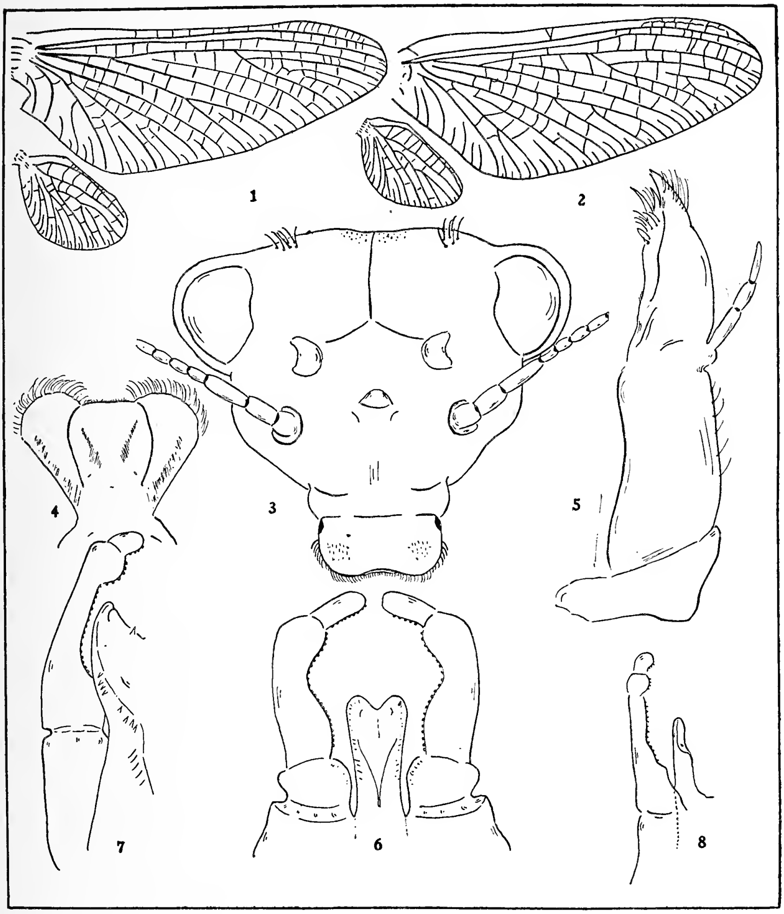


Fig. 1.

1. *E. septentrionalis*—wings of adult;
2. *E. cornuta*—wings of adult;
3. *E. septentrionalis*—head of nymph;
4. *E. septentrionalis*—hypopharynx;
5. *E. septentrionalis*—maxilla;
6. *E. cornuta*—forceps and penes of adult;
7. *E. rotunda*—forcep and penis of adult;
8. *E. septentrionalis*—forcep and penis of adult.

wing extending backward on each side of the median lobe of the metathorax, in slender points. Tails three, whitish. Last segment of the forceps rather elongate, not bulbous; second segment with a rather bulbous swelling at each end.

Female imago:

Measurements: body 9 mm., forewing 10 mm., hindwing 3 mm. Color of thorax a dark brown similar to that of the male. Abdomen a slaty-gray, due probably to the egg mass which showed through.

Subimago:

Wings smoky in color. This nymph was taken as early as May 16th in North Harford Brook. It was found in greatest abundance and maturity in a small swift stream near North Spencer on May 23rd. This last stream contains many small flat rocks on its mud bottom, and the nymphs were with difficulty distinguished from the mud-clumps on the undersides of these rocks. By June 5th they had practically disappeared from this stream, only a few good-sized nymphs and many cast skins being found. They were likewise observed in great numbers in Salmon Creek (in a similar section of the stream) on July 6th, but were gone from here by July 13th—indicating that week to have been the height of their season in that particular stream. They were collected by Dr. Needham as late as August 30th, in Elk River, West Virginia. The nymphs were fairly common in Cascadilla Creek, Slaterville, and North Spencer.

Ephemerella deficiens Morgan

The nymphs taken of this species were very black with a light mid-dorsal line extending from the anterior margin of the prothorax to the posterior margin of the metathorax. The gills, tibiæ and tarsæ are white. In alcohol the blackness of the body fades into a dark brown, and the light mid-dorsal line becomes almost indistinguishable.

Mature nymphs were first taken in the shallowest and most rapid waters of Cascadilla Creek on June 8th. Many full-grown nymphs were obtained from Salmon Creek in a similar sort of habitat on July 6th, and were gone from this stream by July 13th. They were collected as late as August 3rd in Fall Creek.

The subimago of E. *deficiens* is very dark in color, the wings being smoky.

Ephemerella dorothea Needham

Imago:

The imagos reared seem to be 1-3 mm. larger than those of Dr. Needham's original description[1]—the average body length of the male being 7-8 mm., of the female 8 mm. The ocelli of both male and female imagos are ringed at their bases with black.

Subimago:

The wings of the subimago are subhyaline in color with a tendency to turn black around the edges just before the subimaginal molt.

Nymph:

The nymph is much like *E. rotunda* in general appearance, although smaller and without dorsal spines. The two were frequently found associated together amongst the vegetation and moss accumulated around the stones of fairly rapidly flowing streams. The seasonal height in abundance and maturity of *E. dorothea,* however, seems to be a few weeks later than that of *E. rotunda*—the former being in its height in early June when the latter had already begun to disappear. The nymphs were collected as early as May 23rd in the North Spencer Stream, and were found to be fairly common (though never as much so as *E. rotunda*) in most of the local streams.

[1] N. Y. State Mus. Bull. 1908, 124: 190.

Ephemerella rotunda Morgan

Male adult: (reared from nymphs collected in Cascadilla Creek, Salmon Creek, Otter Creek, Van Buskirk's Glen, North Harford Brook, North Spencer Stream and Fall Creek).

Measurements: Body 9 mm., tails 12 mm., foreleg 9 mm., fore wing 10 mm. Head light brown; compound eyes orange-brown. Thorax and abdomen a shiny medium brown. Legs yellowish or tan. Tails ringed with dark brown at the base of each segment. Axillary cords of the fore wing prolonged into slender spines projecting posteriorly on either side of the hinder lobe of the mesothorax. Wings hyaline. Penes with stout spines.

Subimago: Wings subhyaline.

Nymph: (dark variety).
(Taken in Cascadilla Creek, Otter Creek, Salmon Creek.)

Measurements: body 9-10 mm; tails 6 mm. Head smooth and round; labium grayish in color. Thorax broad and flaring, the wing pads descending well over the first several abdominal segments; frontal angles of the prothorax with a prominent tooth, lateral margins with a broad thin shelf-like edge; front angles of the mesothorax with a prominent triangular tooth. Posterior angles of the head forming almost right angles. General color of abdomen blackish-brown, segments 5, 6 and 7 yellowish in color. Dorsal spines very well developed, occurring on segments 2-9. Lateral margins of segments 3-9 acuminate and slightly incurving, acuminate but not incurving on 10. Legs short and stubby relative to body; yellowish in color, the tibia and tarsus with dark brown bands. Gills present on abdominal segments 3-7, the 7th gill almost completely covered by the 6th. Tails lightish with several slightly darker bands, and with circlets of stiff hairs at the bases of the segments; fringed with longer hairs for the last two-thirds of their length. These longer hairs gradually diminish in length toward the tips of the tails, which appear practically hairless.

Nymph: (light variety).

(Taken in Cascadilla Creek, Salmon Creek, Otter Creek, Van Buskirk's Glen, North Harford Brook, and North Spencer Stream.)

Measurements: body 10 mm., tails 6 mm. Head and body rounded and smooth. Posterior angles of head indrawn. Labium not marked with grayish as in the dark variety. General color light brown, tibia and tarsus banded with light brown. Front angles of the prothorax only slightly rounded, lateral margins only slightly flaring. Dorsal spines present on segments 4-9, but not so well developed as in the dark variety. Sometimes very slight spines can be detected on segments 2 and 3. Gills present on segments 3-7, the 7th gill not being so completely covered by the 6th as in the dark variety.

I do not feel that these two are different species, but regard them merely as color varieties of *E. rotunda.* The differences seem to be a matter of degree, with intergradations of such characters as the prominence of the dorsal spines, the extent to which the 6th gill covers the 7th, the toothing of the prothorax and metathorax, and the flaring of the lateral prothoracic margins. This species seems to exhibit many variations in color—from the very dark variety described above, to a light yellow variety with dark markings whose essential characters are the same.

E. rotunda was the most common and abundant member of the genus in the Ithaca streams from early March until late May. It was the earliest nymph collected, being found in great numbers and fully matured as early as March 16th. The last nymphs were seen in the North Harford Brook on June 11th. Although Miss Morgan and several others had never found the males of *E. rotunda,* I was able both to collect and to rear many. I did not notice any particular scarcity of males, the sexes being fairly equally distributed where the nymphs were obtainable at all. The male adults of the light and dark varieties showed no differences when reared, which further convinces me that they are the same species.

The nymphs of *E. rotunda* seem remarkably varied in their choice of habitat. Although most usually found in the mud-gathering moss of flat rocks on the bottoms of fairly rapid streams, they were also collected in all intergrading types of streams from shallow riffles to the rather sluggish sections of deeper streams. This variety of habitat may be in part responsible for the variety of coloration and pattern displayed by this nymph, and even for some of the minor structural differences mentioned in the above descriptions.

Ephemerella septentrionalis McDunnough

Imago:

Measurements: body 10 mm.; tails 12 mm; foreleg of male 16 mm., fore wing 10 mm. (Measurements of female same, except for foreleg). Compound eyes of the male orange-brown, thorax yellowish. First seven abdominal segments grayish, 8th yellowish-gray, 9th and 10th yellow. Head, thorax and abdomen of female yellow; legs yellow. Compound eyes grayish and small; ocelli reddish-brown.

Subimago:

Wings subhyaline.

Nymph:

Measurements: body 10 mm; tails 7 mm; foreleg 6 mm. Head smooth except for a tuft of hairs on either side of the mid-frontal line of the apex. General color of thorax and abdomen light brown with a narrow brown mid-dorsal line. A row of brown dots on either side the median ventral line of the abdominal segments, and one at the base of each leg on the ventral side of the thorax. Legs extremely long and slender in proportion to the body. Tarsi with a band of brown. Gills present on abdominal segments 3-7. Dorsal spines absent. Lateral spines on segments 4-9. Tails light, the segments surrounded at their bases with a circlet of stiff bristle-like hairs.

This nymph was collected only in North Harford Brook on May 16, 17 and 21. It had disappeared from here by June 23. It was collected from the mud-gathering roots of the vegetation along the edges of the stream in fairly great numbers, and was usually buried so deeply in the mud that it was difficult to discern and capture.

HYPERASPIS PALUDICOLA SZ.

Described from Florida. For many years I have owned a specimen doubtfully named as above, which bore the label "Provincetown, Mass.," without other information. On examining the catch of July 5, 1930, made at Dennis, Mass., I found several specimens of the same thing, and have now come to the conclusion that this is another of the many instances of the occurrence of southern species of beetles in the sand plain area of Massachusetts.

HYPERASPIS DISCONOTATA MULS.

This beetle was described from "L. Sup.," and one record appears in the N. Y. List from "Cascade. Aug."

I took one specimen by sweeping grass on June 5, 1927, and one on May 31, 1930, probably by sweeping in the same meadow in Sherborn, Mass.

C. A. Frost, Framingham, Mass.

NOTES ON SOME MOTHS COLLECTED AT SILVER LAKE, CHESHAM, NEW HAMPSHIRE

By Alexander B. Klots

Cornell University

From July 14 to 18 inclusive the writer collected moths at light on the west side of Silver Lake, near Chesham, N. H. A complete list of the species taken would seem unnecessary, but a number of the records are liable to be of interest to students of the distribution of New England Lepidoptera.

The nomenclature followed is that of the New York State List of Insects. All identifications have been checked with the collection of the Cornell University Department of Entomology, and doubtful cases with the collection of the U. S. National Museum. The writer is indebted to Dr. W. T. M. Forbes and Messrs. August Busck and Carl Heinrich for checking (and in some cases correcting) many of his determinations.

Tineidae

Tinea sp. near *croceoverticella* Chamb., but much smaller.

Lyonetiidae

Bucculatrix canadensisella Chamb. Very common.

Gracilariidae

Gracilaria bimaculatella Ely.
Gracilaria packardella Chamb.
Gracilaria serotinella Ely.

Gelechiidae

Gnorimoschema petrella Busck.
Duvita tahavusella Forbes, 2 specimens.
Telphusa fuscopunctella Clem. Common.

Aristotelia rubidella Clem. Common. This species has been confused with *pudibundella* Z. The male has a prominent sex-patch on the under side of the front wing.

A. absconditella Walk.

A. quinquepunctella Busck.

Enchrysa dissectella Z.

Evippe prunifoliella Chamb.

Lavernidae

Perimede erransella Chamb.

Yponomeutidae

Ocnerostoma pinariella Z.

Tortricidae

Olethreutes osmundana Fern.

Sparganothis lycopodiana Kearf.

Tortrix packardiana Fern.

Pyralididae

Polloccia alticolalis Dyar. Common.

Paralispa terrenella Z.

Elophila plevie Dyar. Very abundant. I have also taken this species in abundance at East Killingly, Conn. I cannot understand why its occurrence in the North has been so long overlooked. Type in the U. S. N. M.

Glyptocera consobrinella Z.

Meroptera unicolorella Hulst.

Noctuidae

Parahypenodes quadralis B. & McD.

Panthea furcilla Pack. Very common! One specimen was a partial gynandromorph, the left wings and antenna being male, while those of the right side are female. The abdomen and genitalia appear to be normally male.

Plusia alias Ottol.

Eriopus mollissima Guen.

Eurois (*Matuta*) *youngii* Smith. Specimens were taken which intergraded strongly to *E. elimata* Guen., which was also taken. There appears to be some doubt that these are distinct species.

MOSQUITO CONTROL IN MASSACHUSETTS[1]

By George S. Tulloch

Previous to 1929 little attention had been given to the control of mosquitoes in Massachusetts. Various municipalities through their local boards of health had inaugurated campaigns for the control of the common house mosquito, *Culex pipiens,* and in a few instances communities along the sea coast had directed some attention to the control of the salt marsh mosquito *Aëdes sollicitans.*

In 1911, through the efforts of a group of citizens of Ipswich, on the North Shore of Massachusetts, the ditching of a large area of salt marsh practically eliminated breeding pools in that particular region. Since the area ditched was only a small portion of a large salt marsh, the benefit derived was of little value, as the extensive flight range of *Aëdes sollicitans* permitted infestation from adjacent areas. However, the permanence and practicability of mosquito control by ditching was clearly shown by this project, for the ditches are still functioning properly, and that section of the marsh is in nearly a non-breeding condition after nineteen years of periodical flushing by the high course tides.

In 1929 the State of Massachusetts through its Reclamation Board took an active interest in the problem of mosquito control. This Board, comprised of three men, acting in an advisory capacity, cooperated with various towns in the salt marsh areas and suggested control measures. Under the State Reclamation Board groups of cities and towns are authorized to cooperate by forming a mosquito control project directed by commissioners appointed by

[1]Given before the Entomological Society of America at the Case School of Applied Science, Cleveland, Ohio, December 30, 1930.

the board. Money appropriated by the members of the project can then be spent for the benefit of the project as a whole, without being restricted by town or city boundaries. Adopting this method money was available for actual ditching operations early in 1930.

The island of Nantucket was the first to start operations in April. This island, covering approximately fifty square miles, is situated twenty miles from the southern coast of Cape Cod and about twelve miles from its neighbor, Martha's Vineyard. Its isolated position outside the normal flight range of *Aëdes sollicitans* (the prevalent mainland mosquito) made it an ideal spot to demonstrate the practicability of mosquito control by ditching. The area of salt marsh on the island was 838 acres, while fresh water swamps included over 1300 acres. The salt marsh area was treated first, and over 300,000 feet of ditches, ten inches wide and 24 inches deep, were constructed before it was considered to be in a non-breeding condition. Then attention was directed to the fresh water areas. Here the topography of the island did not permit the accomplishment of mosquito control by the simple means of ditching. In some cases culverts and underground drains were constructed and in a few instances it was necessary to resort to oiling, but in general, whenever possible, permanent control measures were effected. The presence of *Mansonia perturbans,* the larva of which attaches itself to roots and stems of aquatic plants, added to the problem, since it only can be controlled by completely removing the water, a method which oftentimes is impracticable.

The control measures carried on at Nantucket have reduced mosquitoes and added much to the comfort of the residents. In addition land values in some regions have increased twofold or more.

The success of the Nantucket project encouraged the Cape Cod Chamber of Commerce to inaugurate a drive to raise funds to carry on the control work on a more extensive basis than that provided for by local appropriations. Two hundred thousand dollars were pledged by public subscription, the money to be spent over a period of three years, seventy thousand dollars of which became available in August, 1930. Extensive operations were started immediately, and at the present time over 1,000,000 feet of ditches have been dug and the worst breeding areas eliminated. By May, 1931, it is estimated that an additional 500,000 feet will be completed.

In addition to these projects the State of Massachusetts through its Department of Public Works has built a dike, 3,000 feet long and about five feet high, across Race Run at Provincetown, on the tip of Cape Cod. This dike now prevents the tide waters from reaching an area six hundred acres in extent, formerly known to be a prolific breeding-place of salt marsh mosquito. The cost of construction of this dike was assumed by the State, being on land owned by the Commonwealth. In this case, through its Department of Public Works, and also through its Reclamation Board, the State of Massachusetts again has shown her foresight in taking advance steps toward the comfort and prosperity of her citizens.

THE BIOLOGY OF THE MECOPTERA

By Frank M. Carpenter*

Among the curious phenomena of nature none is more unfortunate than the close correlation which exists between the number of species in an insect order and the number of entomologists concerned with it. The entomological world is filled with students investigating the classification, economies, society, pathology, eugenics, intelligence and morals of the Hymenoptera. Our National Parks and Forests are menaced annually by coleopterists, destroying the natural geology and tearing the barks from the trees in their search for new species. The Lepidoptera, especially the more attractive groups, are gradually becoming extinct, because of the enthusiastic quest for aberrations and queer varieties. But the smaller orders of insects are rarely the object of biological or taxonomic investigation. A list of the neuropterists in all the world would not equal a list of the coleopterists in some of our larger cities.

This evening I propose to discuss the habits and life-history of one of the smallest and therefore most neglected orders of insects—the Mecoptera, or scorpion-flies. Many of you have probably never seen one of these insects outside a museum, for they are very seclusive. They fly seldom and for short distances only, and usually keep close to the ground. When disturbed they either dart to the ground and hide among the dead leaves, or they fly to the under surfaces of the leaves and branches of shrubs, where they can be seen only with difficulty. So far as humans are concerned they are entirely inoffensive: they do not feed upon valuable crops, they have no selfish desire for human

*Address of the retiring president of the Cambridge Entomological Club, January 13, 1931. Contribution from the Entomological Laboratory of Harvard University.

blood, and they do not transmit disease, although I have several specimens of *Panorpa lugubris* from Nichols, South Carolina, which were held responsible by the inhabitants of the town during the fall of 1928 for an epidemic of fits among the dogs.

Because of their seclusive habits the scorpion-flies apparently escaped the attention of the ancient and early medieval naturalists more persistently than most other types of insects. According to Figuier,[1] Aristotle thought that the males of the Panorpidæ were flying scorpions because they possessed a swollen bulb at the end of the abdomen resembling the poison sac of the true scorpions. But I consider that this statement is incorrect, for Aristotle was one of the few ancient naturalists who believed that scorpions could not fly.[2]

Pliny the Elder, however, quoting Appoloderus of Athens (144 B. C.) states in his "Natural History" that some scorpions have wings, and it is possible that these flying scorpions were in reality males of Panorpidæ. Definite references to the scorpion-flies seem to be absent from all the so-called encyclopedias and natural histories of the Middle Ages until 1605, when Ulissi Aldrovandi published the insect volume of his "De Animalibus." In this work there are the first recognizable descriptions of Mecoptera, which he placed with the flies, and there are several good figures of Panorpas, showing the elongate beak and other characteristic features (fig. 1A). In 1634 there appeared the "Insectorum sive Minimorum Animalium Theatrum," which is usually attributed to Thomas Moufet. This interesting compilation was originally begun by Edward Wotton, a prominent English physician of about 1550, and was continued by Conrad Genner, Thomas Penny, and Moufet. On page 62 there are three figures of Panorpas, depicting clearly the genital forceps of the males (fig. 1B). The illustrations used in both these works were later republished by Johannes Johnston in his "Historia Animalium," which appeared in 1653. All these figures are really remarkably accurate, and

[1] Les Insectes, 1st ed., 1867, p. 512.
[2] De Partibus Animalium, Bk. 4, Ch. 3, p. 123.

seem especially realistic when they are compared with the serious reproductions of dragons and hydras which are included in the serpent section of Johnston's volume. Linnæus, whose tenth edition of the Systema appeared a little more than a century after Johnston's publication, described only three species of scorpion-flies, placing them in the genus Panorpa of the Neuroptera. About a quarter of a century later (1801) Latreille decided that they required a separate family, which he called Panorpatæ.

Fig. 1. Early illustrations of scorpion-flies:
A (5, 9), from Aldrovandi's *De Animalibus*, 1605;
B, from Moufet's *Insectorum sive Minimorum Animalium Theatrum*, 1643

In 1886 Packard erected the order Mecaptera for them, in reference to the long wings; and in 1895 Comstock changed the name to Mecoptera, the form in which it has subsequently been used. At the present time five families of the order are usually recognized: Notiothaumidæ, including a single species, which is restricted to Chile; Meropidæ, also including a single species, found along our Atlantic coast from Maine to Georgia; Panorpidæ, consisting of about 250 species and being generally distributed over the holarctic regions, with a few representatives in the Australian, Oriental, and Neotropical zones; Bittacidæ, containing about 60 species, which occur in all parts of the world; and Boreidæ, with about a dozen species confined to parts of the Nearctic region and the western edge of the Palearctic.

In a group of insects as primitive as the Mecoptera we should expect to find simple and uninteresting habits. But during the two hundred million years since the first appearance of the order in the lower Permian rocks, there has been ample time for the development of peculiar traits in habits, even though the insects have undergone few structural changes. Unfortunately, nothing is known of the habits of Notiothauma and Merope, except that the latter is positively phototropic. Curiously enough, those habits of the other Mecoptera concerned with courtship and mating show the highest development and diversity; the courtship of the Panorpidæ involves peculiarities which have been found in few other groups of insects. The male Panorpa, on approaching the female, vibrates his wings rapidly and the female usually responds in like manner. Then the male stretches out his abdomen, seizes that of the female with his strong genital forceps, and then moves the forceps along until the female genitalia are reached. During copulation the bodies of the two insects diverge in the form of a "V." Usually the insects remain *in coitu* for a quarter of an hour or even an hour. Campion (1915)[3] observed a pair of *P. germanica* which started to mate at 11:30 A. M. and continued all day; at night when several aphids were introduced into the box, the pair fed together, while still in copulation. Miyaké (1913) has made some interesting observations on the mating habits of *P. klugi:* "One male is usually surrounded by two or three females which seem to the observer to be coquetting with the male. I saw on June 5th a pair in copulation beside two females. At last one of the two (I think the stronger one) began

[3] References not given here will be found in the bibliography of my revision of the Nearctic Mecoptera, now in press (Bull. Mus. Comp. Zool.).

to disturb the pair in copulation, using its long beak as a weapon, and succeeded in separating them. The successful rival then effected a pairing on the spot."

The most interesting feature of the mating habits of Panorpa concern the salivary glands of the male. Brant (1839) and Dufour (1841) observed in their anatomical studies of certain neuropterous insects that the salivary glands of the male Panorpas were much larger than those of the females. Mercier (1915) studied this peculiarity more carefully in *Panorpa germanica, alpina,* and *cognata,* with surprising results. He found that the salivary apparatus in the male consisted of two glands, each of which was composed of three long, filiform branches, and which opened into a common reservoir. The two reservoirs in turn opened into a common excretory duct. This complex structure was not developed until the male was four or five days old, at which time sexual maturity was reached. During the first few days after emergence of the male from the pupa the glandular tubes were only two or three millimeters long, but in eight days they had reached the length of 12 millimeters. Mercier observed that when a male, with its wings vibrating, approached a female, it suddenly ejected from its mouth a small drop of liquid, which coagulated almost the instant it was expelled, forming a small opaline pellet about the size of a pinhead. The male then moved several centimeters away from the pellet and again vibrated its wings. The female advanced and fed on this ball of saliva, whereupon the male rapidly approached, grasped her abdomen with his forceps, and entered into copulation. During the whole process the female continued to feed on the excretion, which (according to Mercier) it dissolved with a brown liquid. As soon as the first pellet of saliva was consumed, the male ejected another one, which was likewise devoured or dissolved in a similar manner. This process continued as long as the two were paired. Mercier believes that this excretion helps the male to secure a mate. Shiperovitsh (1925) has repeated Mercier's observations on *P. communis,* although there seem to be some points of difference, for the males of that species ejected several cylindrical pellets, instead of drops of saliva. It is probable, however, that Shiperovitsh did not examine the drops until they had hardened. This particular type of bribery on the part of the male is, I believe, unique among all the insects, inasmuch as it involves a product of the digestive system. But the dipterous family Empidæ is famous for the peculiar tactics employed by the males, who offer the females particles of food as a preliminary to mating, although some degenerate and more modernistic species have reduced their gifts to inedible debris, such as small pebbles and bits of wood. In a very different group of insects, the cockroaches, we find another instance, more unlike that of the Panorpas. The males of Œcanthus, as shown by Hancock, possess a gland in the center of the metanotum, which secretes a fluid apparently much desired by the female. Just before actually mating the female climbs on the male's back and inserts her mouth at this gland, devouring the secretion ravenously. Unlike the condition in Panorpa, the feeding must end before copulation begins.

The mating habits of the other genera of Panorpidæ besides Panorpa are not known sufficiently to enable us to determine whether on not the males employ similar devices during courtship. Tillyard has made a few observations on the Australian genus Chorista, but has mentioned no such tactics. "If a male and a female be put alive into a glass tube, the male at once seizes the female fiercely with his anal forceps, taking hold of her in any position haphazard. He then quickly moves his appendages to the posterior end of the body of the female, opening his forceps to a great width, and then closing them quickly upon the tip of the abdomen. The result is a lock-grip, the two insects facing opposite directions. When once the male has got his correct hold, no amount of annoyance will persuade him to let go."

The Bittacidæ have apparently not developed any specialized habits in connection with mating; at least, no one has recorded such behavior. Mercier, however, mentions incidentally that the males of Bittacus present the females with particles of food, as a part of courtship, as in the Empidæ; but he does not imply that he has actually seen this done, and he gives no reference to a published account. Miyaké has noted that the males retain the body of a victim for some time after they have finished with it, possibly as a lure to the females, who "come and try to take away the bait," whereupon the males attempt to mate with them. Such behavior, unless carefully observed, might easily be misinterpreted and be the basis of Mercier's remark. During copulation the specimens of Bittacus hang suspended from the branches or leaves, facing each other ventrally.

The snow scorpion-flies of the family Boreidæ have no mating habits like those of Panorpa, although the act of mating itself is a very curious process, and demonstrates the function of the bristle-like wings of the males, as shown by Withycombe. When a male becomes enamoured of an attractive member of the opposite sex, he runs along at her side for a short distance; then, by a series of sudden movements he grasps her near the base of her abdomen with his hooked wings and pulls her upon his back. Next he pushes her around into a more comfortable position, until he is able to seize her abdomen with his forceps and bring about copulation. Then he releases the hold with his wings and "wanders about on the surface of the ground with the female seated on his back and apparently helpless." This manœuver has been observed by Cockle (1908) in *Boreus californicus*, and by Withycombe (1926) in *B. hyemalis*.

The feeding habits of the adult scorpion-flies have been the cause of considerable discussion and the object of several investigations. The earlier writers thought that the Panorpidæ were exclusively predacious, and this view has persisted until within very recent years. Lyonnet started the notion in 1742, in Lesser's "Theology des Insectes ou Demonstration des Perfections de Dieu," where he states that he saw a fly of the size and appearance of a scorpion-fly attack a damsel-fly ten times its own size, and bring it to the ground. The Odonatan was unable to repel its aggressor, and would have perished from the repeated thrusts of the scorpion-fly's beak, had not Lyonnet interfered. Kirby and Spence (1828) describe this encounter in the fifth edition of their "Introduction," and state without reserve that the offending insect was *Panorpa communis*, although there was certainly no evidence for this conclusion; and in view of the more recent observations it seems clear enough that this "tyrant of insect creation" was not a Mecopteron. Brauer (1863) fed adult Panorpas on bits of meat and on insects which had just been killed. In the "Feuille des jeunes naturalistes" for 1880 there is an anonymous note describing several specimens of *Panorpa communis* which were eating portions of fish that had been placed upon a bank near a stream. Felt (1896) fed adults of one of our American species, probably *P. canadensis*, on injured lepidopterous larvæ, and he was also able to keep one female alive for eighteen days on a diet of fresh meat. He believed, however, that only the juices were consumed. Poulton (1906) saw several European species of Panorpa feeding on other Arthropods, but the latter were dead when he first examined them. He suggests that the scorpion-flies feed only on dead prey. Lucas (1910) mentions one Panorpa which was feeding on a "whitish grub." Campion (1915) concluded from several experiments on *P. communis* and *P. germanica* that they feed on dead or nearly dead animal matter. Miyaké (1912) was convinced from his extensive studies on the Japanese *P. klugi* that the food of Panorpas usually consists of dead or injured insects, although he saw one female attack a living and healthy larva of its own species. Shiperovitsh (1925) states that all the investigations on the subject prove that the adults of Panorpa are exclusively saprophagous. However, the term "saprophagous," if so used, must be understood in a very broad sense, for the injured insects and fresh meat used by the authors mentioned above could hardly have started to decay by the time they were devoured by the Panorpas. Also, it must be remembered that some adults have been seen feeding on the nectar of flowers and on fruits, and Miyaké notes that several of his specimens fed on the petals of Sweet William (*Silene armeria* Linné); in every case the entire petal was affected and later wilted. The sum of all these observations seems to me to suggest that the various species or species groups of the genus have widely different sources of food.

The Bittacidæ are essentially predacious and their legs are modified for grasping and holding prey: the femora and tibiæ are covered with strong spines, the tarsal joints are very flexible, and the single tarsal claw can be bent back against the rest of the tarsus. Bittacus is a slow-flying creature and it rarely if ever catches prey in flight. It usually remains motionless under a leaf or twig for many minutes or even hours, until another insect alights within reach of its legs. Then it suddenly reaches out and grasps the victim with its tarsus. When the captured insect has been turned into a satisfactory position, it is carried within reach of the beak, which usually penetrates between the abdominal segments or at the junction of the head and thorax. Probably only the juices are consumed. Soft-bodied insects, like the Diptera, seem to be preferred as food, but Hymenoptera, Hemiptera, Lepidoptera, and even Coleoptera are frequently taken as well. Miyaké has found that the Japanese Bittacus will feed on dead insects, decayed leaves, and even soil. The process by which a slow moving Bittacus attacks and devours active or even stinging insects is a most fascinating one. A splendid description of such an encounter between an Australian Bittacus and a bee has been given by Jarvis (1908) and is worth quoting in full: "Whilst standing by a large bush of *Daviesia corymbosa,* watching the number of specimens of bees that were attracted by the blossoms, I heard a sudden loud buzzing, louder than that caused by the continuous murmur of the bees, and saw that a specimen of *Bittacus australis* had just seized a large honey-bee which was making frantic but ineffectual struggles to escape from its clutches. It had grasped its victim with both hind legs and was holding it as far as possible from its body, with the flexible tarsi wrapped around the unfortunate bee and working continually, just like the fingers of a hand, to prevent it from turning towards its enemy. In such a position, with its back to the fly, the poor insect was unable to make any use of its sting, and all efforts to twist around were anticipated and prevented by the movements of the numerous sharp spines of the encircling tarsi. Some muscular effort is doubtless required to enable the fly to keep its hind legs in an extended and rigid position in spite of the struggles of the large, winged insect, which may account for their being larger and stouter than the others, with the femora being somewhat incressated and the tarsi being larger and more powerful. So intent was it upon securing its prey that I was allowed to examine its every movement minutely, and whilst wondering what would happen next, it suddenly put out its two mid-legs and caught the tips of each primary wing of the bee between the last two joints of the tarsus, in much the same manner as we should take hold of anything between our finger and thumb, and pulled them out to their fullest expanse, thus effectually preventing the last remote chance of escape by these organs of flight. The scorpion-fly was now hanging from the bush by its two arms, and holding its prey with extended wings and body still grasped by the hind tarsi. And now came the closing scene of this insect tragedy; the hind legs slowly contracted to bring the body of the victim nearer, and the cruel, beak-like mouth approached, and, after hovering close to it for a few seconds, was inserted between the head and prothorax of the bee, which was unable to make the slightest resistance while its captor was piercing and biting through the slender, fleshy neck."

Of all the Bittacidæ, certainly the most curious is the Californian *Apterobittacus apterus*, which is completely devoid of wings and resembles a phylangid with a pair of legs missing. But this creature is nevertheless as successful at catching prey as its winged relatives. It replaces its want of wings by great dexterity in climbing, swinging itself monkey-like from twig to twig, often supported by one tarsus. Osten-Sacken (1882) once observed a specimen devouring a tipulid with vestigial wings,[4] and he suggests a possible mimicry of this species on the part of the Bittacid.

The feeding habits of the Boreidæ have been more or less obscure until recently. Brauer observed that the adults fed on moss, as well as on Produra and other small animals living among the moss roots. Whitycombe concluded from investigations which he made in 1921 that they fed on damaged or dead insects, although he found some specimens feeding on the bases of moss plants. Subsequently, however, he made further inquiries into the feeding habits and decided that the food is normally moss, although in captivity, when proper food is not available, other substances may be consumed. He also found that the amount of food needed was very slight, but a great deal of moisture was required.

In the preceding pages we have reviewed what is known of the habits of the adult Mecoptera, and we shall next consider the main features of their metamorphosis. Here again, we have no knowledge of the life-history of the Meropidæ and Notiothaumidæ, and our acquaintance with the development in the other families is almost entirely confined to old-world species of Panorpa, Bittacus, and Boreus. Curiously enough, Swammerdamm, who investigated the metamorphosis of many groups in 1669, including some Neuroptera and Trichoptera, apparently made no observations on the Mecoptera. The earliest research of this kind was done in 1831 by Maquart, who briefly described the pupa and showed that it was the *libera* type. The pupa was also described and figured by Stein in 1838, and the complete life-history of three European species (*P. variabilis, montana,* and *communis*) was worked out by Brauer in 1863. Some of the larvæ and pupæ which he bred sixty-seven years ago are now in the Hagen collection of the Museum of Comparative Zoology. In 1894 Felt succeeded in rearing the larvæ of a Panorpa (probably *P. canadensis*) at Ithaca, New York, but he was not able to obtain a pupa.

[4] Dr. C. P. Alexander tells me that this species is almost certainly *Tipula vestigipennis* Doane.

This is the only account published on the life-history of a New World Panorpa. Miayké has carried out some splendid studies on the Japanese *klugi,* securing all stages; and Shiperovitsh has more recently reared two European species, *communis* and *cognata.* The following discussion of the metamorphosis of Panorpa is based largely on these investigations, supplemented by a few observations of my own on *P. maculosa* Hagen.

The eggs are spherical or oval, and usually white; they vary somewhat in size, depending on the dimensions of the species, but are usually less than a millimeter long. Normally they are laid in the soil in clusters of various sizes, including as many as 97 eggs. The eggs have an extremely thin shell and require a great deal of moisture for development. I have had eggs of *maculosa* dry up and shrivel within a couple of hours from the time they were deposited, when they were exposed to the normal atmosphere, even though placed on a non-absorbent surface. In about 6 or 8 days the larva within the egg pushes up the shell at one pole with the frontal part of its head and, after the shell has broken away, it unrolls itself and crawls out. In comparison with the size of the egg the larva is quite large, about 5 millimeters long. On emergence it has a pure white body, a yellow head, and pink eyes; but in a few hours these colors darken. The antennæ are small, consisting of 4 short segments, but the eyes are large and composed of about 25 ocelli. There are 3 pairs of thoracic legs, each consisting of 4 segments, and there are also 4 pairs of abdominal prolegs. The first 9 abdominal segments bear a pair of stout annulated spines, those of the eighth and ninth segments being much enlarged. The tenth segment possesses a single, very long spine, projecting posteriorly. The larvæ probably pass through seven instars in about two weeks' time, although Shiperovitsh claims that there are only four instars in *P. communis.* During these stages the larva undergoes very few changes: the abdominal legs become relatively shorter, the head smaller, and the spines on the abdominal segments are greatly reduced. The larvæ feed readily on fresh meat, fish, or injured insects; and according to Felt, some of the larvæ are predacious, the larger ones sometimes attacking and devouring the smaller. Usually the larva forms a short burrow in the soil, but it may leave the burrow entirely and feed above the ground. The last instar of the larva is much longer than the others, usually lasting about a month, and this appears to be the hibernating stage. The pupa is formed in a cell constructed in the soil by the last instar larva. It is characteristic of the *libera* type, as found by Maquart, the appendages being free, though immobile. The antennæ and legs are like those of the adult, but the mouth is not prolonged into the beak and there is no genital bulb in the male. In about a week or ten days the pupal case ruptures in the usual fashion and the adult makes its appearance. No observations seem to have been made on the condition of the adult as it emerges, or on the amount of time which elapses before it is able to fly. The adult Panorpas usually prefer dark and rather moist woods, or sometimes more open areas which are low and near water. In New England I have found them most abundant in woodlands containing *Myrica asplenifolia* and associated plants. In the more central and southern states they frequently inhabit open fields; and in the Smoky Mountains of Tennessee I have found a new species to be most abundant on the very edges of a rapid stream, and even resting on the bare rocks in the middle of a large creek.

Much less is known of the life-history of Bittacus than of Panorpa. No one has secured the larva or pupa of an American species, and Brauer alone has succeeded in rearing a species through all stages of development. He found that the eggs are laid in small clusters within the soil during the fall and remain over the winter in that conditon; but both Felt and Miyaké observed the females drop their eggs singly at random while flying over the soil. According to Brauer, if the soil in the egg chamber dries up in the late fall, the eggs hatch the following April; but if the soil stays moist, the eggs remain over until the spring of the second year following. The larvæ live above ground, among leaves and grass, not in the soil like those of Panorpa. Brauer fed his larvæ on raw meat, but he did not determine the natural feeding habits. The larvæ are much more spiny than those of Panorpa and are considerably stouter. They are also more active than the Panorpas; when frightened or disturbed they roll themselves up in the manner of many lepidopterous larvæ, or they throw the anterior part of the body in an erect position, much like the sphingid larvæ. About ten days before pupation the larvæ bury themselves in the soil and form a chamber. The pupæ are similar to those of Panorpa in general appearance, although of course they are very slender and have the habitus of a Bittacus. The adult emerges in about two weeks. Brauer states that the adult of *B. italicus* forms a chamber of leaves or twigs and lives within, feeding on the insects which are unfortunate enough to enter. No such chamber has been observed in the case of the American species, and I am certain that none is used by *B. strigosus*. One species of the genus, *chilensis*, is decidedly cavernicolous. The Bittacidæ are usually very local in their distrbution; in New England *strigosus* can frequently be taken in woodlots less than an acre in extent, but will not occur elsewhere for miles around. Martin (1892) has shown that *B. tipularius* occurs very irregularly in France; in some years, as 1888, it may be very abundant, literally covering the "wheat, clover, broom, heath and thicket," although in a few years' time it may be almost entirely absent. He attributes this decrease in the number of specimens to the corresponding increase of a parasite, although none has ever been found in Bittacus or Panorpa. Certain species of Bittacus, at least our *occidentis* and *strigosus*, are positively phototropic and are frequently caught in light traps.

The life-history of Boreus was also worked out by Brauer (1862), but he did not succeed in carrying any one species through all its stages of development. Additional observations have been made by Williams (1916) and Withycombe (1924, 1926), who has given a splendid account of the biology of the European *B. hyemalis*. The eggs are laid one or two at a time among moss roots. The larvæ hatch in about ten days, usually during December; they possess abdominal prolegs during the first instar (according to Brauer), but lose them later. There are at least four instars, during which time the larvæ feed on moss roots and liverworts. The full grown larva, usually about 6 or 7 millimeters long, is shorter and stouter than that of Bittacus. The larval stage is the longest, lasting from December to August, when the larva prepares for pupation by forming a vertical tube in the soil, nearly extending to the surface. The pupa is more active than the larva, rapidly wriggling up and down the tube when it is disturbed. After from 4 to 8 weeks the imagines appear. The adults may be found in the spring and early summer among moss roots and under stones, but they are only active in the winter, when on sunny days they can be seen hopping about on the surface of the snow, covering as much as 6 inches in a single leap.

From this survey of the biology of the Mecoptera I hope it is clear that our knowledge of the life-history of the American species of scorpion-flies is very meagre and that we have great want of further observations on their habits. This is particularly true of the remarkable *Merope tuber*, which inhabits only our Atlantic states. Perhaps one of you, while searching in the soil for a beetle or a member of some other large order, will be fortunate enough to stumble upon the larva or pupa of Merope, and thus fill in one of the most disconcerting gaps in our knowledge of complete metamorphosis.

SOME ORIENTAL NEUROPTEROID INSECTS

By Nathan Banks

Museum of Comparative Zoology, Cambridge, Mass.

Most of the species described below are from the Philippines, collected some years ago by the late C. F. Baker. Besides the new species there are descriptions of the curious Acanthaclisid (Madrasta), the only one known from the Malayan Islands, and of what I consider both sexes of an Osmylid recently published as new by Mr. Petersen from Ceylon. The types of the new species are deposited in the Museum of Comparative Zoology.

Psocidae

Hageniella pusilla sp. nov.

Body pale yellowish, head and notum with scattered short white hair; antennæ pale, with long gray hairs; legs pale. Wings hyaline; veins brownish. Beyond basal fifth of wing is a broad black band extending out to the areola postica and occupying half of stigma; end of anal vein and base of stigma with a black spot.

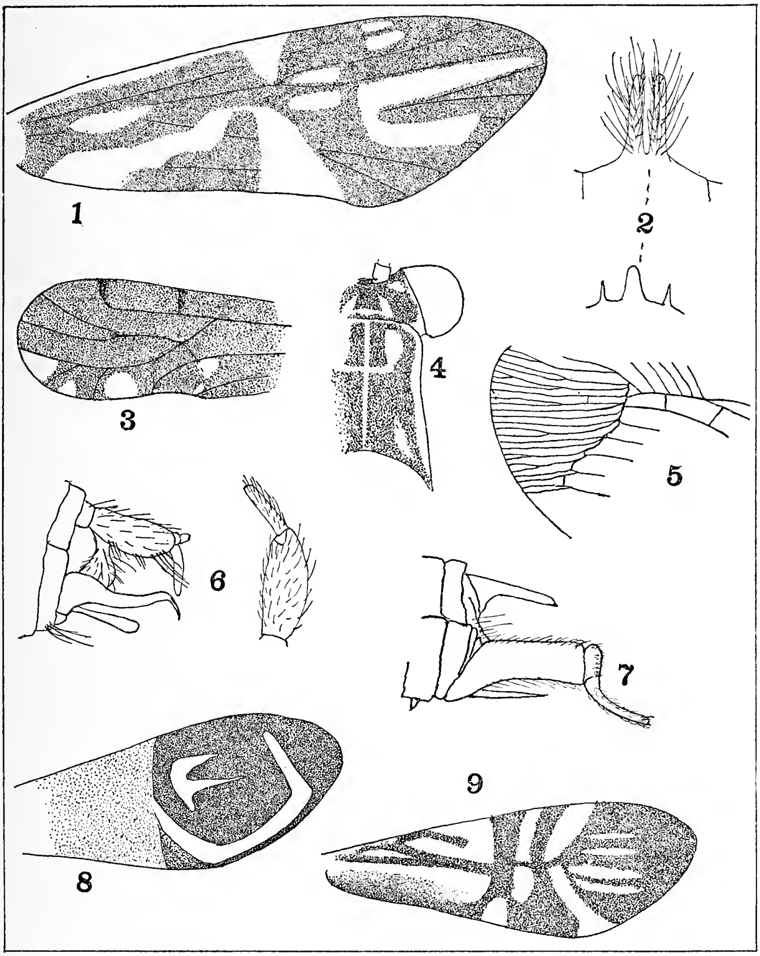
Radius and medius touching at one point, fork of radius about as far back as first fork of medius; areola postica scarcely twice as long as broad; fork of radius about equal to its stem.

Length 2.2 mm.

From Mt. Makeling, Philippine Islands (Baker).

The dark band across fore wing reminds one of *H. zonatus,* but in that species (which is much larger) the band is not one-third as broad, and paler; the areola postica longer, radial stem longer than fork, etc.

Psyche, 1931. Vol. 38, Plate 5.



Banks, Neuropteroid Insects.

Tagalopsocus hyalinus sp. nov.

Head yellowish brown, clothed with short white hair, thoracic notum darker (but not black), with still shorter white hair; antennæ pale, with moderately long hair; abdomen dark; legs pale.

Wings hyaline, veins yellowish brown, margin all around brown as in *T. luzonensis,* the margins and veins with many short hairs as in that species, the stigma is a little wider in the middle, and without the dark color of *T. luzonensis,* the stem of the radial fork is a little curved, and the veins of fork also more curved than in the other species, and lower branches of media also slightly curved. The areola postica is large and high as in that species.

Length 4.5 to 5 mm.

From Imugin, N. Viscaya; Surigao, Mindinao, Mt. Makeling, Luzon, Philippine Islands (Baker).

Ectopsocus aethiops var. **bakeri** var. nov.

Fig. 3.

This agrees with *E. aethiops* Hagen in the position of the pale marks, three along median cells, and one above anal vein. In this form the first and last of those in median cells are very large, and that above end of anal vein a good-sized, triangular spot; in the typical *aethiops* (Ceylon) the three along median cells are all very small and subequal, and that above end of anal vein reduced to a line.

Of the same size as typical form.

From Mt. Makeling, Philippines (Baker).

MYRMELEONIDÆ

Stenares frazeri sp. nov.

♀ Face pale, cheeks wth an inner dark streak next to the clypeus, mandibles and palpi dark, a dark band through bases of the antennae; vertex pale, with a median triangular black spot from behind and numerous (about 40) small scattered dots; pronotum pale, a broad, median black stripe, broadened in middle, a lateral black mark, narrow in front, very broad behind, and in front of this, each side, a dark dot; rest of the notum pale, with median dark stripe, and shorter, narrower lateral stripes; legs dark reddish brown at base, nearly black at tip; abdomen dark, darkest at tip, above toward base mottled with pale.

Hair on thorax long, mostly white or gray, some brown in middle and on sides of notum, pleura with some brownish hair below, abdomen with long white hair at base, beyond with extremely short white appressed hair, some at tip dark; legs with short appressed white hair, and longer black bristles. Labial palpi elongate, last joint about as long as front femur; vertex much elevated, very slightly bilobed; pronotum more than twice as broad as long. Legs short, spurs equal two joints, four tarsal joints short nearly subequal, fifth equal others together. Wings long, rather blunt-pointed, much marked with small dark dots, marks much as in *S. improbus* but the stigmal spot broken up; hind wings also marked in front and behind much as in *S. improbus,* near hind margin a more or less broken streak; there is no trace of the three large spots in the middle area of *S. improbus.* The venation is like that of *S. improbus* except that the costal area of the hind wings is simple for about one-half its length.

Length of fore wing 67 mm., width 16 mm. Length of hind wing 63 mm., width 15 mm.

From Coorg, India, May (Major Frazar).

The several specimens of *S. improbus* that I have seen, as well as the type have the three large spots in the hind wing very distinct.

Nesoleon perpunctatus sp. nov.

Face yellowish, a black spot on clypeus, and the labrum mostly black, a black interantennal mark reaching below the antennæ and above extending up in front of vertex, and continued back over the vertex as a median stripe; palpi pale; antennæ deep black; pronotum pale, with rather broad median black stripe and narrower lateral stripes remote from the margin and interrupted near front end; these three stripes are continued back over the rest of the notum, with a few additional short streaks, the scutelli with broad black stripe; pleura pale, with some black marks mostly on lower part; legs pale, femora dotted and the hind-tibia lined with dark; venter of abdomen black, above pale, with median dark stripe. Fore wings rather densely marked with many dark spots of about one size, nearly always at the junction of veins, but none on the banksian line; hind wings with many similar spots, mostly in the apical area and near posterior margin; stigma in both pairs large, distinct, pale yellowish. In both wings ten cross-veins before radial sector, latter with twelve or thirteen branches, in fore wings one of them looks like a separate radial sector; nine branches of first anal in fore wing, seven in hind wing; in both wings radial sector much beyond the cubital fork.

Length fore wing 34 mm., width 11.5 mm.

Length hind wing 29 mm., width 9 mm.

From Nandapur, Madras Prov., India, 27 October (Major Frazar).

Eophanes gen. nov.

In the fore wing the second anal vein runs close up to the first anal and then turns down and unites with the third anal for some distance; in hind wing but one cross-vein before the radial sector. The legs are slender, the femora cylindric, the front femora more than twice as long as the coxæ; at base of hind wing is a short vein closely parallel to hind margin and running into the branch of the second anal. In the fore wing the radial sector arises beyond the cubital fork; the claws are very long as in *Paraglenurus*. It differs from that genus in having the wings very much broader, and in having the spurs equal to four tarsal joints.

Type: *E. formosa* n. sp.

To this genus probably belongs the *Formicaleo schladeri* of Van der Weele. The wings are much as in his figure, but the hind ones more acute at tip and outer margin concave. The marks of the vertex and pronotum are very different from his figure.

Eophanes formosa sp. nov.

Fig. 4.

Interantennal mark black, extending a little below antennæ and above reaching up on vertex, leaving a yellow spot each side between antennæ and eyes; vertex with a yellow spot each side, and two toward middle behind; antennæ rather pale, tip dark. Pronotum with lateral margins and a fine median line pale, two pale spots in front, and two smaller ones behind; rest of notum mostly dark, but with several pale spots, two on the anterior lobe, and each side on the scutelli; pleura mostly dark, a few pale spots. Legs pale, femora and tibiæ dark at tips, and the tibiæ also toward the base, tarsi dark at tips of joints, spines and bristles black; abdomen dark, apex of first and middle and apex of second segment pale above, hair short, black. Wings with venation black, with patches of yellowish ones, the subcosta with about three times as many dark spots as on the radius; stigma whitish, many veinlets in apical field pale, and in certain lights a white spot (larger than stigma) before apex; the apical forks are dark, and near rhegma are a number of dark veins tending to make a cloud. The hind wing is similar, but the cloud at rhegma is larger, almost reaching the margin, and there is another cloud beyond it; the subapical white spot is present as in fore wing.

Antennæ as long as head and thorax; the pronotum longer than broad. In the fore wings the radial sector arises a little beyond the cubital fork, seven cross-veins before the sector, twelve branches to the sector; in hind wing the radial sector arises far before the cubital fork.

Length front wing 43 mm., width 13 mm.; length hind wing 43 mm., width 10 mm., abdomen 25 mm.

From Mt. Makeling, Luzon, Philippines (Baker).

Syngenes palpalis sp. nov.

Greatly resembling *S. longicornis* in structure and markings; the dark of vertex not connected to the interantennal mark, the lateral dark stripe of the pronotum shows less tendency to be double; the dorsum of abdomen with five bright yellow V-marks, the last two segments with median dark stripe and lateral marginal stripes. The labial palpi are much longer than in *S. longicornis,* the last joint twice as long as the last joint of the maxillary palpi (in *S. longicornis* but little longer). The wings are practically the same as in the African species, but the hind wings are rather broader.

Length fore wing 48 mm., width 12.5 mm.; length hind wing 43 mm., width 11.5 mm.

From Vizagapakan, Madras Prov., India (Major Frazar).

Madrasta handlirschi Navas

Fig. 5.

Face rather bright yellow, above antennæ and the vertex dull black, palpi and basal joint of antennæ yellowish; pronotum black, a faint median pale line, two spots each side in front, a spot each side on middle lobe, and a submedian pair at base, and the posterior outer edge pale; rest of notum mostly black, some small pale spots; pleura largely pale, a few dark streaks; abdomen black, pale on base below; legs mostly pale, front femora dark in middle, tibiæ with two spots near middle and sometimes at tip. Hair of body very long, mostly white, some dark, mostly on face, and middle of pronotum; hair on the abdomen short, appressed, except some long hair below near base each side. Labial palpi very long, last joint longer than space between eyes (much longer than in *occitana*). Body stout;

legs stout, spurs curved; male appendages short, slightly divergent, no longer than height of last segment, the latter much higher than long.

Wings broad toward tip as in *A. fundata*, marked much as in *A. occitana;* with scattered patches of white veins, and small dark spots; the subcosta and radius are dotted as well as spotted, above the origin of the radial sector there is a deep black spot between radius and subcosta, no spots along cubitus, one at base of pale stigma, also in the hind wing, latter not marked except veins partly pale. Costal area with two series of cells almost to base, nine to ten cross-veins before radial sector in fore wings, five in hind wings, nine branches to radial sector, cubitals not connected, banksian lines distinct, second and third anals united for short distance, then the third forked and connected once back to the second.

In the hind wings there is a remarkable structure at the apex of wing; the appearance is that the radius is suddenly turned backward in a curve. This is due to a bending down of the surface, and to the several small cross-veins being in one line, and the veinlets forked at this place, so that beyond, there are twice as many veinlets as usual.

Fore wing 52 mm., hind wing 46 mm., fore wing at stigma 12 mm. broad.

From Baguio, Benquet, Philippines (Baker). Navas has evidently misspelled his locality, obviously intended for Mindoro.

ASCALAPHIDÆ

Suhpalacsa reducta sp. nov.

Face black, yellowish each side near the eyes; clypeus and labrum pale; face clothed with gray hair on lower part, dark above; vertex black, with dark hair; antennæ faintly annulate with pale on bases of joints; thorax above dull grayish black, with much dark and some pale hair; pleura gray, with long white hair; legs black, but rather paler on base, some long white hair on femora, spurs about equal to first tarsal joint; abdomen dull black, last segments with black hair. Wings hyaline, the stigma black, nearly as long as broad; venation dark brown to black; hind wings much shorter than fore pair, and scarcely broadened on the basal part; apical field with two rows of cells; in fore wing four cross-veins before radial sector, in hind wing but two, and the radial sector arises about even with the fork of cubitus; in both pairs but four cross-veins before cubital fork; five branches of radial sector; the first anal does not run into cubital fork, but bends down to margin; in hind wings the cubital area has but two rows of cells, in the fore wing the cubital area has two to four rows of cells, irregular in arrangement.

Length of fore wing 29 to 32 mm., length of hind wing 23 to 25 mm.

From Philippines, Mt. Makeling, Luzon, Island of Samar, and Suerno Mts., Negros.

By its dark face, black legs, wholly dark thorax, two-celled apical field, and open venation, particularly but two cross-veins before radial sector in hind wing, it is separated from all described species.

Chrysopidæ

Chrysopa obliquata sp. nov.

Pale yellowish; face, vertex, and antennæ unmarked, but each side on vertex close to the eye is a narrow red stripe. Pronotum rather darker on sides than in middle, rest of thorax and legs pale; abdomen discolored. Wings hyaline, venation pale, gradates brown, ends of radial cross-veins and a few others partly dark, stigma whitish in both wings, elongate. In hind wing venation pale, but the ends of marginal forks on the outer hind margin are dark. Cubital cells slender, the second scarcely swollen above, divisory veinlet ends on the cross-vein above; gradate veinlets eight and nine, first series curved, nearer to radial sector than to the second series; in hind wings the rows more nearly parallel; in both wings there is a remarkable peculiarity in the outer radial cross-veins, those on basal part are straight across as usual but beyond middle they become very oblique and sinuous, and consequently the radial sector does not bend up so near to the radius as in other species.

Length of fore wing 15 mm., width 5.5 mm.
From Bagio, Benguet, Philippines (Baker).

Spilosmylus ceylonensis Petersen

Petersen described the male; I have both sexes of what appears to be this species, and give the description of the female.

♀ Black; vertex with some red brown marks above; antennæ pale, basal joints dark; on pronotum and also mesonotum are small sharp tubercles or granules, each tipped with a hair; legs pale, front tibiæ with three dark dots above. Wings hyaline; venation pale, sometimes dotted with brown, and some cross-veins wholly brown or margined with brown, several of these spots near cubitus; stigma whitish, with dark at base; between subcosta and radius about six dark spots touching the veins, the last one paler, above these the costal cross-veins are brownish, and behind them there are faint brownish streaks across the wing; outer margin with some dark dots; at end of basal third on the hind margin is a brown tubercle or pupilla not one-half as long as in *S. tuberculatus,* and wholly dark. Hind wings with faint spots between subcosta and radius, the stigma, and some dots along outer margin brown. In fore wings there are two medio-cubital cross-veins before the median fork; between cubitus and its fork are fourteen to sixteen cross-veins; about fifteen cross-veins between radius and radial sector; radial sector with ten to twelve branches; first anal with six or seven branches to margin; in hind wings the base of median fork has the usual appendiculate veinlet.

Length of fore wing ♀ 17 to 19 mm., width 6.5 to 7.5 mm.
Length of fore wing ♂ 20 mm., width 7 mm.
Females from Kandy, Ceylon, May (E. E. Green).
Male from Ceylon (Nietner) Hagen Coll.

In both sexes the fork of the median is only a little before the first fork of the radial sector, not as far as Petersen figures; but I doubt that there are two species closely allied on Ceylon. The male has the pronotum striped and lines on subcosta and radius and between as Petersen describes.

Sericostomatidæ

Goera tagalica sp. nov.

Fig. 2.

♀ Face with a crest of stiff hairs inward of each eye, yellowish at base, brown beyond; basal joint of antenna with yellow hair, but brown hairs near base below, rest of antenna brown, faintly annulate with pale; vertex with dense erect yellow hair; palpi black-haired; thorax with long, erect yellow hair in middle and in front; abdomen dull brown above, more yellowish beneath; front legs mostly dark, others yellowish, the femora more or less brownish, spurs black. Fore wings densely clothed with golden hair, outer fringe black or brown, some black hairs along the veins, bare spot conspicuous; hind wings dark, with nearly black hair and fringes.

Basal joint of antenna long, plainly longer than in *G. conclusa.* In fore wing the first fork goes fully one-half way back on the discal cell, forks two and three equal, the bare space at thyridium rather larger than in *G. conclusa,* about as in *G. octospina.* In hind wing fork one is only equal to fork three, very much shorter than fork two; fork five is but little wider and scarcely longer than fork three. The last ventral segment has a very short, blunt, median spine, and a tiny spine each side of it.

Expanse 17 mm.

From Mt. Makeling, Luzon (Baker).

Differs at once from the two species known from the Philippines by the short fork one of hind wings.

Goerinella minor sp. nov.

Fig. 6.

Palpi pale yellowish, last joint of maxillary palpi white; basal joint of antennæ nearly black; vertex and thorax with brown hair. Legs pale; abdomen brown above, yellowish below, male genitalia very large, lower appendages three jointed, the second joint very large, superior appendages long, slender, up-pointed at tip. Wings short and broad, venation similar to *G. piscina,* but the end of thyridial cell is farther out, plainly beyond base of the discal cell. Scales of fore wing golden to brown, on the costa dense and dark brown; hind wing fumose, costal area hairy, the posterior fringes very long.

Expanse 10 mm.

From Mt. Makeling, Luzon (Baker).

Anisocentropus bellus sp. nov.

Fig. 8

Head, palpi, and first and second joints of the antennæ yellow, with yellow hair, rest of antennæ black, the tips of joints marked with white; thorax yellow, with yellowish hair; abdomen dark brown above, yellowish below; femora yellowish, tibiæ and tarsi brownish, hind tibia and basitarsus with long brown hair. Basal half of fore wings pale brown, with yellowish hair, beyond clothed with black hair, with a curved band of bluish or lavender scales nearly across before tip, then along outer margin, and bending up to about the middle of the pale base; in the enclosed area is another patch of these lavender iridescent scales, with two fingers reaching toward tip of wing; the black marginal fringe is interrupted with tawny spots; hind wings brown, darker at tips. The front tibiæ and tarsi are faintly curved. The wings are more elongate than in

A. magnificus or *A. illustris*, and the venation is not very distinct, but appears much like those species.

Expanse 24 mm.

From Mt. Makeling, Luzon (Baker).

Hydropsychidæ

Macronema caliptera sp. nov.

Fig. 9.

Head and palpi bright yellowish, about four basal joints of antennæ also, then several joints brown to black, then about three joints white, beyond brown, at first white annulate, but toward tip wholly brown. Thorax and pleura black, abdomen dark brown; front femora and tarsi pale, tibiæ brown, mid and hind femora dark, mid femur paler at tip, hind tibia dark brown, mid tibia pale, dark at tip, both tarsi pale on base, dark toward tip. Wings dark brown, much broken with pale, especially toward base, at apical third a nearly complete curved pale band, divided by hardly more than a line, a little before this is a pale band three-fourths way across, on hind margin a little before this is a small pale spot, basal part pale, longitudinally divided by a brown streak, and the hind margin dark, gradually fading within; on costal base is a yellow spot, followed by a black spot, which is extended obliquely into the pale; the two median dark bands have golden scales through their middle, not reaching hind border. Hind wings dark, tip almost black, just before tip on costal margin is a pale spot. The venation is similar to that of *M. radiatum* and *M. opulentum* with the median cell broad and truncate at base.

Expanse 20 mm.

From Mt. Makeling, Luzon (Baker).

Dipseudopsis spectabilis sp. nov.

Fig. 1.

Head black, on vertex behind and near eyes yellowish; basal joint of antennæ yellowish, beyond black; palpi black; pronotum and rest of thorax black; abdomen black above, pale beneath; legs and spurs pale, coxæ dark. Fore wings dark brown with several large pale areas, mostly yellowish, but one beyond anastomosis more hyaline; an oblique spot from basal hind margin and an elongate spot in front of it, a large spot on hind margin, mostly before arculus, and reaching up to medius, a smaller triangular spot above base of discal cell, an elongate spot in discal cell, and one in the cell behind it; behind the anastomosis two elongate streaks, one in area behind fork two, and other over most of fork four and some in cell behind, these streaks broadly connected at base, and neither reaching the margin. Hind wings pale brown; fork one in fore wing very short, fork three with a pedicel nearly one-half of its length; in hind wing fork two reaches back in a point to the discal cell; and the cross-vein from basal part of median cell reaches extreme base of fork five. The inner spur of hind tibia ends in three points, the outer one much the longer and stouter, the middle one quite short.

Expanse 22 mm.

From Sandakan, Borneo, C. F. Baker.

RHYACOPHILIDÆ

Rhyacophila carletoni sp. nov.

Fig. 7.

Yellowish; head and thorax with mostly pale yellowish hair; antennæ pale, scarcely annulate with dark; palpi rather long and very slender. Legs pale, the tibiæ and part of tarsi darker, spurs pale; abdomen dark above, pale beneath. Fore wings pale, with many brown spots, mostly small and scattered, a large one over base, a prominent oblique one over middle of anal area, another, smaller, above the end of anal vein, several more or less connected spots near stigma, outer margin alternately brown and pale; hind wings scarcely infumate. In fore wings fork one barely longer than two, fork three long, about four times as long as pedicel, the connecting veinlet out on fork two, fork four as far back as fork two, and fork five fully as far back as base of discal cell. In hind wings forks one and two equal, fork three fully four times as long as its pedicel.

Expanse 30 mm.

From Kooloo, North India (Carleton coll.).

Explanation of Plate 5.

Fig. 1. *Dipseudopsis spectabilis*, fore wing.

Fig. 2. *Goera tagalica*, tip of abdomen, and spines of last ventral segment.

Fig. 3. *Ectopsocus æthiops bakeri*, fore wing.

Fig. 4. *Eophanes formosa*, prothorax and head.

Fig. 5. *Madrasta handlirschi*, venation at apex of hind wing.

Fig. 6. *Goerinella minor*, genitalia side, and lower appendage from below.

Fig. 7. *Rhyacophila carletoni*, genitalia side.

Fig. 8. *Anisocentropus bellus*, fore wing.

Fig. 9. *Macronema caliptera*, fore wing.

PROCEEDINGS OF THE CAMBRIDGE ENTOMOLOGICAL CLUB

Ten meetings were held in 1930, including one special meeting in September. The programs were as follows: Jan. 14, Dr. F. M. Carpenter, "A Review of our Present Knowledge of the Geological History of the Insects." Feb. 11, Mr. P. J. Darlington, Jr., "Notes on Northern Colombia and its Insects." March 11, Dr. J. Bequaert, "Some Notes on the Entomology of Yucatan"; Mr. W. S. Creighton, "Remarks on the Ant Genus Myrmoteras." April 8, Mr. W. J. Clench, "Notes on the Insect Fauna of Navassa"; Mr. J. H. Emerton, "Notes on Spiders." May 13, Dr. M. Hertig, "The Phlebotomus Sand-flies, Their Medical Importance." June 10, Mr. G. S. Tulloch, "Mosquito Control in Massachusetts." Sept. 9, Summer Collecting Notes. Oct. 14, Dr. J. Bequaert, "The Characters and Distribution of the North American Hornets and Related Wasps." Nov. 11, Mr. D. L. Collins, "Phototropic Reactions of Certain Moths"; Dr. F. M. Carpenter, "Notes on a New Genus of Mecoptera." Dec. 9, Prof. N. Banks and Dr. F. M. Carpenter, "An Entomological Trip to the Carolina Mountains."

During 1930, the club lost four members by death. Two of the deceased, Mr. George Dimmock and Mr. J. H. Emerton, were charter members of the club. Five new members were elected, bringing the total membership to 92.

RICHARD DOW, Secretary.

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ANTS COLLECTED ON CAPE COD, MASSACHUSETTS

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The list below represents the results of collections made each summer from 1925 to 1930 inclusive. Ants have been recorded from Cape Cod by Wheeler (1906, 1910, 1913); these records have not been reproduced in the present list except where they represent localities or forms not included in my own collections.

All available records are included, even for the commoner ants, with the result that a rough estimate of the frequency of a species on the Cape may be made by noting the number of localities from which it has been taken. The dates given represent the extremes between which winged queens or males have been collected. Dates in parentheses are from neighboring portions of eastern Massachusetts when these extend the limits found for Cape Cod.

The list as given cannot be supposed to represent the entire fauna of the region. Three forms in particular were expected and carefully searched for, without success—*Lasius aphidicola*, *L. interjectus*, and *Camponotus caryæ*. They are certainly either absent or much less common than in neighboring portions of the mainland. Other forms that may be expected are *Pheidole pilifera* (recorded by Wheeler from Naushon) and *Tetramorium cespitum* (which I have taken at Rochester, only a few miles from the Cape).

Cape Cod apparently represents the northern limit, or very nearly so, for the range of several ants: *Monomorium minimum, Aphaenogaster treatæ, Leptothorax davisi, Pren-*

olepis parvula, and *Formica difficilis. Lasius neoniger, Formica argentea, F. subænescens,* and *Camponotus noveboracensis* here approach their southern limits at low elevations in the eastern states.

This list may be compared profitably with Wheeler's lists for New England (1906), Nantucket (1928a), and Penikese (1926), and with Davis and Bequaert's list for Long Island and Staten Island (1922).

1. *Stigmatomma pallipes* Haldeman. East Falmouth Waquoit, Mashpee. (Naushon, August 31). This species is usually found in the beech-holly association that occurs sporadically in eastern Massachusetts.

2. *Ponera coarctata pennsylvanica* Buckley. East Falmouth, Brewster. Woods Hole (Wheeler 1906). Much less common than in the New York region.

3. *Monomorium minimum* Buckley. Woods Hole, Waquoit, Pocasset, South Yarmouth, North Eastham, South Wellfleet, Truro. July 15 (mating flight). Common in sand; also nests on the mounds of Formica exsectoides. I have found it only in the latter situation in northern New Jersey.

4. *Solenopsis molesta* Say. Woods Hole, West Falmouth, Sandwich.

5. *Crematogaster lineolata* Say. Woods Hole, Falmouth, East Falmouth, Pocasset, Sandwich, Hyannis, South Harwich, South Chatham, Brewster, South Orleans, Truro. July 24-August 29 (Rochester, July 22).

6. *Myrmecina graminicola americana brevispinosa* Emery. Woods Hole. Two specimens, under fallen leaves.

7. *Aphaenogaster treatæ* Forel. Woods Hole, Brewster. Darker colored than specimens from Mississippi.

8. *A. fulva aquia* Buckley. Woods Hole, East Falmouth, Waquoit, Pocasset. August 6-18.

9. *A. fulva aquia picea* Emery. Woods Hole, East Falmouth, Waquoit, Brewster, Provincetown. July 15-September 8.

10. *Myrmica punctiventris* Roger. Woods Hole, East Falmouth, Waquoit, Mashpee. September 7-13. (Fairhaven, August 13). Mating flight, September 13. Common in old nuts and galls and under fallen leaves.

11. *M. lævinodis bruesi* Wheeler. Woods Hole. July 29-August 28. This form was described from specimens taken in the woods adjoining the Fay Rose Gardens. It is now the dominant ant in these woods. but I have been unable to find a single specimen in any other place. The numerous nests seem to represent branches of a single family, since transfers of workers never lead to fighting—in spite of the fact that the species is very pugnacious and has the most painful sting of any ant I have encountered in the northeastern states.

12. *M. scabrinodis sabuleti* Meinert. Woods Hole, Falmouth, Falmouth Heights, East Falmouth, Pocasset, Truro. August 14-September 6.

13. *M. scabrinodis schencki emeryana* Forel. Woods Hole, Sandwich, South Harwich, Chatham.

14. *Harpagoxenus americanus* Emery. Woods Hole, West Falmouth, Sandwich. July 12-August 14. Sexual pupæ still present August 14. Found with Leptothorax curvispinosus and with L. longispinosus. I have taken this at three other unrecorded localities—Mendham, New Jersey; Cold Spring Harbor, Long Island, New York; Fairhaven, Massachusetts.

15. *Leptothorax longispinosus* Roger. Woods Hole, East Falmouth, Sandwich, Mashpee.

16. *L. curvispinosus* Mayr. Woods Hole, Falmouth, West Falmouth, Waquoit, Mashpee, Provincetown. August 1-7. Sexual pupæ present, July 4-August 7. Common in old acorns, nuts and hollow twigs.

17. *L. curvispinosus ambiguus* Emery. Woods Hole, Falmouth.

18. *L. texanus davisi* Wheeler. South Wellfleet. One nest, in white sand.

19. *Dolichoderus plagiatus* Mayr. Waquoit.

20. *D. plagiatus inornatus* Wheeler. Chatham.

21. *Tapinoma sessile* Say. Woods Hole, Falmouth, East Falmouth, Pocasset, Sandwich, Cotuit.

22. *Brachymyrmex heeri depilis* Emery. Woods Hole, South Orleans. August 22-23.

23. *Prenolepis imparis* Say. Woods Hole, Falmouth, East Falmouth, Waquoit. August 17. This form is apparently common, but is not easily found in mid-summer—as is also true in the New York region.

24. *P. parvula* Mayr. East Falmouth, Pocasset, South Wellfleet. August 29. This species is easily overlooked and may be commoner than is indicated.

25. *Lasius niger neoniger* Emery. Woods Hole, Falmouth, Falmouth Heights, Chatham, Truro. July 24-September 3. This form is not clearly distinct from americanus in this region. I have identified all the intermediates as americanus; I am inclined to suspect that the extreme hairy specimens listed here are not really distinct from the paler form of americanus referred to below.

26. *L. niger alienus americanus* Emery. Woods Hole, Falmouth, Falmouth Heights, West Falmouth, East Falmouth, Pocasset, Sandwich, Hyannis, South Yarmouth, South Chatham, Chatham, Brewster, North Eastham, South Wellfleet. July 11-September 30. There appear to be two distinct forms here—a darker form typically nesting in stumps and logs in the woods, not found infested with Mermithids; and a paler form typically nesting in the soil in sunny places (often on the beaches down to high-tide level), frequently producing short-winged mermithogynes (see Wheeler 1928). In the absence of adequate series from the Palæarctic region and from the western states, I am unable to make a thorough revision of the forms of niger—without which it seems to me undesirable to describe and name these types.

27. *L. brevicornis* Emery. Woods Hole, West Falmouth. August 19-September 30. I have once found mermithogynes in this species (see Wheeler 1928).

28. *L. flavus nearcticus* Wheeler. Woods Hole, Waquoit, Sandwich, Cotuit. August 13-September 8.

29. *L. latipes* Walsh. Woods Hole, Falmouth, Mashpee. Hyannisport (Wheeler). August 12-September 8. (Rochester, July 22.) Both the A and the B type of females occur on Cape Cod.

30. *L. claviger* Roger. Woods Hole, Falmouth Heights, Pocasset, Mashpee, South Chatham, Chatham. August 22-26.

31. *Formica sanguinea rubicunda* Emery. Cotuit. Woods Hole (Wheeler). (Rochester, July 22.) The only nest I have found on Cape Cod had F. subænescens slaves.

32. *F. sanguinea subintegra* Emery. Woods Hole, West Falmouth, Waquoit, Mashpee. August 17-19. I have observed raids on August 6, and (on Naushon) August 25. Two colonies moving to new nest-sites were observed, August 12 and 15. All the slaves observed on Cape Cod have been *F. subsericea.*

33. *F. exsectoides* Forel. Woods Hole, Falmouth, East Falmouth, Waquoit, Mashpee, Chatham. August 22.

34. *F. difficilis* Emery. Hyannis.

35. *F. difficilis consocians* Wheeler. West Falmouth. Woods Hole (Wheeler). July 18. The one nest that I have found on Cape Cod contained numerous larvæ of Microdon.

36. *F. truncicola integra* Nylander. East Falmouth, Mashpee, South Harwich. August 6.

37. *F. truncicola obscuriventris* Mayr. Woods Hole, Pocasset. August 2. (Fairhaven, May 28.)

38. *F. fusca argentea* Wheeler. Woods Hole, Falmouth, Falmouth Heights, West Falmouth, Sandwich, Chatham,

Truro. Cotuit (Wheeler). July 24. This form is common on the beaches and sand-dunes. I have taken it at Guilford, Connecticut, but it has not been found on Long Island.

39. *F. fusca subænescens* Emery. Mashpee, Cotuit. (Fairhaven, August 13.)

40. *F. fusca subsericea* Say. Woods Hole, Falmouth, West Falmouth, East Falmouth, Waquoit, Pocasset, Mashpee. July 15-August 20. (Naushon, August 31.)

41. *F. neogagates* Emery. Woods Hole, Sandwich, Mashpee, Truro. (Rehoboth, August 18.) The specimens from Sandwich were in a nest that also contained the following form, and that was situated on the edge of a sand-dune. This species typically forms small colonies under stones in woods.

42. *F. neogagates lasioides vetula* Wheeler. Falmouth Heights, Pocasset, Sandwich, South Wellfleet. Woods Hole (Wheeler). This form nests on the edges of sand-dunes or salt-marshes.

43. *F. pallidefulva schaufussi* Mayr. Woods Hole, Falmouth.

44. *F. pallidefulva schaufussi incerta* Emery. Woods Hole, Falmouth, East Falmouth, West Falmouth, Waquoit, Pocasset, Sandwich, South Yarmouth, Chatham, South Wellfleet, Truro. July 15-18. (Rochester, July 22.)

45. *F. pallidefulva nitidiventris* Emery. Woods Hole, Falmouth, West Falmouth, East Falmouth.

46. *F. pallidefulva nitidiventris fuscata* Emery. Mashpee. Woods Hole (Wheeler).

47. *Polyergus lucidus* Mayr. Falmouth, West Falmouth. The slaves in both nests were F. incerta.

48. *Camponotus castaneus* Latreille. West Falmouth. August 7.

49. *C. castaneus americanus* Mayr. Woods Hole, Waquoit, Mashpee. August 14.

50. *C. herculeanus pennsylvanicus* Degeer. Woods Hole, Sandwich, Mashpee, North Eastham. August 16-27. (Naushon, August 30.)

51. *C. herculeanus pennsylvanicus mahican* Wheeler. Woods Hole (Wheeler). I have been unable to find this form.

52. *C. herculeanus pennsylvanicus ferrugineus* Fabricius. Woods Hole. One queen and two workers, taken separately.

53. *C. herculeanus ligniperda noveboracensis* Fitch. Woods Hole, Waquoit, Mashpee, Hyannis, Chatham. July 4. Common in logs about sandy ponds, where it replaces pennsylvanicus. At Woods Hole it is much less common than pennsylvanicus; on Naushon pennsylvanicus is still more frequent, but I have not found *noveboracensis*.

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CONCERNING SOME ANT GYNANDROMORPHS

By William Morton Wheeler

I. *Dinergatandromorphs*

In the twenty-sixth volume of Psyche (1919) I described and figured a peculiar gynandromorph of *Camponotus* (*Colobopsis*) *albocinctus* Ashmead from the Philippines and designated it as a "dinergatandromorph" because the left half of its head was that of a male. This individual, therefore, was unlike all previously described ant gynandromorphs, which are combinations either of male and female or of male and worker components. The correctness of my interpretation was doubted by Santschi (1920) and Emery (1924). The latter conjectured that what I had taken to be the soldier half of the head was really a generalized female-worker component, but I gave reasons (1928) for adhering to my original interpretation. Additional considerations might be adduced, but this is no longer necessary, because Vandel (1931) has just published a very careful account of a dinergatandromorph of *Pheidole pallidula,* in which the union of soldier (right-sided) with male (left-sided) characters in the head is even more extraordinary than in my specimen of *Camponotus albocinctus.* The more striking character of Vandel's specimen is due, of course, to the much greater differentiation in the shape of the head of the normal soldier, worker and female castes of Pheidole. The body and right side of the head in the specimen are very clearly those of a soldier, and as in the Camponotus, there is no median ocellus, which should be present if that region of the head were female. The bearing of the two cases on the opposed blastogenic and trophogenic hypotheses of the origin of castes in ants, is obvious. The anomalies under discussion must have arisen either in the egg or during the larval stage. On the former supposition, the soldier like the male component would be blastogenic and the anomaly would be due to unusual nuclear (chromosomal) or other conditions in the unsegmented or just segmented egg; according to the blastogenic hypothesis, the soldier component would be due either to special feeding of the undifferentiated female portion of a germinally determined gynandromorphous organism, or to some shock or other injury to certain tissue areas of the larval or prepupal soma, as in the butterfly gynandromorphs produced by van Someren.

II. *Anteroposterior Gynandromorphs*

Vandel, while discussing the various hypotheses that have been framed by Boveri, Morgan, Doncaster, myself and others to account for gynandromorphs, calls attention to certain ambiguous cases which may be interpreted either as functional ergatomorphic males or as anteroposterior gynandromorphs, that is, as pathological individuals having the anterior part of the body of the worker type and the gaster and genitalia male. The following are cases of this description:—

(1) Santschi (1921) described three specimens of *Cataglyphis albicans* Rogers, taken by Théry in a single locality in Morocco, as having the head and thorax of the worker type, but the gaster and well-developed genitalia male. The head, however, was small and furnished with male ocelli. Santschi was unable to decide whether these specimens were gynandromorphs or normal ergatomorphic males of their species. The fact that some species of Cataglyphis have no marriage flight and have males with rather short wings and that there were three of the peculiar specimens seemed to indicate that they were ergatomorphic males. The number of individuals is not important in this connection since in two other cases recorded in the sequel three undoubted gynandromorphs were taken from the same nest.

(2) Mayr, in 1868, described a peculiar hermaphrodite ("Zwitter") specimen of *Iridomyrmex constrictus* Mayr,

a fossil ant from the Baltic amber. I reëxamined and figured this insect in 1914. It has a typically worker head and thorax and a normal male gaster with well-developed genitalia, but the eyes are large and the antennæ are 13-jointed and therefore male. The specimen, therefore, resembles Santschi's specimens of Cataglyphis even in having some male cephalic characters.

(3) Lomnicki (1914) found in the same colony three very similar specimens of *Myrmica rugulosa,* with the anterior part of the body as far back as the gaster predominantly female and the gaster male, but with poorly developed genitalia (small in one specimen, retracted and invisible in the others).

Lomnicki's specimens are evidently anteroposterior gynandromorphs, though they exhibit some admixture of maleness in the anterior portion of the body, and perhaps of femaleness in the reduced size of their male genitalia. The Cataglyphis and Iridomyrmex cases are also, I believe, anteroposterior intersexes or gynandromorphs which may, perhaps, have become the only males of their respective species. My reasons for this opinion, developed in my paper on intercastes (1928, p. 229 et seq.), are derived mainly from a consideration of the peculiar conditions in the genus Ponera. Some species of these ants (*P. ergatandria* Forel, *P. punctatissima* Roger, *P. mina* Wheeler) have males exactly like the workers, except for the genitalia, while one Mediterranean species, *P. eduardi* Forel, has, in addition to the usual winged male an ergatomorphic male with worker thorax and abdomen but with the head and genitalia male. The ergatomorphic male of *P. punctatissima* was originally described by Roger as *P. androgyna.* These ergatomorphic males are therefore transverse, or anteroposterior gynandromorphs which function as the regular males of the species. Additional support for this statement is furnished by three extraordinary specimens of *P. coarctata pennsylvanica* Buckley, which Professor Clarence H. Kennedy has generously sent me for examination and which he or Miss H. Sheldon will describe in detail. They were taken from a colony nesting in a white oak log on a sand-dune on Point Pelee Island, Ontario, in Lake Erie, and are remarkably alike, having black heads of the male type, though the antennæ are 12-jointed, except in one specimen which has the left antenna 13-jointed. The thorax and abdomen in all of them is pale brownish-yellow, like the color of callow workers. In two the genitalia are purely female, with small though normally developed sting; in the other a similar sting is combined with male genitalia appendages! Since the only known males of *P. pennsylvanica* are of the usual winged type with the body black throughout, we must regard Professor Kennedy's specimens as anteroposterior gynandromorphs. The specimen with hermaphrodite external genitalia is obviously intermediate between such a form as the normal ergatomorphic male of *P. eduardi,* which has a head of the male type with 13-jointed antennæ, and the two other specimens with exclusively worker abdomen and developed sting. The suppression of the sting in the former specimen would convert it into an ergatomorphic male, and if its testes were sufficiently developed it would be essentially like the normal ergatomorphic male of *P. eduardi.*

III. *Additions to the List of Known Ant Gynandromorphs*

In 1929 Donisthorpe listed the known ant-gynandromorphs and gave their number as 49. Vandel has eliminated from this list Santschi's Cataglyphis as a doubtful case (Donisthorpe included only one of the three cases mentioned in Santschi's paper), and has added the two peculiar *Myrmica ruginodis* Nyl. gynandromorphs described by Emery in 1924 (overlooked by Donisthorpe) and his Pheidole dinergatandromorph, thus making the total number of known ant gynandroromphs 51. Donisthorpe, however, omitted a Cardiocondyla gynandromorph described by Swezey in 1926. I have examined this insect in the collection of the Hawaiian Sugar Planters' Experiment Station and have found it to belong to *C. wroughtoni* Forel var. *hawaiiensis* Forel, and not to *C. nuda minutior* Forel, as Swezey supposed. The specimen, which was taken in a compost heap in the garden of the Experiment Station at Honolulu, is a normal female, except that the left eye is decidedly larger and the left antenna of the male type and 13-jointed. In the same collection I discovered a second very similar gynandromorph of the same variety, taken on a window pane in Honolulu. This individual, too, has a larger left eye but the left antenna, though decidedly of the male type, has only 12 joints. Probably the normal male of *C. minutior* has 13-jointed antennæ, but a specimen in the same collection was found to have both antennæ 12-jointed. Adding these two Cardiocondyla gynandromorphs and Professor Kennedy's three Ponera gynandromorphs, the list of these anomalies now totals 56, or if we regard Santschi's three specimens of Cataglyphis and Mayr's Iridomyrmex as anteroposterior gynandromorphs rather than ergatomorphic males, we have 60.

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THE ANT *CAMPONOTUS* (*MYRMEPOMIS*) *SERICEIVENTRIS* GUÉRIN AND ITS MIMIC

By William Morton Wheeler

Camponotus (*Myrmepomis*) *sericeiventris*, owing to its size, wide distribution and dense covering of silver or golden pubescence, is one of the handsomest and most conspicuous ants of the American tropics. It has not been carefully studied, however, though it was originally described a century ago[1] and has since been repeatedly noticed by myrmecologists. When some years ago the huge and unwieldy genus Camponotus was divided into subgenera, *sericeiventris*, together with several species from the Ethiopian and Malagasy Regions, was assigned by Forel to the subgenus Myrmepomis. Later I transferred all the species, except *sericeiventris*, to my subgenus Myrmopiromis, thus leaving Myrmepomis as a monotypic group. In 1907 Forel[2] distinguished a subspecies *rex*, and published some remarks on its distribution and that of the typical form. On recently revising all the specimens that have been accumulating for many years in my collection and in the Museum of Comparative Zöology, I find that there are several varieties of each of the two forms and that workers of both exhibit a peculiar polymorphism. There are not only major, media and minima phases, but a distinct maxima which has not been described. Its head is decidedly larger and somewhat differently shaped from that of the

[1] As *Formica sericeiventris* by Guérin-Méneville (in Duperry, Voyage de le Coquille. Zool. Vol. 2, 1830, p. 205). It was described and figured three years later by Perty (Delectus Anim. Articul. 12, 1833, p. 134) as *Formica cuneata*.

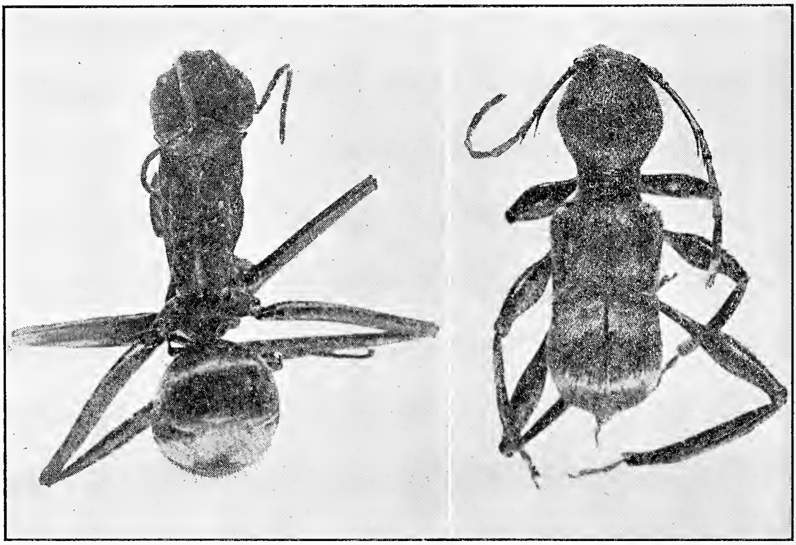
[2] Formiciden aus dem Naturhistorischen Museum in Hamburg. II Feil. Mitteil. Naturh. Museum Hamb. 26, 1907, p. 13.

major and has shining sides. I have seen the females of some of the forms, but the male is still unknown.

The typical *sericeiventris,* originally described from Rio de Janeiro, is less widely distributed than has been supposed. It occurs in Brazil, Paraguay, Uruguay and portions of the Argentine, but I have seen no specimens from the Guianas or Venezuela. It is recorded also from Peru, Ecuador, Colombia and Mexico, but the specimens in my collection from these countries, like those from Panama and other Central American localities, have more brilliantly colored appressed pubescence and represent a distinct variety which I have called *satrapa.* I suspect that Forel has identified some of them as belonging to *rex.* The typical form of this beautiful subspecies occurs in Central America, especially Guatemala, but has varieties in Honduras and Mexico. All the records I have been able to find are cited under the descriptions of the various forms.

Colonies of *sericeiventris* and *rex* are fairly populous. They nest in decayed portions of standing tree-trunks some distance above the ground. I have found several such nests, usually in mango or Celtis trees, in Panama, Costa Rica and Guatemala. The workers are very aggressive and the maximæ are able to bite severely. The smaller workers are often seen ascending and descending the trunks of trees even in bright sunlight. Occasionally this ant is introduced into the United States on fruit boats. Mann found specimens of *sericeiventris* in a restaurant at Palo Alto, California, and I have received two specimens of *rex,* taken by Mr. F. M. Schott in New York City on a boat from Panama. In both cases the specimens probably arrived as stowaways in bunches of bananas.

Some years ago Dr. J. Bequaert gave me several peculiar Cerambycid beetles which he had taken June 4, 1924, on tree trunks at Prieta, Honduras, in company with workers of *C. sericeiventris rex* var. *semirex.* The beetles so closely resemble the ants that they may be regarded as highly mimetic. In an article in the present number of Psyche, Dr. W. S. Fisher has described the beetle as *Eplophorus velutinus* sp. nov., and I have inserted below a photograph made by Dr. F. M. Carpenter (Fig. 2). The beetle's body is black, with short golden pubescence on the posterior half of the prothorax and anterior half of the elytra. The latter are distinctly constricted in front of the middle, where they have on each side an oblique ivory yellow and a larger black fascia. The golden pubescence anterior to the constriction is sparse, like that on the prothorax, but the convex posterior portion is covered with dense, longitudinal appressed pubescence of a brilliant golden hue. There is a



Figures 1 and 2. 1. *Camponotus sericeiventris rex* var. *semirex*. 2. *Eplophorus velutinus* Fisher.

pair of lateral, velvety black spots on the prothorax, and the tibiæ, especially the hind pair are peculiarly flattened as in the ant. The beetle's head and prothorax together represent the ant's head, with the pair of black spots simulating the eyes, and the elongated third joint of the antennæ the scapes; the anterior portion of the elytra resembles the ant's thorax and the posterior portion its gaster. The ivory and black fasciæ give the illusion of the pronounced constriction at the ant's petiole. As in other cases, all this striking mimetic resemblance disappears under a high magnification like that of the photographs. (Figs. 1 and 2.)

The literature contains references to several other ant-mimicking Cerambycids. Belt,[1] who was one of the first to notice such forms, says that "amongst the longicorn beetles of Chontales, *Mallocera spinicollis, Neoclytus Oesopus* and *Diphyrama singularis* Bates, all closely resemble stinging ants when moving about on fallen logs." Bedel[2] in 1885 described a small longicorn as *Pseudomyrmeceon ramalium,* taken in Eastern Algeria on the twigs of *Quercus Mirbecki* D. R. in company with workers of Crematogaster, very probably *S. scutellaris* Oliv., which it closely resembles in size and coloration. Bedel remarks that the beetle's "form, coloration and gait give it, when alive, a singular resemblance to the ants of the genus Crematogaster, and since it is commonly found in their midst, it is easily confounded with them." Our North American fauna also contains a number of Cerambycids, notably species of Clytanthus, Euderces, Cyrtophora and Tillomorpha, which resemble ants in size, shape, coloration and behavior. The resemblance is very striking in two other forms, *Cyrtinus pygmæus* Haldem., which occurs on dead wood among small ants, such as *Lasius americanus* Emery, and the Carolinian *Michthysoma heterodoxum* Lec., which, in life, according to Beutenmüller, extraordinarily resembles small workers of the carpenter ant, *Camponotus pennsylvanicus* Deg.

The following table may serve in identifying the workers of the various subspecies and varieties of *C. sericeiventris:*

Appressed pubescence on body yellowish gray, or pale golden yellow, at the posterior borders of the gastric segments strongly converging to the mid-dorsal line; head of maxima worker longer than broad, its sides only feebly convex, slightly shining, rather densely and finely punctate; pronotal spines acute, longer than broad in all the worker forms
subsp. *sericeiventris* Guérin, 2

[1] The Naturalist in Nicaragua, London, 1874, p. 315.
[2] Ann. Soc. France, 1885, p. cxxxi.

Appressed pubescence longer, coarser and more golden, dull ochraceous or brownish, feebly or indistinctly convergent at the posterior borders of the gastric segments; head of maxima as broad as long, with more convex or swollen cheeks, its sides more extensively smooth and shining and only sparsely and superficially punctate; pronotal spines short and blunt even in the small workers ....subsp. *rex* Forel, 5

2. Gaster and legs deep reddish......var. *holmgreni* var. nov.
Gaster and legs black 3

3. Head of maxima extensively deep red on sides, with rounded lateral borders, the posterior border very deeply excised and the posterior corners narrowed in the major worker; border of petiole much compressed and very sharp; pubescence golden ochraceous, rather sparse on head and thorax......var. *otoquensis* var. nov.
Sides of head of maxima worker black or only slightly reddish, feebly shining, less deeply excised behind......4

4. Appressed pubescence on body silvery, often with a slightly golden hue; border of petiole not produced upward in the middle................*sericeiventris* (typical)
Sides of head of maxima somewhat smoother and more shining; appressed pubescence on body more distinctly and more vividly golden; border of petiole usually produced in the middle as a small blunt tooth
var. *satrapa* var. nov.

5. Pubescence brilliantly and deeply golden, very dense on the thorax and posterior portion of the head, present even on the coxae and petiole....subsp. *rex* (typical)
Pubescence less developed, except on the gaster.............6

6. Pubescence dull ochraceous, dense on the pronotum but poorly developed on the sides of the thorax; sides of head of maxima worker red...
....var. *cualatensis* var. nov.
Pubescence on gaster more deeply and more vividly golden, more as in the typical *rex* 7

7. Pubescence on head, thorax and petiole bright golden yellow but much shorter than in typical *rex* var. *semirex* var. nov.
   Sides of thorax almost or quite devoid of pubescence....8

8. Pubescence dull, golden ochraceous present on vertex, pronotum and petiole............ var. *zacapensis* var. nov.
   Pubescence absent on head, thorax and petiole, on gaster golden ochraceous...............var. *quiriguensis* var. nov.

Camponotus (Myrmepomis) sericeiventris Guérin

Worker maxima. Length 15-16.5 mm.; head 5-5.7 mm. long; 4.5-5.2 mm. wide; hind tibia 5.6 mm.

Head with rather straight sides, without swollen cheeks; subopaque except the sides and gular surface which are reddish and shining, but covered with minute punctures; antennal funiculi dark brown. Spines of pronotum rather sharp, longer than broad. Superior border of petiole sharp, entire and broadly rounded, angulate on the sides. Appressed pubescence not very abundant and not completely concealing the integument on the head, meso—and epinotum, petiole and sides of pronotum; denser on the gaster where it strongly converges at the posterior borders of the segments. Hairs rather long, black, often with white tips; posterior borders of gastric segments with whitish or yellowish hairs.

Workers major, media and minor. Length 7-13 mm.

Resembling the maxima, except in the smaller head and longer and more acute pronotal spines.

Female. Length 17-19 mm.; hind tibia 5 mm.; fore wing 17 mm.

Head smaller and narrower than in the worker maxima, with narrower posterior corners and less convex sides, nearly as broad in front as behind. Color and sculpture similar, but in some specimens the anterior half as well as the sides is red. Pronotal spines reduced to two small teeth.

Mesonotum and scutellum smooth and shining, often reddish, the former as broad as long. Epinotum with short, rounded base and long sloping declivity. Petiolar border notched in the middle, its angulate corners more pronounced and acuminate than in the workers. Pubescence and pilosity similar, short on head and thorax, absent on anterior portion of pronotum and on the scutellum. Wings distinctly brownish, with brown veins bordered with darker brown.

Brazil: Rio de Janeiro, type-locality (Thayer Exped.; J. C. Bradley; C. O. Lovén); Abuna, Rio Madeira (Mann and Baker); Sao Paulo (H. von Ihering); Island of Sao Sebastiao; Raiz da Serra; Jundiahy; Bauru and Piracicaba, in the state of Sao Paulo (H. Luederwaldt); Rio Negro, Amazonas (Ducke); Rio Doce, Espiritu Santo (M. Caullery); Sao Leopoldo (J. W. Stahl); Rio Grande do Sul (C. Lindman); Blumenau; Taquara, Santa Catharina (H. von Ihering).

Uruguay (*teste* Forel).

Paraguay: Encarnacion (J. C. Bradley); San Bernardino (Fiebrig); Aregua (Zürcher).

Argentina: Chaco, Corrientes and Misiones (C. Berg); Misiones (Mme. von Steiger).

Var. **satrapa** var. nov.

Worker maxima. Length 14-15 mm.; head 4.8 mm. long, 4.4 mm. wide; hind tibia 5 mm.

Very similar to the typical *sericeiventris* but somewhat smaller and with more brilliant, golden pubescence, longer and denser on the vertex, thorax and petiole; hairs blackish at base, with yellow tips. Sides of head blackish or dark brown, smoother and more shining, their punctures sparser. Border of petiole usually produced or subdentate in the middle.

Workers major, media and minor. Length 6-13 mm.

Very similar to the corresponding phases of the typical *sericeiventris* but the pubescence is more golden, as in the maxima, and the petiolar border is usually more or less distinctly subdentate in the middle.

Female. Length about 16 mm.

Closely resembling the female of the typical *sericeiventris* but with entirely black head and thorax, the former more deeply excised behind and with much smoother and more shining sides, the petiolar border without a median notch and with less produced lateral corners. Wing membranes distinctly more deeply infuscated. Appressed pubescence more golden as in the worker *satrapa,* and the convergence of the pubescence on the second and third gastric segments even more pronounced than in the typical *sericeiventris.*

I have seen specimens of this form, which has been confused with the true *sericeiventris,* from nearly all the following localities:

Panama: Barro Colorado Island, type locality (Wheeler; N. Banks; P. Rau; W. C. Allee; P. Haskins); Rio Chenillo (Wheeler); David (C. Richter).

Colombia: (Lindig); (Tischbein; Forel); Antioquia (Nisser; Kraemer); Puerto de los Pobres, Antioquia (O. Fuhrmann).

Ecuador: Santo Domingo de los Colorados and between San Nicolas and Guanasilla (P. Rivet).

Peru: Santa Ana, 3,000 ft. (Yale Peruv. Exped.); Upper Pachitea (J. C. Bradley).

Brazil: Puerto America, Rio Putumayo (J. C. Bradley).

Costa Rica: (Tonduz); Port Limon (Wheeler; F. C. Paulmier); Turrucares (P. P. Calvert); Turrucares and Hamburg Farm (C. W. Dodge); Rio Raventazon, Santa Clara (P. Biolley); near San Jose (H. Schmidt).

Honduras: Ceiba, Lombardia; Carmelina, Progresso, Tela (W. M. Mann).

Var. **holmgreni** var. nov.

Worker major. Length 12 mm.

Very similar to the typical *sericeiventris,* but the funiculi, corners of the head, the gaster and legs are deep red.

The appressed pubescence is somewhat coarser and more yellowish and on the head and thorax somewhat longer than in the typical form of the species.

Worker minor. Length about 8 mm.

Colored like the worker major but the red coloration is more extensive, involving also the scapes, gula, sides of pronotum, petiole and coxæ.

Two major and a single minor worker taken by Dr. N. Holmgren at Tuiche, Bolivia and belonging to the Stockholm Museum.

Var. **otoquensis** var. nov.

Worker maxima. Length 13-14 mm.; head 4.5 mm. long, 4 mm. wide; hind tibia 5 mm.

Head narrowed behind at the posterior corners, which are narrow and very prominent; posterior border deeply concave; sides extensively and gula deep red, smooth and shining, with very fine, superficial punctures. Pronotal spines acute. Upper border of petiole strongly compressed, in some specimens irregular in outline, in others deeply excised in the middle. Appressed pubescence very dull yellow, shorter and less abundant on head, thorax and petiole than in the var. *satrapa.* Legs somewhat brownish.

Workers major and media. Length 10-12 mm.

Like the maxima in color and pubescence, except that the sides of the head are deep brown or black.

Described from a series of workers taken by myself Nov. 19, 1911 from a nest in the decayed portion of a large mango tree on Otoque Island, about 30 miles from the City of Panama.

Subsp. **rex** Forel.

Worker maxima. Length 13-14 mm.; head 4.5 mm. long and 4.5 mm. broad; hind tibia 5.2 mm.

Differing from the maxima worker of *sericeiventris* in its somewhat more robust stature, in having the head as broad as long, with more convex, or swollen cheeks, the pronotum with short, very blunt spines, the meso- and metanotum less strongly compressed above, the petiole with blunt, broadly rounded superior border and more obtuse lateral angles, the flattened tibiæ somewhat broader. The appressed pubescence is coarser, longer and denser, deep golden yellow, feebly or indistinctly converging to the mid-dorsal line at the posterior borders of the gastric segments. Hairs abundant, on the head and thorax, black with deep fulvous tips, on the gaster fulvous throughout. Head and mandibles deep red, vertex blackish, sides, clypeus and gula shining and very finely punctate, the posterior corners with several short impressed line-like punctures.

Workers major, media and minor. Length 8-12 mm.

Resembling the maxima, except in having the head smaller and black throughout, the appressed pubescence, however, even more abundant, covering the thorax, coxæ, petiole and posterior half of the head as well as the gaster. Pronotal spines short and blunt, petiole with obtuse superior border as in the maxima.

Female (undescribed). Length 16-17 mm.; fore wing 15.5 mm.

Resembling the worker maxima, but head slightly longer than broad, subtrapezoidal, with rather straight sides and feebly excavated posterior border; the sides, clypeus and gula smooth and shining, deep red, as are also the mandibles. Pronotum with small blunt projections instead of the spines. Petiole shaped as in the maxima. Pubescence, especially on the head and thorax somewhat shorter. Scutellum and anterior portion of mesonotum smooth and shining, without pubescence. Wings colored as in the typical *sericeiventris*.

Costa Rica: Pacuarito, type-locality (W. Paap).

Guatemala: Champerico, Corinto and San Benito (R. Paessler); Retaluleu (Stoll); Patulul (Wheeler).

Mexico: La Zacualpa, Chiapas (A. Petrunkevitch). Santa Lucrezia, Vera Cruz (F. Knab); Cordova; Remutadero, Cameron and Mirador, Vera Cruz (E. Skwarra).

Var. **semirex** var. nov.

Workers media and minor. Length 8-11 mm.

Very similar to *rex*, but the appressed pubescence is almost lacking on the thorax and petiole, though well developed on the head and dorsal surface of the pronotum. The pronotal spines are very short and obtuse, the petiolar scale with blunt, broadly rounded border as in *rex*.

Described from five specimens taken by Dr. J. Bequaert at Corocito, Honduras.

Var. **cualatensis** var. nov.

Worker maxima. Length 12-14 mm.; head 5 mm. x 5 mm.; hind tibia 5.2 mm.

Head entirely red, shining, especially on the sides and clypeus; mandibles black. Pronotal spines as in *rex*. Petiole with sharp, compressed dorsal border, seen from behind broadly rounded, entire, with pronounced lateral angles. Appressed pubescence dull, rather ochraceous yellow, less abundant on the sides of the thorax than in *rex*. Hairs abundant, but distinctly shorter, especially on the epinotum and gaster, fulvous yellow. Legs somewhat reddish.

Workers major, media and minor. Length 8-12 mm.

Like the maxima, except for the smaller head. This is more or less reddish in the major but black in the smaller phases. Meso- and epinotum strongly compressed dorsally, as is also the border of the petiolar scale.

Mexico: Cualata, Colima, type-locality (C. H. T. Townsend); Jalapa (S. F. Rangel); Guadalajara (J. F. McClendon; M. Diguet).

Var. **zacapensis** var. nov.

Worker maxima. Length 13-15 mm.; head 5 x 5 mm.; hind tibia 5.5 mm.

Resembling the maxima of *cualatensis* but with the head black. Pronotal spines broad and obtuse, somewhat flattened. Dorsal border of petiolar scale blunt, not compressed, seen from behind broadly rounded and entire. Appressed pubescence dull ochraceous, slightly brighter on the gaster than in *cualatensis,* very short and feebly developed on the vertex, long and more conspicuous on the middle of the pronotum, shorter on the dorsum of the mesonotum, absent on the pleuræ and coxæ, very short on the posterior surface of the petiole. Hairs short, especially on the gaster where they are mostly orange yellow; on the head and thorax with black bases and orange tips.

Workers major, media and minor. Length 8-12 mm.

Like the maxima, but head smaller and without shining sides, gula and clypeus; in the smaller individuals with nearly straight posterior border. Pronotal spines very obtuse as in the maxima; meso- and epinotum more strongly compressed above. Hairs similar but less abundant on the head and thorax.

Described from numerous specimens which I took Dec. 14, 1911, from a flourishing colony nesting in the decayed wood of a large Celtis tree in the very arid country around Zacapa, Guatemala. There are also specimens in the Museum of Comparative Zoology from Portilla Grande, Honduras (R. E. Stadelmann).

Var. **quiriguensis** var. nov.

Worker maxima. Length 12-13 mm.; head 4.5 x 4.5 mm.; hind tibia 5 mm.

Smaller than the preceding variety, but the head very similar, black with somewhat less shining sides. Pronotal spines and petiolar node similar. Appressed pubescence on the gaster dense and brilliant golden as in the typical *rex,* but almost absent on the head and thorax, there being only some short dilute ochraceous pubescence on the vertex and dorsum of the pronotum. Hairs similar, but less abundant on the head and thorax and somewhat longer on the gaster, though not as long as in *rex.*

Workers major, media and minor. Length 8-11 mm.

Very similar to the maxima, except for the smaller head and opaque cheeks and clypeus. Spines of pronotum, though blunt, more slender than in the var. *zacapensis*.

Described from several workers taken by myself Jan. 13, 1912, running on the trunk of a recently felled tree in the banana plantations near Quirigua, Guatemala (type-locality). I possess specimens also from the following localities in the same republic: Polochic River and Cacao, Trece Aguas, Alta Vera Paz (Barber and Schwarz), Livingston (H. S. Barber), Los Amates, Baja Vera Paz and Sanarola (Kellerman), and from Belize, British Honduras.

A NEW ANT-LIKE CERAMBYCID BEETLE FROM HONDURAS

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In nearly all of the later works on Cerambycidæ the genus *Eplophorus* Chevrolat is placed as a synonym of *Apelocera* Chevrolat, but the former name seems to be valid and should be used for the species of this genus. Thomson (Classif. Ceramb., 1860, p. 229), under the genus *Tillomorpha,* gives *lineoligera* Blanchard as the typical species, and states that *Tillomorpha spinicornis* Chevrolat from Mexico and another species in his collection from Venezuela have the third joint of the antennae strongly spinose at the extremity, and should constitute a new genus, but he does not give it a new name. Chevrolat (Journ. Ent., vol. 1, 1861, p. 248) quotes Thomson's remarks on *spinicornis,* and states that he has proposed the name *Eplophorus* in a printed catalogue for this Mexican species. Chevrolat (Ann. Soc. Ent. France, ser. 4, vol. 2, 1862, p. 61) erects the genus *Apelocera* for a new species, *waltli,* from Brazil, also includes *spinicornis,* and in a footnote he says: "I propose to give *Apelocera* to the insects which I previously placed in the genus *Eplophorus* (Journ. Ent., vol. 1, 1861, p. 248), as I abandon *Eplophorus* since the root of this genus has not proper significance." In this same publication (Ann. Soc. Ent. France, ser. 4, vol. 2, 1862, p. 535), Chevrolat writes *Apilocera* instead of *Apelocera,* and this name has been used by Pascoe (Trans. Ent. Soc. London, ser. 3, vol. 5, 1866, p. 295), and also by Bates (Biol. Centr.-Amer., Coleopt., vol. 5, 1880, p. 60; 1885, p. 305).

Eplophorus velutinus new species

Male.—Moderately large, elongate, black, and subopaque; elytra ornamented with a short, oblique, smooth, ivory fascia, extending from near the lateral margin to middle of each elytron.

Head about as wide as long, and nearly flat in front, sides nearly parallel between the eyes, flat between the antennal tubercles, which are very widely separated and scarcely elevated, surface coarsely, irregularly punctate, more or less longitudinally rugose, sparsely clothed with short, recumbent, white hairs, with a very long seta arising from a large puncture on each side behind the epistoma; eyes small, finely granulated, distinctly divided, lower lobes rounded, upper lobes very small and narrow. Antenna eleven-jointed, about three-fourths as long as the body, sparsely clothed with very short cinereous pubescence and a few long, moderately stiff, black hairs; first joint robust, about three times as long as wide; third joint nearly as long as the following three joints united, and armed with a very long spine at apex; fifth joint slightly longer than fourth and both joints armed with a short spine at apex.

Pronotum slightly longer than wide, slightly narrower at base than at apex, and strongly convex; sides strongly arcuately rounded, and more strongly constricted at base than at apex; surface sparsely covered with elongate elevations, rather densely clothed with recumbent, yellowish pubescence, with numerous long, erect hairs intermixed, the pubescence shorter and more inconspicuous on apical half, with a small, round, conspicuous, black, pubescent spot on each side in front of the middle. Scutellum narrowly triangular, and densely clothed with recumbent, yellowish pubescence.

Elytra about twice as long as wide, and at base about equal in width to the pronotum at middle, strongly, abruptly deflexed at base, arcuately deflexed at apex, strongly, transversely depressed at middle, humeri distinct, and strongly elevated, a large longitudinal callosity on each side near the base, at middle a moderately wide, oblique, glabrous fascia, in front of which is a narrow, oblique, smooth, eburneous fascia, extending from near lateral margin to middle of each elytron; sides nearly parallel to behind middle, where they are strongly, arcuately expanded, with the tips broadly truncate; surface finely, densely punctate, except on middle glabrous fascia and tops of the callosities, where it is coarsely, confluently punctured, rather sparsely clothed on basal half with long, recumbent, yellowish pubescence, apical half densely clothed with long, silky, golden yellow pubescence, which conceals the surface, and with numerous long, erect hairs intermixed over the entire surface.

Beneath finely punctate, with a few coarse punctures intermixed, sparsely clothed with recumbent pubescence and a few long, erect hairs intermixed, pubescence golden yellow on abdomen and silvery white on rest of surface. Legs long, sparsely clothed with short, white pubescence, and long, stiff, black and white hairs intermixed; femora strongly expanded at middle; tibiae slightly arcuate, strongly flattened, and longitudinally carinate.

Length, 9-10 mm.; width, 2.8 mm.

Type locality.—Prieta, Republic of Honduras.

Other localities.—San Pedro, Honduras. Cacao, Trece Aguas, Alta Vera Paz, Guatemala.

Type, allotype, and paratypes.—Cat. No. 43479, United States National Museum.

Described from four examples, two males (one type), and two females. The type (male) and one male paratype collected at the type locality, April 5, 1924, by Dr. J. Bequaert, allotype collected at San Pedro, Honduras, April 21, 1923, by S. C. Bruner, and one paratype collected at Cacao, Trece Aguas, Alta Vera Paz, Guatemala, by G. P. Goll.

This species is very closely allied to *magna* Bates, but differs from that species in being smaller, the pronotum not much longer than wide, with the entire apical half of the elytra densely clothed with silky, golden yellow pubescence. In the two females the pronotum and basal half of the elytra are not clothed with yellowish pubescence.

NOTES ON NORTH AMERICAN ANYPHÆNINÆ IN THE MUSEUM OF COMPARATIVE ZOOLOGY

BY ELIZABETH B. BRYANT

In a recent revision of the spiders of this sub-family in the Museum of Comparative Zoology from North and Central America and the West Indies, it was found that there has been much confusion in the use of genera. The genus Anyphæna was made by Sundevall in 1833 (Conspectus Arachnidum, p. 20) for *Aranea accentuata* Walckenaer. L. Koch (Die *Arach.* fam. Drassiden, 1866, p. 194) first called attention to the position of the ventral furrow, "as either in the middle of the length of the abdomen or behind the middle." Nicolet (Say, Hist. de Chili, 1849, 3, p. 450) made the genus Gayenna for the South American species where the posterior spiracular openings are nearer the spinnerets than to the epigastric plate. F. O. P. Cambridge (Biologia Centrali-Americana, 1900, 2, p. 94), definitely restricts the genus to "Spiracular rima situated behind the middle of the ventral area of the abdomen towards the spinners," and states that the genus is not found in Central America. Mr. Banks has used the genus Gayenna when the ventral furrow is behind the middle of the entire abdomen.

The genus Marcellina has been made for *Clubiona piscatoria* Hentz, known only from two males from Alabama and an immature male from Newton, Massachusetts. The large anterior median eyes, the peculiar palpus, and the short spines on the legs are very different from any other genus.

Hentz, in his descriptions of *Clubiona saltabunda* and *C. albens,* questions the generic position. The exaggerated length of the legs in both sexes, the difference in the male palpi and the number and arrangement of spines on the legs do not agree with any of the genera from Central America, so the new genus Anyphænella has been made for them.

1. Ventral furrow one-third nearer epigastric plate than to spinnerets .... Aysha.

   Ventral furrow one-third nearer spinnerets than to epigastric plate, anterior median eyes largest .... Marcellina

   Ventral furrow about midway between epigastric plate and spinnerets, anterior eyes equal or median slightly smaller .... 2.

2. Anterior tibiæ as long as both cephalothorax and abdomen .... Anyphænella

   Anterior tibiæ normal .... Anyphæna.

Marcellina gen. n.

Type: *Clubiona piscatoria* Hentz.

Cephalothorax oval, thoracic groove rather long, front broad and obtuse. Anterior row of eyes slightly recurved, equidistant, median largest of the eight; posterior row procurved and equal; quadrangle higher than wide, wider in front; lateral eyes separated by less than diameter of anterior laterals. Clypeus not as wide as diameter of anterior median eye. First leg longer than fourth; anterior legs with few spines on ventral side. Mandibles of male well-developed with two widely separated teeth on superior margin of groove and two teeth on inferior margin. Ventral furrow one-third nearer spinnerets than to epigastric plate.

The genus differs from Gayenna, which has the ventral furrow near the spinnerets, by the large median eyes and from the other American genera by arrangement of the eyes, number of teeth on the mandibles and the shorter spines on the legs.

Marcellina piscatoria (Hentz)

FIGS. 1, 2

Clubiona piscatoria Hentz, Journ. Boston Soc. Nat. Hist.; 1847, 5, p. 450, pl. 23, f. 15; "♂ Alabama"; reprint, 1875, p. 84, pl. 10, f. 15, pl. 18, f. 29.

♂ 7 mm. long, cephalothorax 3 mm. I leg, 15 mm. long.

Cephalothorax pale yellow without markings, covered with many fine, black hairs; abdomen pale yellow without markings, with many long, fine hairs; legs pale, covered with dark hairs; spines on all legs less than diameter of joint, few and becoming irregular; more spines on upper side of legs than on ventral. Spines, I leg, tibia 2, near middle, 1 lateral, all less than diameter of joint; metatarsus 2-2, 1 lateral. Metatarsus as long as tibia.

Eyes; anterior row recurved, equidistant, A. M. E. largest; posterior row procurved so that lateral eyes are almost touching, equal in size; P. M. E. slightly nearer P. L. E. than to each other and smaller than A. M. E. Clypeus about as wide as diameter of A. L. E.

Mandibles, brown, porrect, one-half the length of cephalothorax, covered with long, black hairs. Two isolated teeth on superior margin and two isolated teeth on inferior margin. Cephalothorax widest between II and III leg and only slightly narrowed in front of I coxae; thoracic groove rather long, sternum triangular, widest between coxae I and II; coxae IV separated by less than half a diameter. Ventral furrow one-third nearer the spinnerets than to the epigastric plate.

Palpus. Femur two-thirds as long as cephalothorax, curved, tibia but little longer than patella, with apophysis near tip, as in figure 1, tarsus longer than femur and prolonged far beyond the palpal organ; embolus prolonged in a fine straight point the length of the tarsus.

2 ♂ Ala.; Auburn, C. F. Baker coll.; 1 ♂ im.; Mass.; Newton 17 Oct., 1904, E. B. Bryant coll.

Anyphæna

Type: *Aranea accentuata* Walckenaer, 1802.

Cephalothorax oval, thoracic groove rather long, front broad and obtuse. Anterior row of eyes straight or weakly recurved, the median usually the smallest; posterior row weakly procurved, equal and usually equidistant; quadrangle of median eyes higher than wide and narrower in front; lateral eyes well separated. Legs long with scopulæ on all tarsi and often on the anterior metatarsi. Ventral furrow about midway between epigastric plate and spinnerets.

The genus Anyphæna was made by Sundevall in 1833. (Conspectus Arachnidum, p. 20) for *Aranea accentuata* Walckenaer. In this species the ventral furrow is a little nearer the epigastric plate than to the spinnerets and there is one pair of spines (basal) on the anterior metatarsi. The A. M. E. are smaller than the A. L. E., the mandibles are vertical, with two teeth on the inferior margin of the groove and the palpus is quite unlike any of the American forms.

In a careful examination of one of the common species (*A. celer* Hentz), it is found that the position of the ventral furrow often varies from the middle to just in front, or a little behind the middle, so that it is not easy to use as a primary character, but in all species examined the position of the furrow is approximately the same in the two sexes, also the number and arrangement of the spines on the anterior legs. With the exception of *A. calcar* sp. n. from Florida and *A. aperta* Banks from Washington all the American species have two pairs of spines on the first and second metatarsi. The first species also differs in having a large club-shaped process on the patella of the male palpus, a character found on at least one European species.

In 1913 Berland, Araignees de l'Equateur, called attention to the subdivision made by M. Simon in 1903. The first group has two teeth on the inferior margin of the mandibles and the ventral furrow is nearer the spinnerets than to the epigastric plate. The second group, which includes Anyphæna, has several teeth on the inferior margin (from 4 to 10), and the ventral furrow is nearer the epigastric plate than to the spinerets. This character of teeth is found variable, as in *A. laticeps* sp. n. there are no teeth on the superior margin of the male and a distinct carina on the inferior margin; and in the female, a carina on the superior margin and no teeth on the inferior margin, yet the male palpus is nearer the type of the genus than any other American species.

With the material available, the genus Gayenna is restricted to species from South America, with the ventral furrow near the spinnerets (at least one-third nearer than to the epigastric plate), and the genus Anyphæna, to species with the ventral furrow near the middle (midway between the epigastric plate and the spinnerets) and usually two pairs of spines beneath the anterior metatarsi. Future study may prove that the American species of Anyphæna may belong to some of the numerous neotropical genera, rather than to the European genus Anyphæna.

It has not been possible to make a satisfactory key for the females of the genus. Possibly when both sexes of all species are known, some character can be recognized by which they can be separated, but at present they can be identified only by the vulva. In both sexes the number and position of spines on the anterior legs is the same.

Anyphæna

Males

1. I metatarsus 1-1 spines, head broad, mandibles geniculate, large club-shaped spur on patella of palpus *calcar* sp. n.

   I metatarsus 2-2 spines .... *2.*

2. Head but little narrowed in front of I coxae, mandibles porrect, cephalothorax shining chestnut brown *laticeps* sp. n.

   Head less than half as wide as cephalothorax between II and III legs, cephalothorax never brown.......... 3.

3. II, III and IV coxae modified .... 4.
   All coxae normal .... 5.

4. III coxae with posterior spur bifid and with central process of palpus broad.......................... *pectorosa* Koch.
   III coxae with posterior spur slender and curved and with central process of palpus slender..*fraterna* Banks.

5. III leg modified .... 6.
   III leg normal .... 9.

6. III tibia with 2 short, stout spines on ventral, posterior margin .... 7.
   III tibia with but 1 short, stout spine on ventral posterior margin .... 8.

7. Dorsal section of tibial apophysis of palpus broad and triangular .... *celer* Hentz
   Dorsal section of tibial apophysis slender and sharp *maculata* Banks.

8. Tip of ventral part of tibial apophysis fairly broad and bifid and upper part reduced to a small, sharp point scarcely noticeable .... *coloradensis* sp. n.
   Tip of ventral part of tibial apophysis rather slender and notched, and the upper lobe fairly large, pointed and triangular .... *crebrispina* Chamb.

9. Distal apophysis of tibia ending in a simple, sharp point, tibia twice length of patella............ *ruens* Chamb.
   "Distal apophysis in form of undivided chitinous lamina and narrowing distad, but with apex subtruncate and weakly notched at middle"........... *saniuana* Chamb.

Anyphæna calcar sp. n.

FIG. 3

♂ 4 mm. long; cephalothorax 1.7 mm.

Cephalothorax yellowish, darker in front with white hairs on head; abdomen pale yellow with many dark spots and streaks, which unite in the posterior median part to form a series of chevrons; legs yellowish with faint traces of dark spots; spines, I leg; tibia 2-2, second pair at about middle of joint, 2 lateral; metatarsus 2, 1 lateral, scopulae very scant on anterior tarsi and metatarsi.

Anterior row of eyes slightly recurved, equidistant, A. M. E. smallest; posterior row longer than anterior, P. M. E. slightly nearer P. L. E. than to each other, P. M. E. largest; quadrangle higher than distance between P. M. E. eyes. Clypeus narrow, scarcely more than diameter of A. M. E. eyes. Mandibles vertical, with many long, black hairs; superior margin of fang groove, a denticulate carina; inferior margin a group of five minute teeth near median edge.

Ventral furrow midway between spinnerets and epigastric plate.

Palpus. Patella and tibia of equal length, the former with a large club-shaped spur on the outer side, nearly as long as the joint; tibia with a long apophysis resting against the palpus, ending in a sharp spine; the ventral side of the tibia has a pronounced keel two-thirds the length of the joint. The upper half of the palpal organ has a large white sack with a slender white filament at the upper end and a tube from the lower part which bends and disappears in the upper part of the organ. On the inner side is a piece ending in a sharp point a little above the white sack, and in the opposite side is a slender piece ending in a curved hook.

Type: 3 ♂ Fla.; Dunedin, 1927, W. S. Blatchley coll.

This is the only American species of Anyphæna with a spur on the patella.

Anyphæna laticeps sp. n.

FIGS. 4, 24

♂ 4 mm. long; cephalothorax 1.5 mm., abdomen 2.5 mm. Cephalothorax shining chestnut brown, a little darker about the eyes; abdomen greenish gray; legs little lighter in color than cephalothorax, long and slender with darker bands at middle and end of tibia. Spines, I tibia 2-2, long and slender, no lateral, metatarsus 2-2, long and slender, no lateral.

Eyes: anterior row straight, equal and equidistant; posterior row slightly procurved, longer than anterior row, P. M. E. little nearer P. L. E. than to each other; laterals separated by radius of P. L. E.; quadrangle as high as distance between P. M. E. Clypeus a little wider than diameter of anterior eyes.

Mandibles dark, porrect and more than half as long as cephalothorax, no teeth on superior margin of groove, distinct denticulate carina on inferior margin; fang long and sinuate; labium longer than wide, half as long as maxillæ, and deeply notched.

Cephalothorax, narrowed but little in front of I coxae. Sternum twice as long as broad, widest between II coxae. Ventral furrow a little nearer epigastric plate than to spinnerets.

Palpus. Tibia twice as long as patella, apophysis one-third length of tibia and pressed close to tarsus. Palpal organ nearly fills the cavity.

♀ 4.2 mm. long.

Cephalothorax shining chestnut brown, darker about the eyes and with scattered white hairs on sides; abdomen pale yellow with irregular dark marks arranged to form broken chevrons; venter pale; legs lighter in color than cephalothorax without the dark bands and spines as in male. Eyes as in male. Mandibles dark brown and geniculate; carina on superior margin of groove and no teeth on inferior margin. Cephalothorax narrowed but little in front of I coxae. Sternum light and shining, nearly twice as long as broad. Ventral furrow a little nearer epigastric plate than to spinnerets. Epigynum dark with two broad openings below two pairs of dark spots.

Type: ♂ ♀ Ga.; Thompson's Mills, H. Allard coll.

Paratypes. 1 ♀ Va.; Falls Church, N. Banks coll.; 1 ♀ Ala.; Auburn, C. F. Baker coll.

The dark color of the cephalothorax would seem to ally this species to *A. striata* Becker, but the description of that species would indicate a much larger spider, possibly an Aysha.

The two following species are separated in the males by the modified posterior coxae.

Anyphæna pectorosa L. Koch

FIG. 5

Die Arach. fam. Drassiden, 1866, p. 198, pl. 8, f. 131, "1 ♂ Baltimore."

Anyphæna calcarata Emerton, Trans. Conn. Acad. Sci.; 1890, 8, p. 189, p. 6, f. 3, "♂ ♀ Conn.; West Haven, July .... N. Pike's Long Island Collection."

The IV coxae in the males have a small, pointed process directed outward; the III coxae have two processes, the posterior one is pointed inward and distinctly bifid, the anterior process is a blunt tooth. The principal process in the palpus is broad and flattened. On the upper side of the tibia is a small spine.

This species is found from Massachusetts south to North Carolina and Tennessee and west to Missouri.

Anyphæna fraterna (Banks)

FIGS. 6, 23

Gayenna fraterna Banks, Trans. Amer. Ent. Soc.; 1896, 23, p. 63. "♂ near Sea Cliff, N. Y. June."

Anyphæna conspersa Keyserling, Verh. Zool. bot. Ges. Wien 1887, 37, p. 453, pl. 6, f. 23 "♀ Ky.; Bee Spring," preoccupied by Simon, 1878.

This species is distinctly spotted. In the male the posterior process on the III coxae is slender and simple, not bifid as in *A. pectorosa.* In the palpus the largest process is slender and curved only at the tip. The tibia has a small cone-shaped process on the inner basal side as well as a short spine on the upper. The epigynum is long and narrow instead of broad as in *pectorosa.*

Type. 2♂ N. Y.; Sea Cliff, N. Banks Coll. Found from Massachusetts to Tennessee and Kentucky.

The four following species form a natural group, with the third leg in the male modified, with the third femur enlarged, and one or two stout, cone-shaped spines on the posterior ventral side of the tibia. In both sexes there is a distinct dark ring near the distal end of each femur.

Anyphæna celer (Hentz)

Figs. 7, 25, 28

Clubiona celer Hentz, Journ. Boston Soc. Nat. Hist.; 1847, 5, p. 452, pl. 23, f. 20; reprint, p. 87, pl. 10, f. 20. "North Carolina, Alabama."

Anyphæna incerta Keyserling, Verh. zool. bot. Ges. Wien, 1887, 37, p. 452, pl. 6, f. 22. "♀ Mass.; Cambridge."

A widely distributed species found under dead leaves from New England to Texas. The position of the ventral furrow varies from mid-way between the spinnerets and the epigastric plate and nearer to the epigastric plate. The under side of the tibia of the third leg has two very short spines on the posterior side.

A common species from Massachusetts south to Texas.

Anyphæna maculata (Banks)

Figs. 8, 31

Gayenna maculata Trans. Amer. Ent. Soc.; "♂ D. C.; Washington." 1896, 23, p. 64. S. C. Bishop and Crosby, Journ. Mitch. Soc. 1926, 46, p. 189, pl. 24, f. 37, 38.

Crosby and Bishop give a very full description of the male, but fail to mention the enlarged third femur and the two stout spines on the tibia of the third leg. The palpus is very similar to that of *A. celer,* but the tibial apophysis is quite distinct. The upper branch is shorter and ends in a sharp point, and the inner branch is a thin leaf-like plate, folded almost double. The large rounded protuberance on the basal half is larger and more conspicuous than in *A. celer.*

Type: ♂ D. C. Washington.

♂ ♀ N. Y. ; Sea Cliff, N. Banks Coll.; ♂ Va.; Falls Church, N. Banks Coll. 1 ♀ Ky.; Hart Co.; Rio. A. F. Archer coll.

Anyphæna coloradensis sp. n.

FIGS. 9, 10, 30, 33

♂ 4.5 mm. long.

Cephalothorax light brown with faint dark marks from the lateral eyes to the posterior margin; abdomen light yellow with five median dark bars slightly bent as chevrons, sides and venter with dark spots and streaks; sternum light; legs light with dark spots at base of spines; spines I leg, tibia, 2-2-2 none apical, 2 lateral, metatarsus, 2-2, 2 lateral, metatarsus shorter than tibia; coxae III and IV densely, minutely, spinulate, femur III enlarged and on ventral surface, minutely spinulate; two long spines on dorsal surface and one very short, stout spine on posterior, tibia III two long spines on anterior edge and one stout spine posteriorly, two lateral. Ventral furrow is nearer spinnerets than to epigastric plate. Eyes; anterior row recurved, A. M. E. smallest and less than their diameter apart, and less than radius from the A. L. E.; posterior row procurved, P. M. E. nearer P. L. E. than to each other; laterals separated by less than radius of A. L. E.; quadrangle nearly twice as high as distance between posterior median.

Palpus: Patella as long as tibia; tibial apophysis prolonged half the length of the tarsus, with upper edge serrate, with one distinct tooth midway, palpal organs filling the entire cavity and similar to A. celer.

♀ 4.7 mm. long.

Markings the same as in the male, but not quite as distinct, except on the legs where the dark marks are more pronounced. The posterior coxae are not roughened or the III femur enlarged. Eyes same as in the male. Epigynum as figured.

Type: 1 ♂, 2 ♂ Col.; Boulder, T. D. A. Cockerell coll. N. Banks Coll.

Anyphæna crebrispina Chamberlin

FIG. 11

Pomona Coll. Journ. Ent. Zool.; 1919, 12, p. 10, pl. 4, f. 4. "♂ Cal.; Claremont", No. 353.

The third tibia has but one stout spine on the posterior side. The tibial apophysis has the lower branch about one-third the length of the tarsus, with a distinct notch at the tip and the upper lobe in a pointed triangle.

Type: 1 ♂ Cal.; Claremont, R. V. Chamberlin Coll. This is probably the male of *Anyphæna californica* (Banks) as the later has been found at Claremont.

Anyphæna ruens Chamberlin

Pomona Coll. Journ. Ent. Zool.; 1919, 12, p. 11, pl. 5, f. 1. "♂ Cal.; Claremont, April, 1913, No. 352." Anyphæna mundella Chamberlin, ibid, p. 12, pl. 5, f. 3. ♀ *nec* ♂ "Cal.; Claremont."

In the original description of *A. mundella* the female only was described and the palpus of the male figured. On examining the specimens, the two obviously belong to different genera. The male has but one pair of spines on the anterior metatarsi, a broad low cephalic region and the ventral furrow quite near the epigastric plate, all characters of Aysha. The female has two pairs of spines on the anterior metatarsi, the narrow and high cephalic portion and the ventral furrow at "middle or slightly behind middle of abdomen." In all species of Anyphæna seen the number of spines on the anterior legs, shape of cephalothorax and the position of the ventral furrow is the same in both sexes.

Type: 1 ♂ M. C. Z. no. 352, Cal.; Claremont. 1 ♀ M. C. Z. no. 348, Cal.; Claremont.

♂ B. C.; Victoria, Taylor coll.; ♂ ♀ Cal.; Claremont; C. F. Baker coll.; Mt. Helens; 8 July, 1918. Helen Van Duzee coll.

The following species are known only from females.

Anyphæna aperta (Banks)

Fig. 35

Gayenna aperta Banks, Proc. Cal. Acad. Sci.; 1921, 11, p. 100, f. 3. "♀ Wash.; Olympia."

The ventral furrow is midway between epigastric plate and spinnerets. The spines on I tibia 2-2-2 (one pair distal), 2 lateral, metatarsus 2, 2 lateral.

Type: 1 ♀ Wash.; Olympia, T. Kincaid coll. 1 ♀ Wash.; Blakley Is.; 8 July 1928. L. G. Worley coll.

Anyphæna californica (Banks)

Gayenna californica Banks, Proc. Cal. Acad. Sci.; 1904, 3, p. 338, pl. 38, f. 2. "♀ Palo Alto, Mill Valley."

Anyphæna intermontana Chamberlin, Can. ent.; 1920, 52, p. 200, f. 6.

Type: 1 ♀ Cal.; Palo Alto, R. W. Doane coll.

1 ♀ Cal.; Marin Co.; Ross, 3 ♀ Claremont, N. Banks Coll. 2 ♀ Utah; Mill Creek, R. V. Chamberlin coll.

Anyphæna fragilis Banks

Fig. 32

Can. Ent.; 1897, 29, p. 194 "♀ Fla.; Jacksonville."

Gayenna parvula Banks, Proc. Ent. Soc. Wash.; 1899, 4, p. 191. "♀ La.; Shreveport."

Cephalothorax brown, darker about the eyes with scattered white hairs, cephalic groove short; abdomen pale, sometimes with a few marks bent almost to form chevrons posteriorly; venter pale without marks; legs pale, sometimes with traces of two dark rings on anterior tibiae, and at end of metatarsi. Spines; I leg, tibia, 2-2, long, no lateral metatarsus, 2-2, long, no lateral. Cephalothorax very broad at anterior margin, with only a slight narrowing in front of coxae I. Mandibles geniculate and very dark brown, covered short hairs.

Eyes; anterior row straight, equidistant and A. M. E. a little smaller than A. L. E.; posterior row procurved, equal and P. M. E. a little nearer to P. L. E. than to each other. Quadrangle but little higher than wide and narrowed in front. Clypeus low, but little wider than diameter of A. M. E. Ventral furrow a little nearer epigastric plate than to spinnerets.

Type: 2 ♀, 1 ♂ im. Fla.; Jacksonville; 2 ♀ La.; Shreveport. N. Banks Coll.; 1 ♀ Ga.; Bainbridge, J. C. Bradley coll.

Anyphæna pacifica (Banks)

FIG. 36

Gayenna pacifica Banks, Trans. Amer. Ent. Soc.; 1896, 23, p. 63. "♀ Wash.; Olympia."

Type: 3 ♀, 1 ♂ im. Wash.; Olympia, J. Kincaid coll.; 1 ♀ Idaho; Moscow Mts., 29 Oct. 1910. J. A. Hyslop coll.; 2 ♀ Wash.; Wawawai, W. M. Mann coll.; 1 ♀ Cal.; Mt. Tamalpais, Cal. Acad. Sci. Coll.

Anyphæna zina Chamberlin

Pomona Coll. Journ. Ent. Zoöl.; 1919, 12, p. 11, pl. 4, f. 5.

Type: 1 ♀ Cal.; Claremont, R. V. Chamberlin coll.

Anyphænella gen. n.

Type: *Clubiona saltabunda* Hentz.

Eyes similar to Anyphaena; A. M. E. smaller than A. L. E. Mandibles vertical on both sexes, with row of many minute teeth on the inferior margin, and a row of four distinct teeth on the superior margin. First leg longest and tibia longer than or nearly as long as the entire length of spider. Two pairs of spines beneath I tibia and two pairs beneath I metatarsus. Ventral furrow about midway between spinnerets and epigastric plate.

It differs from Wulfila in the number of spines on the metatarsi and from Sillus in the much longer legs and the structure of the male palpi.

Anyphænella saltabunda (Hentz)

Figs. 18, 22

Clubiona ? saltabunda Hentz, Journ. Boston Soc. Nat. Hist.; 1847, 5, p. 453, pl. 23, f. 23; "Alabama". reprint, p. 89, pl. 10, f. 23, pl. 18, f. 19.

Anyphæna saltabunda Emerton, Trans. Conn. Acad.; 1890, 8, p. 187, pl. 6. f. 4.

♂ 3.5 mm. long; ♀ 4 mm. long.

Cephalothorax, abdomen and legs light yellow with gray, broken stripes on cephalothorax, and a broken marginal band; two parallel rows of gray dots on the abdomen. Sternum light with a scalloped dark mark around edge. Legs very long and slender. I metatarsus as long as I tibia. Spines, I tibia, 2-2-2. 2 lateral; metatarsus, 2-2, 3 lateral.

Front less than half the width of cephalothorax between III legs. Eyes; anterior row straight, A. M. E. smallest; posterior row procurved, equal, P. M. E. nearer P. L. E. than to each other; lateral eyes almost touching. Clypeus width of A. M. E. Mandibles small and vertical, with four teeth on superior margin and with many, minute ones on the inferior. Labium slightly notched. Ventral furrow midway between epigastric plate and spinnerets.

Palpus: tibia more than twice as long as patella, much bent and the apophysis near the base.

Epigastric plate extends nearly across the abdomen.

Found from Massachusetts to Florida and west to Wyoming.

Anyphænella alba (Hentz)

Figs. 20, 21

Clubiona ? albens Hentz. Journ. Boston Soc. Nat. Hist.; 1847, 5, p. 454, pl. 23, f. 24; "Alabama" reprint, p. 89, pl. 10, f. 24, pl. 18, f. 32.

Chiracanthium albens Hentz, Banks, Proc. Phila. Acad.; 1904, p. 123.

♂ 4.5 mm. long; ♀ 4 mm.

Cephalothorax, abdomen and legs almost colorless and without markings. Legs very long and slender, I metatarsus longer than I tibia. Spines, I tibia, 2-2, 2 lateral, metatarsus 2-2, 2 lateral. Eyes; anterior row slightly recurved, A. M. E. smallest and less than a diameter apart, and nearer to each other than to the A. L. E.; posterior row, procurved, equal and equidistant, oval and surrounded by black, quadrangle much higher than wide, anterior side about half as wide as posterior. Mandibles small and vertical. Ventral furrow a little nearer epigastric plate than to spinnerets.

♂ D. C.; Washington, N. Banks Coll.; Va.; Falls Church, N. Banks Coll.; N. C. Raleigh, C. S. Brimley coll. Aug. 1916. 1 ♀ Ky.; Bee Spring, F. G. Sanborn; 1 ♀ Fla.; Sebastian, 17 Apr. 1919, G. Nelson coll.

Aysha

Type: *Aysha prospera* Keyserling.

Cephalothorax low and broad, only slightly narrowed in front of the first coxae. Posterior row of eyes almost straight, anterior row subequal; clypeus about as wide as diameter of anterior median eye. First leg usually longer than fourth, one pair of spines beneath on first metatarsi. Ventral furrow near epigastric plate, at least one-third nearer than to spinnerets. The male palpus has the embolus in a sweeping circular curve, and the epigynum with a distinct circular chitinous rim.

F. O. P. Cambridge states (Biol. Cent. Amer., 1900, 2, p. 98), that the lower fang groove of the mandible has 3-7 teeth. In *A. cambridgei* sp. n. there are no teeth on the lower groove, and the upper groove has a denticulate carina, instead of the usual three or four distinct teeth.

Males

1. Tibia of palpus with 1 spur 2
   Tibia of palpus with 2 spurs 5

2. Tibia much longer than tarsus, spur bifid at tip *longipalpus* sp. n.
   Tibia plainly not longer than tarsus 3

3. Tibia shorter than tarsus, spur as long as tibia. I tibia 2-2. 1 lateral, metatarsus 2, 1 lateral....*gracilis* Hentz
Tibia about as long as tarsus, spur shorter than tibia 4

4. I leg, tibia 2-2-2. 2 lat., metatarsus 2, 1 lateral. Spur with large hook at tip ....*velox* Becker.
I leg, tibia, 2-2, no lat., metatarsus 1-1, no. lat., spur sinuous with minute hook at tip........*cambridgei* sp. n.

5. Upper spur as long as tibia and with rest of joint as long as tarsus..*minuta* Camb.
Upper spur shorter than tibia but with tibia longer than tarsus...*decepta* Banks

Aysha longipalpus sp. n.

Fig. 12

♂ 10 mm. long. ceph. 4 mm.

Cephalothorax light brown with scattering white hairs; abdomen light grey without markings; legs light brown, first and second darkest. Spines, I, leg, tibia, 2-2-2, (one pair distal), no lateral; metatarsus, 2, no lateral. I femur 5 mm., patella 1.5 mm.; tibia 7.5 mm., metatarsus 8 mm., tarsus 2 mm. Eyes; anterior row slightly recurved, equal and equidistant; posterior row procurved, equal and equidistant; lateral eyes radius of P. L. E. apart. Clypeus slightly more than radius of anterior eyes. Mandibles porrect, two-thirds as long as cephalothorax; four teeth on superior margin and a row of minute teeth on inferior margin; fang long; sternum widest between II and III coxae and prolonged between the IV coxae. Ventral furrow very near epigastric plate.

Palpus. Tibia much longer than tarsus and more than twice as long as patella; very slender, apophysis bifid at tip and little longer than diameter of the segment. Appendages of the palpal organ confined to the upper half of the bulb.

Type: 1 ♂ Costa Rica; San Jose, Valerio coll.

Differs from *A. tenuis* (L. Koch) Fig. 19, by the longer and more slender tibia, notched tibial apophysis and smaller palpal organ.

Aysha gracilis (Hentz)

Figs. 13, 26

Clubiona gracilis Hentz, Journ. Boston Soc. Nat. Hist.; 1847, 5, p. 452, pl. 23, f. 19; reprint, p. 86, pl. 10, f. 19, pl. 18, f. 8. "North Carolina, Alabama."

Anyphæna rubra Emerton, Trans. Conn. Acad., 1890, 8, p. 186, pl. 6, f. 1. "♀, Massachusetts and Connecticut and in Pike's Long Island Collection." ibid, 1909, 14, p. 220, pl. 9, f. 8.

Aysha orlandensis Tullgren. Bih. Svensk. Akad.; 1901, 27, p. 19. f. 4. "♀ Fla.; Orlando."

A widely distributed species from Massachusetts to Florida and as far west as Nebraska.

Aysha velox (Becker)

Figs. 14, 34

Anyphæna velox Becker, Ann. Soc. Ent. Belg.; 1879, 22, p. 83, pl. 2, f. 5-7. ♀ "Mississippi; near Pascagoula."

Anyphæna floridana Banks, Trans. Amer. Ent. Soc.; 1896, 23, p. 63. "♀ Fla.; Lake Worth."

Chiracanthium falculum Chamberlin, Bull. Mus. Comp. Zoöl.; 1925, 67, p. 220. "♂ Fla.; Sebastian."

The type, a female, is from Miss. It is the common Aysha in Florida, Alabama and Louisiana, and is found in Bermuda, Cuba and was found by Mr. Banks on Taboga Island, Panama, 29 June, 1925.

Aysha cambridgei sp. n.

Fig. 15

♂ 8.5 mm. long; ceph. 3 mm.

Cephalothorax light brown; abdomen yellowish grey without markings; legs light brown, lighter than cephalothorax. Spines, I leg, tibia 2-2, no lateral, metatarsus 2, no lateral. I femur 4 mm., patella 1.8 mm., tibia 4.8 mm.; metatarsus 4 mm., tarsus 2 mm. Eyes; anterior row slightly recurved, equal and equidistant, posterior row procurved, equal and equidistant, lateral eyes separated by diameter of P. L. E. Posterior eyes not surrounded by black. Mandibles brown, less than one-half as long as cephalothorax; porrect; denticulate carina on superior margin and teeth and carina lacking on inferior margin. Maxillæ much broadened above the emargination, labium notched at tip. Sternum twice as long as broad.

Palpus. Tibia not as long as tarsus. Apophysis two-thirds as long as tibia ending in a small hook. Appendages of palpal organ filling three-quarters of upper portion of tarsus.

Type: 1 ♂ Mexico; Guanajuato. N. Banks coll.

The palpus is similar to *A. velox* Becker, but differs in the larger and heavier tibial apophysis. The spines on the anterior legs are quite different, also the teeth on the mandibles.

Aysha minuta F. O. P. Cambridge

Fig. 17

Biol. Cent. Amer. 1900, 2, p. 99, pl. 7, f. 18, 19. M. C. Z. Coll. 1 ♂ Mex.; Mexico City. 1 ♀ Costa Rica, San Jose. Tristan Coll.

Aysha decepta (Banks)

Figs. 16, 27

Anyphæna decepta Banks, Proc. ent. soc. Wash.; 1899, 4, p. 190. "♀ La., Shreveport; Texas, Brazos Co."

Anyphæna incursa Chamberlin, Pomona Coll. Journ. Ent. Zool.; 1919, 12, p. 12, pl. 5, f. 2. "♀ Cal.; Claremont."

Anyphæna mundella Chamberlin, ibid, p. 12, pl. 5, f. 4. ♂ *nec.* ♀. "Cal.; Claremont."

Anyphæna johnstoni Chamberlin, Proc. Cal. Acad., 1924. 12, p. 662, f. 105, 106. Gulf of California.

Found in Louisiana, Texas and California. This species may prove to be *Aysha simplex* Cambridge, Biol. Cent. Amer., 1897, 1, p. 227, pl. 29, f. 4, 5. Panama, Veraguas. Cambridge says, "Palpi, short, slender, cubital joint short, not half the length of the radial, which is very lightly curved, cylindrical, furnished with a few long, slender spine-like bristles, and has a tapering somewhat sinuous reddish-yellow brown apophysis projecting nearly at right angles to the joint at its fore extremity on the outer side. This apophysis is longer than the width of the joint."

In the Spiders of Porto Rico, Trans. Conn. Acad.; 1930, 31, p. 61, Mr. Petrunkevitch has placed *Aysha simplex* Cambridge as a synonym of *Aysha tenuis* L. Koch. From the number of specimens in the Museum of Comparative Zoology collection from various islands in the West Indies, the tibia of the male palpus of *Aysha tenuis* is longer than the tarsus, and at least five times as long as the diameter; there is but one tibial apophysis, not two, which is comparatively short, the embolus occupies the upper half of the palpal organ.

From the two figures of *Aysha simplex* Cambridge, the tarsus is longer than the tibia, which is about three times the diameter; there are two apophyses and the embolus occupies more than half the palpal organ. It differs from *Aysha decepta* (Banks) by the shorter upper apophysis and the relatively smaller palpal organ.

Aysha nigrifrons (Chamberlain and Woodbury)

Anyphæna nigrifrons Chamberlain and Woodbury, Proc. Biol. Soc. Wash.; 1929, 42, p. 137, pl. 1, f. 4. ♀ "Utah, St. George, Dec. 1925."

The figure of the epigynum, number of teeth on the inferior margin of the mandibles and number of spines on the anterior metatarsi show that this species is an Aysha rather than Anyphæna.

Plate 6

Fig. 1. *Marcellina piscatoria* (Hentz) lateral view of left palpus.

Fig. 2. *Marcellina piscatoria* (Hentz) dorsal view of eyes.

Fig. 3. *Anyphæna calcar* sp. n. ventral view of palpus.

Fig. 4. *Anyphæna laticeps* sp. n. ventral view of palpus.

Fig. 5. *Anyphæna pectorosa* L. Koch lateral view of palpus.

Fig. 6. *Anyphæna fraterna* (Banks) lateral view of palpus.

Fig. 7. *Anyphæna celer* (Hentz) lateral view of palpus.

Fig. 8. *Anyphæna maculata* (Banks) lateral view of palpus.

Fig. 9. *Anyphæna coloradensis* sp. n. lateral view of palpus.

Fig. 10. *Anyphæna coloradensis* sp. n. ventral view of palpus.

Fig. 11. *Anyphæna crebispina* Chamberlin lateral view of palpus.

Plate 7

Fig. 12. *Aysha longipalpus* sp. n. lateral view of palpus.

Fig. 13. *Aysha gracilis* (Hentz) lateral view of palpus.

Fig. 14. *Aysha velox* (Becker) lateral view of palpus.

Fig. 15. *Aysha cambridgei* sp. n. lateral view of palpus.

Fig. 16. *Aysha decepta* (Banks) lateral view of palpus.

Fig. 17. *Aysha minuta* Cambridge lateral view of palpus.

Fig. 18. *Anyphænella saltabunda* (Hentz) lateral view of palpus.

Fig. 19. *Aysha tenuis* (L. Koch) lateral view of palpus.

Fig. 20. *Anyphænella alba* (Hentz) epigynum.

Fig. 21. *Anyphænella alba* (Hentz) lateral view of palpus.

Fig. 22. *Anyphænella saltabunda* (Hentz) epigynum.

Plate 8

Fig. 23. *Anyphæna fraterna* (Banks) epigynum.

Fig. 24. *Anyphæna laticeps* sp. n. epigynum.

Fig. 25. *Anyphæna celer* (Hentz) third left leg.

Fig. 26. *Aysha gracilis* (Hentz) epigynum.

Fig. 27. *Aysha decepta* (Banks) epigynum.

Fig. 28. *Anyphæna celer* (Hentz) epigynum.

Fig. 29. *Anyphæna californica* (Banks) epigynum.

Fig. 30. *Anyphæna coloradensis* sp. n. epigynum.

Fig. 31. *Anyphæna maculata* (Banks) epigynum.

Fig. 32. *Anyphæna fragilis* Banks epigynum.

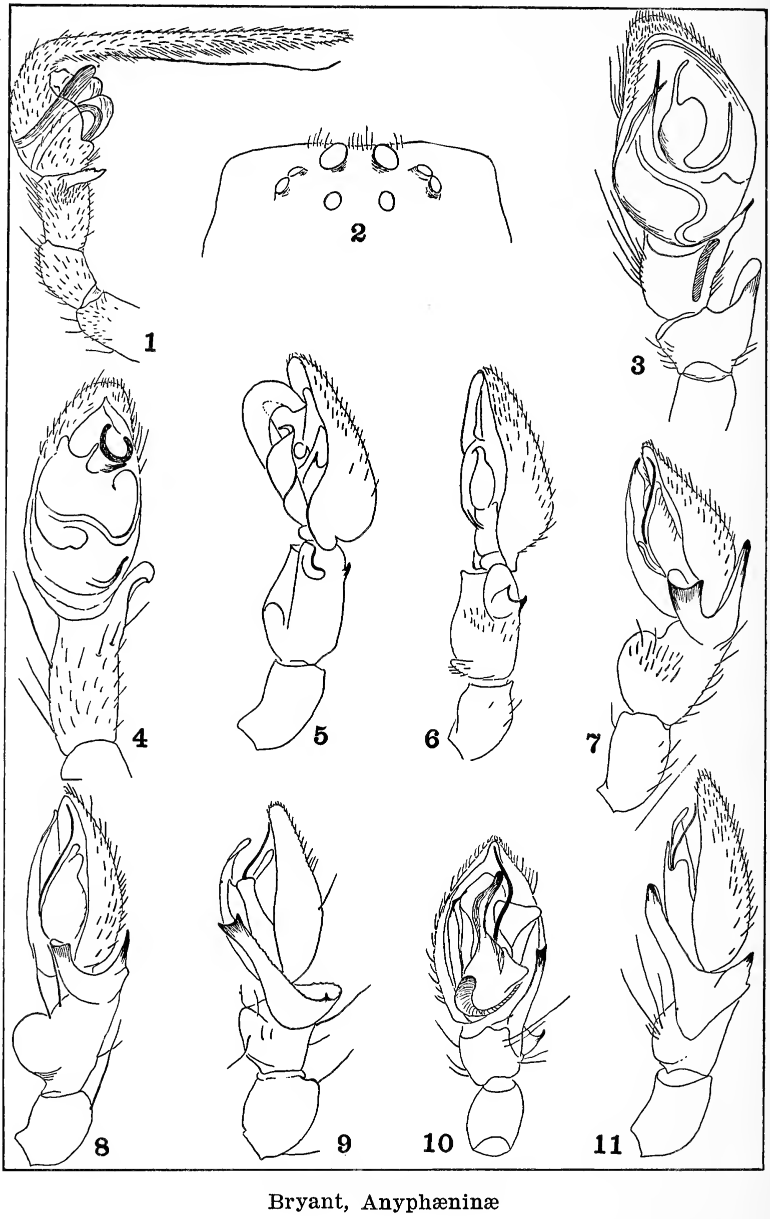
Fig. 33. *Anyphæna coloradensis* sp. n. third left leg.

Fig. 34. *Aysha velox* (Becker) epigynum.

Fig. 35. *Anyphæna aperta* (Banks) epigynum.

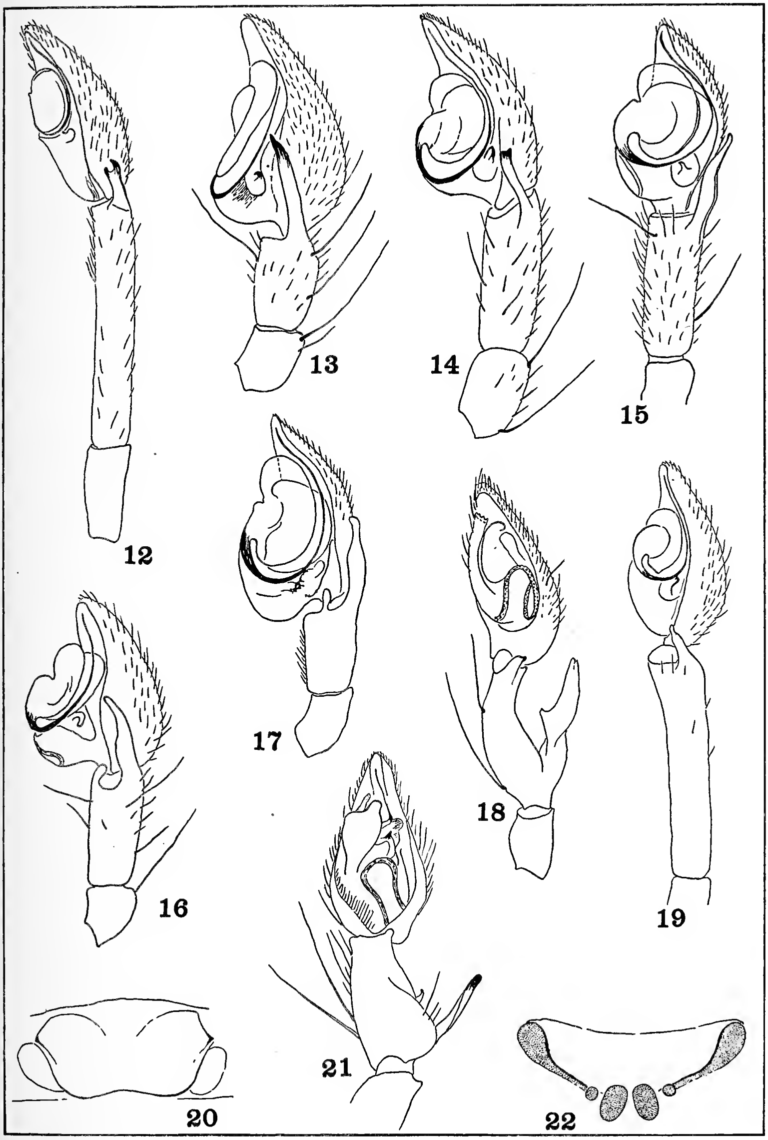
Fig. 36. *Anyphæna pacifica* (Banks) epigynum.

Psyche, 1931 Vol. 38, Plate 6



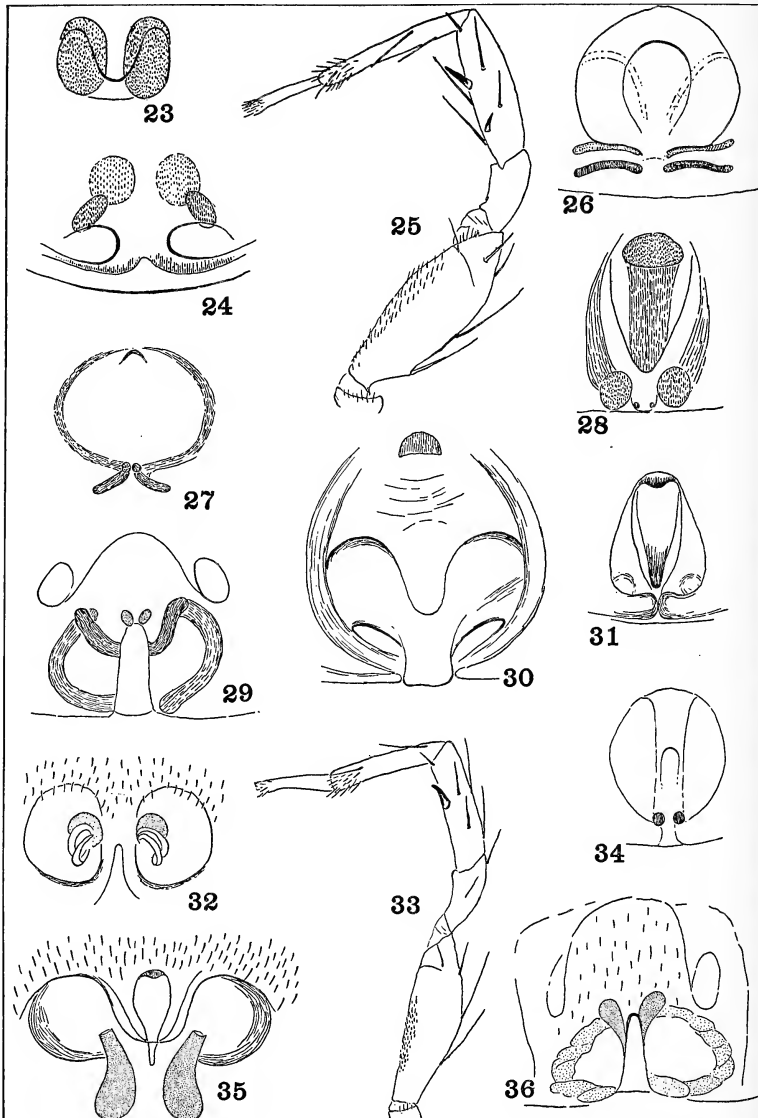
Bryant, Anyphæninæ

Psyche, 1931 VOL. 38, PLATE 7



Bryant, Anyphæninæ

Psyche, 1931 Vol. 38, Plate 8



Bryant, Anyphæninæ

BOOK NOTICE

GUIDE TO THE STUDY OF THE WINGS OF INSECTS WITH SUGGESTIONS FOR THE INSTRUCTOR. By Professor J. C. Bradley. Daw, Illston & Co., 1931. 41 + 17 pages, 68 plates.

In recent years the venation of the wings of insects has come to play a large part in the classification of these invertebrates and in our understanding of their phylogeny. This use of the venation has been made possible largely by the application of a uniform terminology to the veins in the wings of all insects. A knowledge of the venation has consequently become an essential although troublesome part of the program of the entomological student. Professor Bradley's guide is designed to aid the student in his attempt to decipher the venation in the various orders and to understand the main lines of evolution along which the wings have advanced. The guide itself consists of a discussion of the general characteristics of the wings and the important features of the venation in the orders and certain representative families. The 68 plates, which are loose in an envelope, include drawings of 67 species belonging to 13 orders; the figures are printed faintly, so that the student can ink the veins as he studies the wings in the laboratory. The booklet of suggestions for the instructor consists mainly of an explanation of the more difficult and perplexing features of the wings illustrated.

The venational interpretation used in the guide is essentially that of Comstock and Needham, whose investigations over 30 years ago were responsible for the system of uniform terminology now in general use. Professor Bradley has modified the portions of that system which have been shown by subsequent research to be incorrect: the radial sector of the Odonata is interpreted in accordance with the conclusions of Lameere, Martynov, and Tillyard; the cubitus and anal veins in the Neuroptera, which Comstock and Needham confused, have been correctly determined; and the interpretation of several details in the venation of the

Diptera has been changed as a result of Alexander's investigations. Professor Bradley has not accepted, however, the identification of Cu2 made by several recent workers (Tillyard, Martynov, Imms). The author maintains that Comstock and Needham originally designated as 1A the vein which these investigators call Cu2 and that the original name (1A) should be retained. If it be true that the vein was independent of Cu1 in the ancient insects, then the terminology of Comstock and Needham should of course be used. But if the vein arises from the stem of Cu1 and is therefore a part of the cubital system, I believe it should be designated the *posterior cubitus* (CuP), as suggested by Martynov. Unfortunately, our knowledge of the convexity and concavity of the veins in the Paleozoic insects is very meagre, most of the insects of that horizon having been described before the significance of that aspect of the wing was realized; but I believe that what little evidence is at hand points definitely to the conclusion that 1A (of Comstock) originally arose from the stem of the cubitus.

F. M. CARPENTER.

PSYCHE

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THE NESTING HABITS OF *POLISTES RUBIGINOSIS*, WITH SPECIAL REFERENCE TO PLEOMETROSIS IN THIS AND OTHER SPECIES OF POLISTES WASPS

By Phil Rau

Kirkwood, Missouri

The ingenuity of various species of *Polistes* in their task of nest-building, and the consistency with which each species adapts the nest to the chosen situation, have ever been the cause of pleasant surprise to the student of these wasps. In a paper recently published[1] on the habitat of Polistes, we find that each of the four species that are common hereabouts choose nesting-sites which are more or less distinct. *Polistes pallipes* build their symmetrical nests in sheds, barns, and under the eaves of roofs where space is not limited. *Polistes variatus* make their nests more compact, to fit small spaces under rocks on the ground or in pockets in banks of soil. *P. annularis* build nests in the tree-tops, with a side-wise tilt and a heavy roof to shed the rain. But *P. rubiginosis* long kept their secret of where they hid their nests. It was indeed puzzling that the literature contained so little on the habits of a wasp which is so common and conspicuous in the fields. The reason is evident when we learn that they habitually build in dark, inaccessible places, often high up out of reach, in hollow trees, or

[1] Ecology, 10:191-200. 1929.

behind the walls of old wooden buildings where they find ingress and egress through a tiny crack or knot-hole (Figs. 1 and 5) some distance from the actual site of the nest.

Under these conditions, I was indeed fortunate in finding a nest of *rubiginosis* unusually low so I could make observations on their behavior. Since these wasps prefer dark, inaccessible places, the queen which began this one

Fig. 1.

found an ideal spot here. The little shanty was one of a half-dozen huts which had been built for the storing of ammunition during the war. They stood in a large woods about seven miles from the city, but now were unused and abandoned. This was a sheet-metal structure among half a dozen wooden ones in a row, all windowless and dark, with only a small opening near the top of each for ventilation. With the door closed, the place was dark enough to make happy the heart of any seclusion-loving creature. Here it was that, on opening the door on October 13, 1928, I was delighted to find a colony of these wasps. The nest was large, with all of the cells empty, and occupied by about fifty fine adults, which I supposed were queens. This was my opportunity to learn something of their habits of hibernation, and the founding of new colonies the next spring. I have already shown[2] that in *P. annularis* the queens hibernate some distance away from the nest, but on warm, sunny days of winter they often return to the old homestead, and when they make ready to found their own colonies, they do so in the vicinity of their former home, often with several queens co-operating in constructing one nest, and occasionally biting out the cell walls of their old nest for building materials for the new.

These, then, were the problems which I wished to solve for *rubiginosis:*

(a) Will these queens hibernate on the nest all winter, or will they disseminate?

(b) Will they revisit the old home during the warm days of winter?

(c) When they do build in the spring, will they choose nesting-sites near to the one where they were born?

Occasional visits to the shed yielded the following data in answer to the above questions:

On October 13, fifty queens were on the nest; on October 27, forty were there; on November 4, ten remained, and on December 3, three were on the wall near the site, the nest having fallen to the floor. A careful search through the five similar buildings nearby revealed none on these dates. This shows that they do not hibernate on the nest, but wander elsewhere; that they do not leave the nest in a body or swarm, and that some cling to the nest more tenaciously, literally and figuratively speaking, than do others. But the fact that they do not leave in a body does not mean that they do not hibernate gregariously, for

[2] Annals Ent. Soc. Amer. 23: 461-466, 1930.

during the previous year in January, I discovered about a hundred queens of this species huddled together in the galleries of the carpenter ant in a fallen tree. They were grouped in three masses, and when taken into the laboratory would often come out of the log when the room was warm, but would always huddle together in the galleries when the room became cold.

I cannot say with certainty whether they return on warm days to the old home, thereby refreshing their memories of the site. I was unable to visit the place during the winter as often as I intended: however, on three visits on very warm days in February no wasps were present.

Fortunately, we have a more positive reply to the question whether the queens build their new nests near the place where they were born, after having spent the winter elsewhere in hibernation. Likewise the question, does more than one queen work together on a nest, is answered in the affirmative, as the following data will show regarding these two points.

My next visit to the row of sheds was on June 8. There I found in the little house a new nest, just a few feet from the site of the old one. As mentioned before, the old one had fallen during the early winter, and I had left it on the floor, but it had been carried away during the winter. Hence the nest itself could hardly have been the object which they remembered or which attracted them, but the little building itself. This new nest was hexagonal, with 148 cells, only 8 of which were capped; the rest were shallow and filled with eggs and larvæ of various sizes. There were no full-sized empty cells from which adults could have emerged; in spite of this, however, seventeen adults were on the nest. These, then, were undoubtedly the queens which had emerged the previous autumn. Of course, when one finds more than one queen on the nest, one suspects that the surplus queens sink into the insignificant role of workers, while only one rules the nest in royal fashion. Whether or not this happens has yet to be ascertained, but here with so large a nest so early in the year, it is quite probable that all the queens had shared in the labor of its construction. Not all of the queens were on the nest when I arrived at 9 a.m.; only eleven were there, but during the following three hours, six came in, some carrying materials and others left from time to time. Since all of these queens were given individual marks, I could make certain that the majority of them shared in the work.

The adjacent building, made of wood, similar in structure, equally dark and only two feet away, had contained no nest the previous year; now it harbored three nests of *rubiginosis*. One of these had four queens and 48 cells, another had two queens and 35 cells, and the third had one queen and 15 cells. The number of cells was only roughly in proportion to the number of queens per nest; the more queens, the more cells per nest. This, in turn, would mean, as one would expect, that all or most of the queens do work. However, it is evident that as the number of queens on the nest increases the work done by each individual is proportionally less. The nest with seventeen queens averaged nine cells per queen; the one with four queens averaged twelve cells each; the one with two queens averaged seventeen cells, while the lone queen had made fifteen cells. An individual *rubiginosis* mother, even though of larger size than *pallipes,* builds no faster than many queens of the latter; this is shown by a comparison of the size of the nest of this species with that of *pallipes*. Six nests of the latter in nearby buildings with one mother each, had 15, 20, 14, 12, 10 and 7 cells on this same date.

To summarize, then, we find that, like *P. annularis* of the tree-tops, this species remembered the old nesting-site and returned to it after hibernating elsewhere, and disseminated from the place of their birth, but did not go very far from it to build their own nests.[3] One or more queens founded the new nest and shared in the work. The founders

[3] Hoffer (Clements and Long, Experimental Pollination, p. 248. 1923) found that bumble bees remembered the place of their nest from the middle of October to April, when they returned. Also see article by Frison, Canad. Entom. 62: 51, 1930, who also finds that bumble bees remember the home site after spending the winter in hibernation.

of the nest were true sister queens, sharing in the activities alike, and so far as I could see no individual assumed the haughty role of queen.

At this point it will be well to digress from the nest-building habits of this species and discuss the facts of pleometrosis and its origin.

In a very interesting paper by Dr. J. Bequaert, entitled "Vestigial Pleometrosis in the North American *Polistes pallipes*,"[4] the term "pleometrosis" (which Wasmann introduced for ants) is used to signify the founding of a new colony by two or more fecundated females. Bequaert says that when pleometrosis occurs "among strictly monogynous wasps as with *Polistes*, it is well worthy of careful investigation, since it evidently is then one of those vestigial instincts whose study is of great value for a proper understanding of animal behavior."

Pleometrosis occurs here about St. Louis abundantly in *P. annularis*, occasionally in *P. rubiginosis* and but rarely in *P. pallipes*. This seems to be contrary to the findings for *P. pallipes* about New York.[5]

After viewing the occurrence of this habit in our *Polistes*, I am inclined to believe that pleometrosis in our northern species of *Polistes* had its origin in the "swarming" habit of tropical *Polistes*. In a paper now in course of publication on *Polistes canadensis* and *Polistes versicolor* of Barro Colorado Island in Panama, I show that when the colony grows too large or a catastrophe occurs to the nests,

[4] Bull. Brooklyn Entom. Soc. 18: 73-79, 1923.

[5] During a period of ten years, I have seen, among a thousand or more nests of *P. pallipes* examined, only six nests with two queens, and only one nest with three queens. I have always been on the lookout for the nests in the spring before the workers emerged, so that I could mark the queens with paint and find if one was truly a specialized egg-laying queen, and the other sank into the insignificant role of worker. In every case where this was tried, the queens deserted the nests soon after the ordeal of being marked, and the problem remains unsolved. Had I waited until larvæ were in the cells they might have been more faithful to their tasks; one must, however, mark the queens in *pallipes* before the young emerge, since it is not possible to distinguish workers from queens by either size or color. In course of two years I have been able to examine only about twenty-five nests of *P. variatus* in early spring, but I have never found more than one queen founding a nest.

swarming occurs much after the fashion of swarming of honey bees, with this difference; whereas the honey bee swarm seeks a new location in body, the swarm of *Polistes* wasps in the tropics breaks up into many smaller groups of few or many individuals, and these found the new homes. In the tropics where winter and hibernation do not occur, this is the method of dissemination. In the north, cold and hibernation interfere with this method, but we do see an adherence more or less complete (but in certain species no less complete) to the habit of pleometrosis, after assembling on the old home site which, after all, is very similar to swarming. This may or may not be vestigial in character, for it is difficult to tell whether pleometrosis is ascending to higher socialization, or is in a vestigial condition.

Thus we see that the occasional condition (more or less frequent according to the different species of *Polistes*) of more than one mother founding a colony has an analagous counterpart in the swarming of a sister species in the tropics. There seems to be but little difference between the psychological reactions of members of a colony when activities are cut short by the violent destruction of the nest in the tropics, or the violent curtailment of their activities in the north by the cold. In both cases, members of the colony disband and found new colonies with one, two or more queens present; however, in the tropics the founding of new colonies occurs immediately after adverse conditions occur, while in the north the founding of new colonies is interrupted by a period of hibernation in which the wasps are numb with cold. In any event, the long period of dormancy in the northern species apparently has not caused the wasps to forget how to behave like their tropical sisters when colonization occurs. Pleometrosis of *Polistes* in the tropics is due to the fact that with a twelve-month calendar, the colony splits up occasionally when it reaches great size, and one to many sister wasps go forth and found a new nest. But in the north where cold weather curtails the *Polistes* activities to only a fraction of a calendar year, pleometrosis undoubtedly has its origin in the queen's remembering the home location, going there in the spring and meeting sister queens, and founding their nests near by. This marked difference between the two populations exists, however: in the northern *Polistes,* only the queens survive the winter and are ready to scatter in the spring, whereas in the tropical species, some of those which found new colonies may be workers. Bequaert (*loc. cit.* p. 76) says that in some species of tropical *Polistes,* "it is often hardly possible to distinguish externally workers from fertile females, and in some of the species it is even doubtful whether a differentiated worker caste is present."

Of course, if all of the wasps built close to the old home, there would be no world-wide distribution. Some of them fare forth alone to greater distances. Even so small a trait as this shows that they have individual psychological characteristics upon which selection may play. The inclination to stay near the old home or the inclination to venture farther may be very significant in the development of the habits of the species. It is the difference between conservatism and initiative, which, small in the beginning, may be vast in the end.

In this instance of fifty *P. rubiginosis* that were seen on the nest October 13, only twenty-four appeared the next spring, building the four nests already referred to. Some of the other 26 must have gone to greater distances to build, unless the mortality was that great. The powder-houses in which these nests were found had presented the same opportunities for this species to build for the past five years, but this is the first time that one of these pioneers found it good for a nest, and fixed a site for twenty-four of her less venturesome descendants. Of course, in studies of this kind we can follow only the lives of those conservative individuals which remain near home; of those venturesome pioneers which blaze new trails, we can have nothing to say. The first *rubiginosis* queen that came to this shed must have ventured some distance from her old home, perhaps in some hollow tree.

With these four new nests of *rubiginosis* at hand, all within easy reach of the eye (an unusual condition), I made plans for learning more of their habits, but unfortunately the house containing the three nests was destroyed by the new owner of the grounds, and an accident befell the fourth which was in the metal house. The latter, however, gave me the following notes before the occurrence of the accident.

This nest with seventeen queens was revisited on June 19, after a nine-day absence. During this period, ten cells had been added to the nest, and instead of seventeen adults, only thirteen were on the nest. The others may have become easy prey to their enemies because of the conspicuous paint spots which I had placed on their bodies. The nest was attached to the ceiling about ten inches from two small ventilator-slits in one side-wall; through these slits the wasps came and went. On hot days, one, two or three wasps were stationed at these ventilators; they vibrated their wings rapidly for periods up to ten minutes. When the sun beat down upon the sheet-iron roof, it was indeed sweltering in there; hence I suppose this performance was for the purpose of cooling the nest, much after the manner of the trumpeter bees which ventilate the nests of bumblebees, or honey-bees that do the same at the entrance to the hive.

It is hard to see how this would be accomplished with the nest ten inches away; I sometimes wonder if the same behavior on the nest instead of at the opening would not do more good, but doubtless the wasps' judgment is better than mine in that. Their behavior agreed with that of other species of Hymenoptera which do their fanning at the hive entrance.

The incoming queens carried water, and placed much of it in large globules in the cells with the eggs or young larvæ. The lids of four sealed cells were thoroughly saturated with water, and another cell which had a concave instead of a convex cap had this cavity completely filled with water. This habit of spreading water on the outside of sealed cells was also noted for *pallipes* colonies elsewhere;[6] this precaution may protect the pupae from drying up. These *P. rubi-*

[6] See article to appear in Ecology, 1931, entitled "Polistes Wasps and their use of Water."

ginosis bring in large globules that glisten in their jaws as they fly. Sometimes if disturbed they lose their drops in flight or as they alight on the nest; by placing my notebook under the nest I have collected many such drops. At first I thought that the liquid might be a thin nectar, but when I substituted my tongue for my notebook, my taste told me it was clear water.

It is strange that so many of the wasps remained on the nest most of the time. In this colony of thirteen queens, from nine to thirteen were on the nest at all times; this means that sometimes none were out, and never more than four were out at one time. I could not understand why, with June still young, this group did not hustle to bring in pulp and increase the size of the nest. It appeared that they were merely waiting for the workers to emerge; with the first of their queenly instincts satisfied, they were remembering that they were queens, and now had only to await the vassals. Many of the larvæ were full-grown and ready to spin, and the younger larvæ could be sustained with only a few of the queens at work occasionally. While nine days ago only eight cells had been capped, today twenty-eight were capped. All this prospect of help from twenty-eight workers in the near future may account for the aristocratic languor of these queens.

With so many adults on the nest, it was hard to follow the activities of each, even though all bore distinguishing marks, but a few notes were so made. For instance, three certain wasps were seen more frequently than the others at the ventilating hole, vibrating their wings. "Red-thorax" gave special attention to inspecting the cells with larvae; "Blue-thorax" often left her ventilating post and flew afield, and when she returned to the nest the others would sip nectar or what not from her mouth. No paper pulp was being brought in now, and only a few shallow cells contained eggs. In one place instinct had miscarried; a cell with one-fourth grown larva contained also an egg, deposited a little below it. Since no cell is capable of bringing to maturity two larvæ, one must eventually perish.

The nest did not adhere well to the smooth iron ceiling, so when I attempted to pull off with the forceps a tightly clinging queen, the whole nest crashed to the floor. I could not again fasten the nest to the metal ceiling, but since I had seen *P. pallipes* and *P. variatus* build again in the same spots after their nests had been taken, I hoped the same would occur here. Not knowing what to do with the nest, I placed it, open side down, on the shelf near the ventilating hole where the wasps would pass it on their way in and out. The wasps were furious for some time, and flew angrily about, and then one by one settled on the spot where the nest had been attached. After an hour, five queens left this congregation and assumed duties on the nest on the shelf. I left them with six wasps on the ceiling at the old site, and five on the nest on the shelf.

When their instincts are misled, one may expect almost anything. When I returned to the colony on June 23, I found the number of wasps complete, but they had left the ceiling and all were now at work on the nest on the shelf. Here, it seemed, would be something new in behavior; instead of all constructing a new nest, all now united in work on the old nest on the shelf, destroying it and carrying it out bit by bit. About fifteen cells had already been completely removed; the nest material and larvæ were being discarded, and even the capped cells were broken open and the pupæ carried out. Some of the queens would bite off pieces of the nest and drop them directly below, while others would fly out a distance and drop them while on the wing. One particular wasp would always drop her load below, six inches east, where already an accumulation of litter on the floor told of her diligence; another habitually dropped her loads toward the south. Eleven of the old, marked queens remained on the nest, but no new ones were there; this indicates that the maturing pupæ had been thoroughly destroyed.

The whole colony seemed to be demoralized, and several were seen eating and kneading the flesh of their own young. They were all restless, and appeared nervous and angry, working in helter-skelter fashion, destroying when they should be building, yet all seemed to be of one mind, intent upon demolishing the nest and its contents and getting it off the premises as soon as possible. At a short distance from the nest, the chewing of paper pulp by the angry wasps sounded like the gnawing of a mouse in old papers. They were indeed as busy as they were angry, as they energetically poked their heads into the cells, as if in search for any that might remain. The larvæ seemed more the object of their wrath than the nest itself. The larvæ were always carried out and dropped at a great distance, while the bits of material were merely dropped below near by. Sometimes the larva was too heavy to permit a long flight; then the wasp would fly to the ground with it, but always drag it one to four feet away before abandoning it.

On June 30, a week later, they were still at the job; the nest was about two-thirds gone. Even two weeks later, July 14, a portion of the old nest still remained, with eight queens on board. They were unusually susceptible to intrusion, and one marked with green singled me out for attack during my entire stay of an hour. She stung me once, and came back to renew her attacks as often as I chased her out.

Perhaps their nervousness was increased by the fact that there was now a new nest also to be defended. On the ceiling, near the spot where the old nest had been, was the new nest with four of the queens on it. It was hexagonal in shape, and contained fifty-one cells, arranged in beautiful symmetry; the first row on one side had six cells, and the others in order contained 7, 8, 9, 8, 7 and 6 cells, respectively. Here they were at last doing what they probably would have done at first, had not the presence of the old, broken nest near by disconcerted them. They rebuilt the nest near the old site, just as *P. pallipes* and *P. variatus* had done elsewhere when their nests were removed.

By July 28 I found a thriving nest of eighty-two cells, all shallow, of course, each containing an egg, and every cell but the four newest ones at the edge had round, shiny pellets of honey. The globules in the cells varied in size and number. My sense of taste told me that these were really thin nectar, and not the drops of water which these wasps bring in when the larvæ are in an advanced stage or the cells are capped. Thus we find that this wasp provides honey for the first meal for the larvæ, just as do the other species of *Polistes*.[7]

Although eight or nine queens were on the new nest on the ceiling, they had not yet entirely abandoned the old one on the ledge. Three wasps, still wearing their identification marks, were on it, but all that was left of that beautiful nest of 175 cells was the mutilated stumps of about twenty-five cells. However, the wasps had tried to do something for the colony. Most of the cells contained eggs, but four cells had two eggs each, and two had three eggs. Perhaps it is no wonder their egg-laying instinct had gone astray amid such confusion.

The wasps guarded this new nest carefully. Only a few ventured out at any one time. Possibly they had something to fear from ants. A mouse made itself quite at home, running along the ledge nearby, not fearing even my presence; no doubt he would have made inroads on the eggs and larvæ if the guards had not been present.

We can readily see how *Polistes annularis*, coming back to the old home nest in the trees in the spring after a period of hibernation in a distant sheltered spot, can readily disseminate to similar branches near by. Obviously it is not so easy for *P. rubiginosis* to find nesting-places which fill her exacting requirements other than the immediate site of the parental nest. This difficulty, coupled with the innate tendency to return, probably accounts for the habit of nesting repeatedly near the same spot. In the photograph (fig. 1) the knot-hole[8] affords an entrance to a colony of *rubiginosis* situated in the dark space between the inside and outside wall. The paper nest was attached to the horizontal beam. Horizontal and vertical studding

[7] See article on "Honey Gathering Habits of Polistes." Biol. Bull. 54: 503-519, 1928.

[8] The knot-hole is the scene of the observations on behavior described under the title, "At the end of the season with *Polistes rubiginosis*." (Ent. News 40: 7-13. 1929.) There I have shown how the inhabitants of the nest congregate in clusters about the opening with nothing to do but wait for the impulse to seek hibernating quarters. I failed, however, to include one note on the return of these wasps to this knot-hole the following spring, which I wish to add here, because it shows how after a period of hibernation elsewhere, the wasps (like *annularis*) remember the home site and return to it.

made a small, square room surrounding this hole. For three years, returning queens in the spring congregated in abundance about this opening. The second year another colony appeared up under the roof, and later others appeared in various parts of this old building, wherever a knot-hole or a crack was available. When finally the building was wrecked, I found eight such nests between the lath and the outer wall.

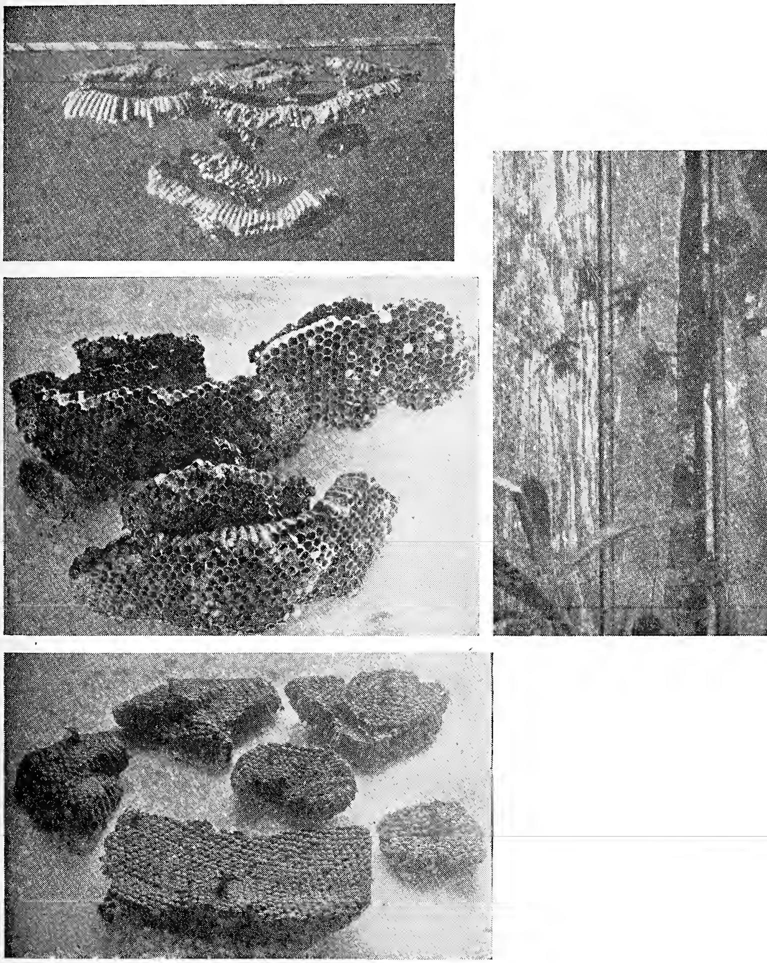
In two other distant localities in St. Louis County and Jefferson County the same condition prevailed and upon pulling off the boards which covered the nests I found in each several large combs which these wasps had built, one below another in true *Vespa* (not *Polistes*) fashion. In nest shown in fig. 2, each comb was attached to the one above by one or more pedicels, much after the manner of the comb attachment in nests of *Vespa*.[9] On the floor of this little square enclosure lay several old nests which had fallen of their own weight. Because of crowded conditions and the scarcity of proper dark nesting sites, these wasps had built tier below tier on the old nest; they had not used the old soiled cells, but each time had built anew, just below. Another new departure in habit also was apparent here: they were salvaging and rechewing the paper in the old combs for material for the new ones, as can be plainly seen in the top three sections in fig. 2. This certainly seemed like an ingenious step in the direction of economy. It was interesting to note that in reducing these old nests to pulp, they used only the clean, soft cells, but did not attack the roofs; these were extremely tough, and were contaminated by the many larvæ that had grown in the cells. Moreover, if the roofs had been broken, the support of their nests would have been weakened.

I say that the combs, attached one below the other, remind me of the nests of *Vespa*. It is easy to imagine this as the beginning of a new habit of nest building in *rubiginosis*, or to conjecture that it is a revival of some ancestral habit.

Vespa usually adds sheets of paper to enclose the

[9] A close-up of the same nest is shown in fig. 3.

combs. They make all of the combs in one season, instead of building a new comb each year. However, *Vespa*



Figs. 2-5. For explanation see text.

crabro[10] builds comb below comb in hollow trees, without paper covering-sheets, and builds the combs all in one

[10] Buetenmuller. Trans. New York Entom. Soc. 6, plate 9, 1911.

season. The indications are that in the course of[11] evolution, *P. rubiginosis* is becoming, in nest-building habits, more like *Vespa crabro* than it is like any other species of *Vespa* or *Polistes*, because they build in dark and inaccessible places, and build comb beneath comb.

A nest was taken at Wickes on September 7, 1919. Two days later, I noticed that one capped cell had an incision, and further observation showed a parasite in the act of emerging. The cap was removed, and under it I found the shrivelled pupa of *P. rubiginosis* pushed up toward the capped opening, and one-third of the distance down in the cell was a second cap or partition. This proved to be the covering of a series of elongated cocoons, each containing

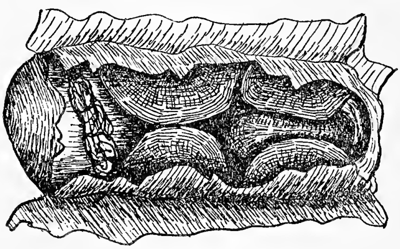


Fig. 6.

a parasite, *Christelia arvalis* Cress. [R. A. Cushman]. (fig. 6). In this particular case the host, despite parasitization, had succeeded in spinning its cap, but in four other cells in this nest infestation had occurred earlier, so the wasp larvæ had not the strength to spin their own coverings. Each parasite had spun its own cocoon; some had spun in nearly a horizontal position, others had spun in an upright position against the wall. The *Polistes* cells each contained about six cocoons of the parasite.

[11] When *rubiginosis* has sufficient room to build, the nests are very evenly made, and beautifully hexagonal in shape. When the conditions are crowded and space limited, the nests are made in various shapes, as shown in the collection of six in fig. 4. In fig. 3, which is another view of fig. 2, one can see more of the ill-shaped handiwork. However, if one looks closely in the center of the lowermost nest in the latter figure, one can see how the nest started out to be hexagonal, but the additions added to either side grew according to the available space.

ON SOME CARIBIDÆ, INCLUDING NEW SPECIES, FROM THE MOUNTAINS OF NORTH CAROLINA AND TENNESSEE

By P. J. Darlington, Jr.

In late August and early September, 1930, I collected with an expedition from the Museum of Comparative Zoölogy (of Cambridge, Massachusetts) on several of the mountain ranges of western North Carolina and eastern Tennessee. Probably because of the lateness and dryness of the season few phytophagous or other arboreal beetles were found. However, Carabidæ, in which I was chiefly interested, were abundant in suitable places, especially on the heavily forested slopes of the higher mountains, so that we (Prof. Nathan Banks, Dr. F. M. Carpenter, Mr. Gilbert Banks and myself) were able to secure about 1800 specimens of the family. Dr. W. S. Creighton and Mrs. Creighton collected about 400 additional Carabidæ at Little Switzerland, in the Black Mountains, North Carolina, also during the summer of 1930. This collection they have very kindly turned over to me. Study of these series of accurately labeled specimens has led to the recognition of several new species and subspecies, and it is chiefly to describe these novelties that the present paper is written. However, a few previously described local forms are discussed. It is hoped that the paper may help to stimulate coleopterists to collect and study the interesting fauna of the southern Appalachian uplands. Only when much more collecting has been done, and the specimens labeled accurately *and in detail,* can a comprehensive study of this fauna and of its distribution be undertaken.

I am indebted to the authorities of the Museum of Comparative Zoölogy not only for sending me with their expedi-

tion to the southern Appalachian region, but for permitting me to study the Coleoptera which were secured, and to refer to the invaluable type collections in the Museum. The authorities of the American Museum have very kindly allowed me to examine several types and other specimens in their care collected by Beutenmüller in the Black Mountains.

Scaphinotus viduus irregularis Beut.

Taken by us at about 6,000 feet on Mt. Mitchell, Black Mountains, N. C., and at 5,200 feet at Newfound Gap, Smoky Mountains, on the North Carolina-Tennessee state line. Three specimens in all, under stones and loose bark.

I have seen the type in the American Museum. This is a geographical subspecies of the more northern typical *viduus,* not an aberration as stated by Roeschke (1907, p. 145). *Irregularis* seems to be the only recognizable subspecies of *viduus,* for the series of *viduus* which I have examined from New England and other regions show conclusively that *leonardi* Harr. is not valid. All the characters given by Harris (1839, p. 193) to distinguish *leonardi* from *viduus* prove to be of a purely individual nature.

Scaphinotus confusus n. sp.

General form and structure of the subgenus Irichroa as defined by Roeschke (1907).

Color black, with variable æneus or purplish reflections above.

Head of the usual Irichroa type, but with the labrum less deeply emarginate and the eyes less prominent than usual.

Prothorax narrow, by actual measurement very slightly (about 10%) wider than long, but appearing as long as wide; about 1.6 times as wide as head. Sides bluntly angulate just before the middle, slightly convexly arcuate from lateral angles to anterior angles, slightly concavely arcuate and converging from lateral angles to basal angles, which are obtusely rounded. Base and apex slightly emarginate. Lateral margins very narrowly and evenly flexed from base to apex; each margin with a seta at the lateral angulation and a second seta a little before (not in) the basal angle. Disc of pronotum irregularly punctate and transversely wrinkled especially near the base and sides, variably elsewhere. Disc with a deep basal and a shallower apical transverse impression, the two connected by a median longitudinal impressed line.

Elytra with humeri broadly rounded, nearly obliterated. Each elytron with about 16 punctured striae anteriorly, but with more, especially in the ♀, near and behind the middle. Striae frequently in part irregular, however, especially laterally and apically and along a well-marked zone between the 9th and 11th striae (as counted near the front of the elytron). Epipleuræ rather closely and coarsely, but not deeply, punctured.

Anterior tarsi of ♂ very narrowly dilated, sole of the basal joint with spongy pubescence only in apical one-fourth of its length.

Length: ♂, 22.5-24-5; ♀, 26-28 mm.

Type: ♂, Museum of Comparative Zoölogy, No. 16430, from Mt. Mitchell, Black Mountains, North Carolina, taken by myself, September 7, at about 6,000 feet altitude, under loose bark at the base of a dead conifer in damp forest. Allotype ♀ and 5 paratypes (♂ ♂ ♂ ♀ ♀) from "Black Mountains, N. C., Beutenmüller," dated from May to July. One ♂, which I have not made a type, was taken by myself between Newfound Gap and Clingman's Dome, 5,200-6,642 feet, in the Smoky Mountains, on the North Carolina-Tennessee state line, September 2. A pair of paratypes is in my own collection; all the other specimens mentioned are in the Museum of Comparative Zoölogy.

Scaphinotus confusus may be distinguished from the other species of subgenus Irichroa as follows:

1. Prothorax rather broadly margined, the margin expanded toward the base .... *S. viduus*

   Margin usually narrower, not expanded toward the base 2

2. Anterior tarsi of ♂ scarcely dilated, sole of first joint with spongy pubescence confined to apical ¼. Elytral striae confused from about the 9th to the 11th striae, the zone of confusion separated from the marginal area of confused punctuation by several regular striae. Size larger, all specimens seen over 22 mm. long 3

   Anterior tarsi of ♂ more dilated, sole of first joint with spongy pubescence covering at least apical ½, sometimes nearly whole sole. Elytra usually, but not always, without a zone of confused striae separated from the margin by regular striae. Size smaller, usually under 22 mm. 4

3. Prothorax both actually and proportionately wider, almost exactly twice as wide as head...............*S. guyoti*

   Prothorax narrower, about 1.6 times as wide as head. Upon direct comparison the lateral margin of the prothorax is seen to be more abruptly and more narrowly reflexed, and the eyes to be less prominent than in *guyoti* ....*S. confusus*

4. ....All other species of Irichroa

Beutenmüller included *confusus* in his conception of *guyoti,* and it is possible that he had specimens of *confusus* before him when he described *angelli* (1918, p. 89). However, since the *entire* description of *angelli* consists of a statement that it is merely a black color form of *guyoti,* since no type seems to have been designated, and since Beutenmüller's material is so scattered that it is impossible to say that he did not have a black *guyoti* in his series, it seems best to take his statement at its face value and consider *angelli* as really a black form of *Scaphinotus guyoti* Lec. (It is to be noted that *S. guyoti* and *S. confusus* cannot be separated by color.) By thus interpreting Beutenmüller's inadequate description literally, I think that much future confusion may be avoided, especially abroad.

Scaphinotus guyoti Lec.

(*angelli* Beut.)

Not taken by the Museum of Comparative Zoölogy expedition. Described from "The Black Mountains of North Carolina . . . resembling in its characters *C. andrewsi*, but as large as *C. viduus*" (from original description, Leconte, 1866). The only specimens I have seen in addition to the type are a pair (♂ ♀) in the Blanchard Collection, Museum of Comparative Zoölogy, from Highlands, N. C. The relationship of this species to *confusus* Darl. (see key above) parallels very closely that of *S. andrewsi* to *S. germari*, as interpreted by Roeschke (1907).

It is to be noted that Roeschke did not know *guyoti*, but drew his description from those of several authors who failed to distinguish *confusus* from *guyoti*.

Nomaretus (Maronetus) unistriatus n. sp.

Of the general form and structure of the subgenus, sometimes called genus, Maronetus; *i. e.*, of the *imperfectus* group of Nomaretus.

Piceous black, strongly shining.

Head as usual in the subgenus, constricted just behind the eyes but expanded posteriorly to form a condyle.

Prothorax as long as wide, about 1.6 times as wide as head, widest about the middle; sides broadly arcuate in anterior ¾, converging but slightly sinuate before the obtuse basal angles; base and apex nearly squarely truncate. Disc of pronotum smooth and shining, with deep basal and shallower apical transverse impressions, the two connected by a median impressed longitudinal line; pronotum with also a short, deep sublongitudinal impression on each side near the basal angle. Raised lateral margin of pronotum very fine and even; each margin with two setigerous punctures, one about ⅓ from apex and one a little before base.

Elytra widest well before the middle, outer margin strongly arcuate anteriorly, slightly and nearly evenly arcuate posteriorly to the pointed but not produced apex. All striae completely obliterated except the sutural, which is represented in anterior ⅔ of elytral length by a series of coarse, subconfluent punctures. Disc of elytra otherwise shining and impunctate, except that on the left elytron there are three and on the right two setigerous (the bristles can be detected in three of the five punctures, and are broken off in the other two) punctures in a position corresponding to the 4th interval in striate Maronetus. Subapital marginal setigerus punctures of elytra nearly obliterated, only one or two very small ones being visible on each elytron.

Epipleuræ and under surface of body shining, impunctate except for the usual orderly series of setigerous punctures.

Tarsi and palpi of ♂ unknown; those of ♀ normal for Maronetus.

Length: ♀, 7 ¾ mm.

Type: ♀, Museum of Comparative Zoölogy, No. 16431, from Highlands, N. C., June, 1888. In the Frederick Blanchard Collection, probably collected by Blanchard himself.

Nomaretus unistriatus is unique in the great reduction of the elytral striation, and probably also in the reduction of the marginal setigerous punctures near the apex of the elytra. Blanchard's specimen (my type) has been mentioned by Leng (1916, p. 42) as probably representing an undescribed species, but Leng did not describe it, because he was unable to determine the amount of variation normally occurring in species of Maronetus. Fortunately the series of over 50 specimens of *M. schwarzi* before me shows pretty conclusively that such variation is not extreme, so that I feel sure that *unistriatus* is a real species, not an individual variant of some striate form. In addition to the unique characters by which it may be recognized at a glance, *unistriatus* differs from *schwarzi* in having the dorsal surface not microreticulate, and from *imperfectus* (probably its closest relative) in having setigerous punctures on the elytra in a position corresponding to the 4th interval in the striate species.

Nomaretus (Maronetus) debilis debilis Lec.

Taken by us in the Smoky Mountains at Newfound Gap near 5,200 feet, and between the Gap and Clingman's Dome, near 6,000 feet. Both localities are on the North Carolina-Tennessee state line. Three specimens in all. These have the elytral striae less impressed and less heavily punctured, especially apically and externally, than the unique type of *debilis* from Georgia, but it would not be wise to describe a Smoky Mountain race until a larger series of both it and the typical form can be examined.

Nomaretus (Maronetus) debilis alpinus Beut.

Taken by us in the Black Mountains on Mt. Mitchell, 5,000-6,711 feet, and on Grandfather Mountain, 3,000-4,000 feet. Five specimens in all. This distinct form is stouter than *debilis,* with nearly impunctate elytral striae. It seems to be a geographical (northern) rather than an alticoline subspecies of *debilis,* notwithstanding the opinions of Beutenmüller (1903, p. 512) and of Roeschke (1907, p. 160) to the contrary, for in the Smoky Mountains nearly typical *debilis* ranges nearly as high as *alpinus* does in the Black Mountains.

Both *Nomaretus debilis* and its subspecies *alpinus* seem invariably to be found under stones and logs on the ground, not under loose bark or among dead leaves like most of our other eastern Cychrini.

Sphæroderus multicarinatus n. sp.

Unusually elongate for the genus. Black, with bluish or purplish reflections on the head, prothorax, and outer margins of elytra.

Head as usual in the genus, except much more rugose than usual between the eyes, and usually with a strong, longitudinal puncture midway between the eyes.

Prothorax about 1.6 times as wide as head; appearing at least as long as wide, but by actual measurement about ⅛ wider than long. Base slightly wider than apex. Sides evenly, not strongly, arcuate in anterior ¾, distinctly sinuate before the right or slightly obtuse posterior angles. Base and apex slightly emarginate; lateral margins narrowly and evenly elevated, with a single setigerous puncture at middle. Pronotum with moderate basal and apical transverse impressions, with a fine longitudinal median impression from base to apex, and with a deep longitudinal fovea on each side extending from base more than ⅓ to apex. Numerous punctures are grouped in and near the foveæ and across the base, otherwise the disc is smooth, impunctate, and shining.

Elytra widest behind the middle, sides more arcuate posteriorly than anteriorly. Each elytron with about 16 striae as counted across the middle of its length. Intervals 4, 8 and 12 cariniform, but often interrupted; intervals 2, 6 and 10 also often cariniform (especially in ♀) but usually lower and more interrupted; other intervals much lower and usually so much interrupted that they resemble series of small tubercles; apex and outer margin of elytron studded with small tubercles, the striae confused. Epipleuræ moderately closely and coarsely punctate.

Anterior ♂ tarsi broadly dilated, basal joint entirely pubescent below; ♂ palpi each with last joint expanded, as usual in the genus.

Length 14-17 mm.; width 5.8-7 mm.

All type specimens from the Smoky Mountains, as follows: holotype ♂, allotype ♀, and 23 paratypes (12 ♂ ♂, 11 ♀ ♀) from Newfound Gap, near 5,200 feet, on the North Carolina-Tennessee state line, August 30 to September 3, 1930. 7 paratypes (♂, 6 ♀ ♀) from between Newfound Gap and Clingman's Dome, 5,000-6,642 feet, on the same state line, September 2. 2 paratypes (♀ ♀) from State Road to Newfound Gap, Tennessee side, 3,500 feet, September 1. 3 paratypes (♂ ♂ ♀) from Deep Creek (Bryson City), North Carolina, 2,000 feet, August 23-26. Holotype, allotype and paratypes in the Museum of Comparative Zoölogy (No. 16432); paratypes in the writer's collection. All type specimens taken by the writer and the other members of the Museum of Comparative Zoölogy 1930 expedition, in forest, usually under loose bark, in rotten logs, or on the ground among dead leaves. I have seen other specimens, which I have not made types, from Highlands, N. C. (Blanchard Collection, Museum of Comparative Zoölogy.)

This species may be distinguished from other Sphærodeus as follows:

Sides of prothorax near base broadly and distinctly, though not strongly, sinuate; elytra with numerous parallel carinæ ....*S. multicarinatus*

Sides of prothorax not sinuate, or, if sinuate, elytra without distinct parallel carinæ
All other species of Sphæroderus

The exceptionally narrow prothorax, and strong puncture on the head midway between the eyes in *multicarinatus* are also useful diagnostic characters.

Multicarinatus is a geographical representative of *Sphæroderus bicarinatus* Lec., which it replaces in the Smokies. As species go at present in the genus, *multicarinatus* is a specific form, differing from *bicarinatus* (of which I have seen the type and numerous other specimens from the Black Mountains, N. C.) in being more slender, with the sides of the prothorax sinuate, with a constant puncture between the eyes (rarely present in *bicarinatus*), and with better developed elytral carinæ. However, I have seen intergrades between the two species—notably a specimen from Lake Toxaway, N. C., 3,000 feet, August 28, taken by myself. Notwithstanding Leng's (1961, p. 41) opinion to the contrary, I think that *Sphæroderus lecontei, bicarinatus,* and *multicarinatus* are all geographical representatives of a single stock, and that when the genus is revised upon a sounder basis, the last two forms should be considered as (very distinct) subspecies of *lecontei.* Until a revision can be undertaken, however, the three forms had better be kept apart.

Nebria appalachia n. sp.

A member of subgenus Nebria *s. str.*, group XI of Bänninger's (1925) "Die Nibriini."

Brownish to piceous black; legs, palpi, antennæ, and (usually) a pair of spots between the eyes flavous.

Head proportionately large, with unusually prominent eyes.

Prothorax cordate; about 1/5 wider than the head across the eyes; just over 1/2 wider than long; base slightly narrower than apex, nearly 1/3 narrower than widest part; sides evenly arcuate in anterior 3/4, strongly sinuate before the *acute* basal angles. Base and apex slightly emarginate; basal angles each with a setigerous puncture; lateral margins narrow, without setigerous puncture; Disc of pronotum not punctate; transverse basal and apical impressions and median longitudinal line present, and also a pair of short, linear basal foveæ just within the basal angles.

Elytra widest behind the middle, each elytron independently rounded at apex; humeri distinctly narrowed; elytra each with 8 well impressed striae, the striae faintly or not punctate, the 3rd interval with 3 or 4 large setigerous punctures. Inner wings about as long as the elytra.

Prosternal process margined except at extreme apex. Abdominal sternites 3 to 5 each, with a pair of single setæ near middle. Anterior tarsi of ♂ slightly dilated, the first 3 joints pubescent beneath.

Length 7.5-8.5 mm. Width 3.0-3.7 mm.

Holotype ♂, allotype ♀, and 43 paratypes from the Smoky Mountains, below Newfound Gap, Tennessee side, near 5,000 feet, August 30. 8 paratypes from the Black Mountains, Mt. Mitchell, N. C., near 6,000 feet (just above Camp Alice), September 5. Holotype, allotype, and paratypes in the Museum of Comparative Zoölogy (No. 16433); paratypes in the writer's collection. All specimens taken by the writer under stones on gravelly bars and banks of small mountain brooks.

The absence of the lateral marginal bristle of the prothorax and the presence of red spots between the eyes distinguish *appalachia* from all our other species of Nebria *s. str.*, group XI (*cf.* Bänninger, *l. c.*) except from *pallipes*. From the latter *appalachia* may be known at once by its much smaller size, proportionately smaller prothorax and larger head, and especially by the acute rather than obtuse basal angles of the prothorax. *Appalachia* is one of our smallest, perhaps really our smallest, Nebria, and is apparently a strictly alticoline species. Careful search at 3,500 feet along the banks of the very stream, on the upper reaches of which the type series (Smoky Mountains) was collected, did not yield a single specimen.

Pterostichus (Gastrellarius) unicarum n. sp.

Small, slender, but slightly ventricose; dark brown or piceous, antennæ, palpi, tarsi, and apices of tibiæ rufous.

Head with two setigerous punctures over each eye; eyes moderately prominent; antennæ long and slender; mentum tooth entire, elongate, triangular, bluntly pointed at apex.

Prothorax by actual measurement very slightly wider than long; 1⅓ times as wide as head; somewhat constricted toward base; base slightly narrower than apex, ⅔ as wide as widest part; sides evenly arcuate in anterior ¾, rather strongly sinuate before the rectangular basal angles; lateral margin very fine and even; base margined, but sometimes indistinctly so at middle. Pronotum with basal and apical transverse impressions faint, connected by a deeper, longitudinal impressed line on middle of disc; later basal foveæ linear, extending from base ⅓ or less toward apex; surface of pronotum impunctate even about the foveæ.

Elytra more than ¼ wider than the prothorax ⅖ to ½ longer than wide; striae entire, not or just detectibly punctate; 3rd interval with a single setigerous puncture at or just behind the middle. Inner wings atrophied.

Anterior tarsi of ♂ slightly dilated, first 3 joints pubescent below; apex of last ventral segment with 1 bristle on each side in ♂, 2 in ♀.

Length 6.2-7.5 mm. Width 2.5-3 mm.

All specimens from the Smoky Mountains, as follows: Holotype ♂, allotype ♀, and 33 paratypes from Newfound Gap, North Carolina-Tennessee state line, 5,000-5,200 feet. 4 paratypes from State Road to Newfound Gap, Tennessee side, 3,500 feet. 13 paratypes from Deep Creek (Bryson City), N. C., 2,000 feet. All specimens taken by myself. Holotype, allotype, and paratypes in the Museum of Comparative Zoölogy (No. 16434); paratypes in the writer's collection. The Deep Creek specimens were washed from piles of drifted trash along the banks of the creek; they may have been carried down from higher altitudes. All the other specimens were taken among loose dead leaves (*not* in compact leaf mold) on the ground on forested slopes.

The name I have used is derived from that of the Unica Mountains, of which the Smoky Mountains are a part. I completely failed to find this species outside of the Smokies.

The various species of the subgenus Gastrellarius of Pterostichus may be tabulated as follows:

1. Base of pronotum with numerous scattered punctures; average size larger; only 1 setigerous puncture over each eye in *honestus* and probably in Casey's three species—

   honestus Say *scolopaceus* Csy.
   atronitens Csy. *deficiens* Csy.

   Base of pronotum not punctate; average size smaller; 2 setigerous punctures over each eye........ 2

2. Base of pronotum distinctly (and by actual measurement) wider than apex; form stouter and more convex; head proportionately smaller; elytral striae as a rule more distinctly punctate; length 5.0 (*teste* Casey)-6.8 mm. ....*blanchardi* Horn

   Base of pronotum distinctly (and by actual measurement) narrower than apex; form more slender, much as in *honestus;* other characters opposed to those above; length 6.2-7.55 mm. ....*unicarum* Darl.

I know Casey's three species only from description. I am indebted to Mr. L. L. Buchanan for pointing out to me the interesting reduction of the supraoccular setæ in *Gastrellarius honestus*. The presence of an entire mentum tooth in this subgenus is also noteworthy.

Pterostichus, subgenus or section Monoferonia Csy.

Casey 1918, p. 363

Excellent series, including all previously described and several new forms in this subgenus, are before me, so that it seems desirable to publish a complete review of the species. The treatment of Monoferonia as a group of full generic rank seems to me to be unjustified. I prefer to treat it merely as a natural subgenus or section of Pterostichus, as is done in the Junk Catalogue (Csiki 1930, p. 674). Among the other Pterostichini, Monoferonia may be characterized as follows:

Body slender, convex, black or piceous, very highly shining; mentum tooth deeply emarginate at apex; two bristles over each eye; prothorax never much constricted at base, the basal angles obtuse, often rounded at apex; inner basal stria of pronotum deep and linear, outer shorter, often deeply obliterated; elytral striation complete except that the scutellar stria is nearly or quite obsolete; a single dorsal puncture on inner edge of third elytral interval behind the middle (two punctures on one or both sides in rare individuals); inner wings atrophied; met-episternum short; sides of body below with or without (variation largely individual) scattered, shallow punctures; anterior tarsi of ♂ dilated, joints not oblique; ♂ palpi slender; last ventral abdominal segment of ♂ modified.

The species are difficult, but I think may be distinguished by the following table:

1. Elytral striae shallow, distinctly punctuate near base, intervals perfectly flat near apex; last ventral of ♂ only slightly modified .... 1. *primus* n. sp.

   Elytral striae more impressed, not distinctly punctulate, intervals distinctly convex even at apex (less so in typical *mancus*, in which, however, the ♂ last ventral is characteristically modified—see description below) 2

2. Outer basal fovea of pronotum nearly or quite obsolete, basal angles rounded at apex; last ventral

of ♂ with sculpture consisting of a large, apical, transverse impression, oval in form, and bounded anteriorly by a curved, transverse, subcariniform elevation .... 2. *diligendus* Chd.

Outer basal fovea usually (not always) well impressed, about ½ as long as inner fovea; basal angles of prothorax sometimes rounded apically, sometimes more abrupt; scultpure of ♂ last ventral not as described above 3

3. Last ventral of ♂ with a small but distinct, bubble-like, sometimes slightly transverse tubercle set in the middle of a weak, post-median depression; basal angles of prothorax rounded apically.

Striae of elytra lightly impressed apically (Ga.) 3a. *mancus* Lec. (typical)

Striae deeply impressed at apex (N. C.) 3b. *mancus plethorus* subsp. n.

Last ventral of ♂ weakly impressed behind the middle, with a weak, transverse elevation at extreme apex; basal angles of prothorax scarcely rounded apically.

Sides of prothorax distinctly, usually strongly, sinuate before the base; body stouter (Black Mountains region, etc.) ....4a. *carolinus* n. sp.

Sides of prothorax not or very slightly sinuate before the base; form more slender (Smoky Mountains)........4b. *carolinus fumorum* subsp. n.

"Monoferonia" idahoanus Csy. (1924, p. 78), of which I have apparent topotypes, is nothing but *Pterostichus sphodrinus* Lec. It lacks the dorsal puncture of the elytron characteristic of the subgenus Monoferonia (Casey himself notes this fact), and belongs in subgenus Hypherpes, or possibly Leptoferonia, by Casey's own table (1918, pp. 320-).

Since all our species are mutually similar in appearance and in most points of structure, the following brief descriptions are all that are necessary to characterize them. I shall take the commonest and best known species, *diligendus* Chd. (*osculans* Csy.), as a basis for comparison of the others. All of the species are found under stones and logs in damp forests.

1. **Pterostichus (Monoferonia) primus** n. sp.

Of usual form and appearance for the subgenus; sides of prothorax oblique and usually slightly sinuate before the basal angles; latter only minutely rounded at apex, and therefore more abrupt than in *diligendus;* outer basal stria of pronotum nearly or quite obliterated; elytral striae comparatively little impressed, distinctly punctulate in basal ½, intervals slightly convex anteriorly, completely flat in posterior ⅓; last ventral of ♂ slightly impressed behind the middle, with a very weak transverse ridge adjacent to the apical margin.

Length 10.0-11.3 mm. Width 3.6-4.0 mm.

Smoky Mountains at comparatively low elevations: holotype ♂, and 2 (♀♀) paratypes from Deep Creek (Bryson City), N. C., near 2,000 feet; 2 (♂♀) paratypes from State Road to Newfound Gap, Tennessee side, 3,500 feet. All collected by myself. A pair of paratypes is in my own collection; the rest of the type series, in the Museum of Comparative Zoölogy (No. 16435).

2. **Pterostichus (Monoferonia) diligendus** Chd.

(1868, p. 334)

osculans Csy. (1884, p. 2)
apalachius Horn (1892, p. 41)
appalachius (as corrected by) Csy. (1913, p. 132)

Of usual form and appearance for the subgenus; sides of prothorax oblique, rarely just perceptibly sinuate, before the basal angles; latter more broadly rounded at apex than in most Monoferonia; outer basal stria of pronotum either obliterated or very weak; elytral striae deep, only rarely with even the slightest trace of punctulation; elytral intervals definitely convex even at apex; the last ventral of ♂ with a large, subapical, transverse impression which is bounded anteriorly by a pronounced transverse ridge.

Length 10.7-14 mm. Width 4.0-5.0 mm.

Range at least from the lower slopes of the White Mountains of New Hampshire to Virginia (Pennington Gap) and possibly to North Carolina (1 ♀ from Linville, doubtfully determined), and west (*teste* Casey 1924, p. 78) to Priest Lake, Idaho. Common in some localities.

There seems to be no doubt that Chaudoir's *Feronia* (*Evarthrus*) *diligenda* is a species of Monoferonia, and I am reasonably sure that it is the present species, in spite of Chaudoir's later opinion (*cf.* Horn 1892, p. 41) that the name is a synonym of *mancus* Lec. *Mancus* and the present species, like all Monoferonia, resemble each other so closely, especially in the absence of males, that Chaudoir might easily have considered them identical, even upon a comparison of specimens, and we do not even know that he had an opportunity for direct comparison. Setting aside Chaudoir's later opinion as of no certain value, then, we have the following statements in the original description of *diligenda* which, in combination, I think can refer only to the present species: the basal angles of the prothorax are obtuse, with the apices rounded; the inner basal fovea of the pronotum is recurved along the base and the lateral margin, where it is obliterated (this description fits some of my specimens but not others); the elytral striae are smooth and deep through their entire length; and, most significant of all, the ♂ last ventral has a transverse oval impression near the posterior margin. The species under discussion is the only Monoferonia known to me to which this last statement really applies. Casey (1918, p. 363) points out that Chaudoir mentions a depression on the ♂ last ventral but not a more anterior transverse ridge, and evidently concludes that the ridge would have been mentioned if it had been present and that since it is not mentioned, *diligenda* must be distinct from *osculans,* which has such a ridge. This, of course, is merely another example of Casey's specious reasoning—its weakness becomes strikingly evident when it is pointed out that Casey, in his own original description of *osculans,* mentions only the depression, not the ridge, of the ♂ last ventral. It may be added that the present species is the commonest and most widely distributed Monoferonia, and that its range is the most easily accessible, facts which increase the probability that it is what Chaudoir had in hand.

3a. **Pterostichus (Monoferonia) mancus mancus** Lec. (1852, p. 234)

Form as usual in the subgenus; sides of prothorax oblique, sometimes just detectibly sinuate, before the posterior angles; the latter rounded at apex as in *diligendus;* outer basal stria of pronotum sometimes well marked and ½ as long as inner stria, sometimes almost obsolete; elytral striae less impressed than in any other Monoferonia except *primus,* intervals barely convex near apex, though more so anteriorly; striae not punctulate; last ventral of ♂ with a small, abrupt, rounded or sub-transverse, bubble-like tubercle set in the center of a very weak postmedian depressed area; tubercle smaller but distinct in the single ♀.

Length 11.0-11.8 mm. Width 3.9-4.4 mm.

Known to me only from Leconte's original series of three specimens (♂ ♂ ♀) from Georgia. A fourth (♀) specimen from the same locality, associated by Leconte, is *Pt.* (*Monoferonia*) *carolinus* (see below). In order to avoid confusion, I have labeled and here designate Leconte's first specimen (a ♂) as the type of *Pterostichus mancus* Lec. Type number: Museum of Comparative Zoölogy 16439.

3b. **Pterostichus (Monoferonia) mancus plethorus** subsp. nov.

Precisely similar to typical *mancus* except that the striae of the elytra are deeply impressed, with the intervals much more convex even at apex; last ventral of ♂ as in typical *mancus;* last ventral of ♀ usually (but not invariably) showing the ♂ sculpture in reduced form, *i. e.* with a minute, abrupt, bubble-like tubercle about 1/3 or 1/4 from the apex of the segment, but usually *not reaching the apex.* Females of other Monoferonia often have a less abrupt, longitudinal, *apical* elevation on the last ventral.)

Length 10.0-13.0 mm. Width 3.6-4.6 mm.

Holotype ♂, allotype ♀, and 81 paratypes (47 ♂♂, 34 ♀♀) all from the Black Mountains, Mt. Mitchell, North Carolina, 5,000-6,711 feet, taken by the writer and the other members of the museum expedition. Holotype, allotype, and paratypes in the Museum of Comparative Zoölogy (No. 16436); paratypes in the writer's collection.

This species (*mancus* and subspecies *plethorus*) seems to be the only one in which the sculpture of the ♀ last ventral is of assistance in identification, but the character is not to be depended upon even here, for it varies somewhat.

4a. **Pterostichus (Monoferonia) carolinus carolinus** n. sp.

Of usual appearance for Monoferonia; sides of prothorax rather strongly sinuate before the basal angles; the latter obtuse but almost right, rather abrupt, rounded only at extreme apex; outer basal stria of pronotum usually about 1/2 as long as inner, but sometimes partly obliterated; elytral striae deep, not punctulate, intervals strongly convex even at apex; ♂ last ventral weakly impressed behind the middle, with a weak transverse elevation contiguous to the apical margin.

Length 11.2-12.3 mm. Width 3.9-4.5 mm.

Holotype ♂, allotype ♀, and 29 paratypes, (18 ♂♂, 11 ♀♀), from the Black Mountains, Little Switzerland, N. C., about 3,400 feet, all taken by Dr. W. S. Creighton, August 9 to September 10. In addition to the types I have seen 1 ♀ from Linville, N. C., September 8 (Creighton); 3 ♂♂ (not quite typical) from Black Mountain City, N. C., 2,700 feet (taken by myself); and 1 ♀ from Georgia in the Leconte Collection. Paratypes are in the collection of the writer; all other specimens mentioned are in the Museum of Comparative Zoölogy (type No. 16437).

The sculpture of the ♂ last ventral of this species resembles that of *primus,* but the other characters of the two species are very different.

4b. **Pterostichus (Monoferonia) carolinus fumorum** subsp. nov.

Similar to typical *carolinus,* but a little smaller, with the sides of the prothorax only slightly or (usually) not at all sinuate before the basal angles; the latter therefore more obtuse than in typical *carolinus,* but still not nearly so rounded as in *diligendus;* ♂ last ventral as in *carolinus.*

Length 10.1-12.0 mm. Width 3.7-4.5 mm.

Holotype ♂, allotype ♀, and 17 paratypes (6 ♂♂, 11 ♀♀) from the Smoky Mountains, between Newfound Gap and Clingman's Dome, along the North Carolina-Tennessee state line, 5,000-6,642 feet, September 2, all collected by the writer. Strangely enough, the species was not found near Newfound Gap itself. Several paratypes are in the writer's collection; the rest of the type series is in the Museum of Comparative Zoölogy (No. 16438).

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A CUBAN VERMILEO

By William Morton Wheeler

In a brief note[1] I recently recorded the occurrence in Cuba of a very handsome species of the Rhagionid genus Vermileo. Knowing my interest in these insects, one of my students, Mr. Richard P. Dow, brought me 30 living larvæ which he had collected August 28 and 29, 1930, from their pitfalls in the sand under overhanging limestone cliffs at Mayari (2800 feet) and San José (900 feet) in the Trinidad Mountains of the southern part of that island. Three of the larvæ pupated after I had transferred them to fresh sand. Two failed to yield imagines, but in late October a somewhat crippled male fly issued from the third, and was readily identified as belonging to *Pheneus tibialis,* described by Walker some eighty years ago from Jamaica.[2] This insect is of unusual interest, both on account of its peculiar larval habits and because it is the type of Walker's genus Pheneus, which now becomes merely one of the numerous synonyms of Vermileo. In the note above cited I also called attention to the existence of yet another species of this genus, taken by H. H. Smith at an altitude of 7000 feet in the State of Guerrero, Mexico. This form was described by Williston in 1895[3] as *Arthrostylum fascipennis,* but was later[4] regarded by him as synonymous with Walker's *Pheneus tibialis.* The description, however, shows that it must be a different species of Vermileo. Of this genus, therefore, we now know four widely and discontinu-

[1] In "Demons of the Dust," W. W. Norton, New York, 1930, p. 275.

[2] Insecta Saundersiana. Vol. I, Diptera. London, 1850-1856, p. 156, Pl. 4, Fig. 3.)

[3] Two Remarkable New Genera of Diptera, Kansas Univ. Quart. 4, 1895-1896, pp. 107-109.

[4] Biol. Centr. Diptera, 1, 1901, p. 264.

ously distributed species in the New World, namely *V. comstocki* Wheeler of California, *opacus* Coquillet (possibly only a variety of *comstocki*) of California and New Mexico, *tibialis* Walker of Jamaica and Cuba, and *fascipennis* Williston of Mexico. The only other species, the genotype V. *vermileo* Linn., is confined to the Mediterranean region.[5]

On the approach of winter the larvæ collected by Mr. Dow were placed in a cold room and not brought into the heated laboratory till April 1, 1931. They at once became active, excavated fresh pitfalls and greedily seized and sucked the juices out of the ants, termites and meal-moth caterpillars with which they were provided. Some of them pupated in late May and several perfect flies of both sexes emerged during the period from June 10 to July 5. A day or two before emergence the brown, sand-incrusted pupa wriggled up through the sand till one or two millimeters of its anterior end projected into the air, and a few hours before emergence vigorously thrust its entire body out till it lay freely exposed on the surface. Then, usually in the early morning, the exquisite imago escaped from the pupa-case and was able to fly within two or three hours. It is a very delicate, short-lived, positively heliotactic insect which, unless very carefully handled, loses its legs quite as readily as many crane-flies (Tipulidæ).

Comparison of my Cuban specimens with Walker's brief description of the Jamaican *V. tibialis* reveals certain slight differences which are scarcely more than varietal or subspecific. Walker, however, was not noted for the adequacy of his dipterological descriptions, so that the recovery of the true Jamaican *tibialis* must be awaited before the precise status of the form discovered by Mr. Dow can be determined.

[5] The South European, Balearic and Egyptian localities in which this species is known to occur are listed in the "Demons of the Dust" (pp. 147-150). I there predicted its occurrence in Sicily, unfortunately overlooking the fact that it had already been taken at Taormina on that island by my friend Horace Donisthorpe (The Ants [Formicidæ] and some Myrmecophiles of Sicily. Ent. Rec. 38, 1926, pp. 161-165, 39, 1927, pp. 6-9; and the Guests of British Ants, London, 1927, p. 120, fig. 21.)

Vermileo tibialis (Walker)

var. **dowi** var. nov.

Female (living). Length 11-12; wing 9.5-10 mm.

Surface of body shining; rich fulvous yellow, with olive green eyes; face densely white pollinose; ocelli black; front and posterior surface of head dark brown, covered with grayish yellow dust. This becomes glistening white on the inferior posterior surface. Proboscis, palpi and antennæ pale yellow, the terminal antennal joint fulvous yellow, the arista white with blackish tip. Thoracic dorsum reddish, the mesonotum with a pair of narrow, ill-defined brown vittæ; scutellum, metanotum, pleuræ and coxæ and four abbreviated longitudinal lines on the anterior half of the mesonotum glistening white pollinose in most specimens. Abdomen with the posterior half of the tergites obscurely brownish, terminal segments and valves darker; venter anteriorly flesh-colored, sides whitish. Fore and middle legs yellow, paler than the hind legs, which are fulvous; the three terminal tarsal joints of all the legs, the distal three-fifths of the hind tibiæ and a long spot near the apex on the extensor surface of the hind femora, black. Wings smooth and glossy, their anterior borders broadly bright fulvous yellow shading into grayish posteriorly, their tips and a median transverse band, broadest near the costal border, blue black or blackish slate-colored; veins fulvous, blackish in the dark areas. Halteres fulvous yellow. Thorax and wings hairless; abdomen and legs, especially the hind pair, with extremely short and minute pubescence; orbital cilia white, short and inconspicuous.

Face and front narrow, linear, parallel-sided, of equal width. First antennal joint slender, at least twice as long as broad, second joint as long as broad, third joint slightly narrower than the second, oval, nearly twice as long as broad; arista distinctly segmented, somewhat longer than the remainder of the antenna. Thorax robust, very nearly as broad as the head, at least through the wing-insertions, and about one and one-half times as long as broad, very convex dorsally, rectangular anteriorly. Wings rather narrow; venation much as in *V. comstocki,* but the anterior branch (R 4) of the third longitudinal vein is more curved at the tip, the fourth posterior cell (M 3) is closed near the wing margin, forming a very short M 3 + Cu vein, and the apex of the first anal cell is so greatly contracted as to be almost closed. In *V. vermileo* the tips of the fourth posterior and first anal cell are contracted but not closed. Fore and hind tibiæ with a single stout spur; middle tibiæ with two spurs. Abdomen long and narrow, tapering at the tip; genital appendages small, the outer pair short and broadly excised distally, with rather acute anterior tips.

Male (living). Length 9.5-10 mm.; wing 8 mm.

Differing from the female in its smaller size and more slender stature, the thorax being decidedly narrower than the head and less convex dorsally, and the abdomen much more slender and clavately enlarged at the tip, though the genitalia are small. Face and front not narrower than in the female, but the two basal joints of the antennæ are distinctly broader, shorter and more flattened.

Mounted specimens of this fly soon lose their rich fulvous color and become dull reddish and the eyes dark brown. The glistening white dust on the thorax and coxæ is absent or poorly developed in some recently emerged individuals.

According to Walker the male of the Jamaican *tibialis* measures 4 lines (8.3 mm.) though the wings measure 7 lines (about 12 mm.). The former measurement may be readily explained as due to the shrinkage of the abdomen in drying, but the latter exceeds that of the females of the Cuban specimens. The Jamaican form, moreover, seems to have an entirely black antennal arista, the halteres having dark-colored knobs, the markings on the wings are brown instead of blue-black, and there is no dark spot near the apex of the hind femora. Walker's figure shows two spurs on the fore and hind, as well as on the middle tibiæ, but this may be a draughtsman's error.

Williston's description shows that the Mexican *Vermileo fascipennis* differs from *tibialis* in having the face bare, the dorsal portions of the three antennal joints as well as the arista, three posteriorly confluent stripes on the mesonotum, the pleuræ and the basal portion of the first (second?) abdominal segment, black. This segment has a yellow spot on each side. The hind femora, except their tips, the median portion of the hind tibiæ and the tip of the second joint of the hind tarsal are also black. The fourth posterior and anterior anal cell are closed as in *tibialis,* but the hind tibiæ have two spurs as in *V. vermileo.* The markings on the wings resemble those of the Jamaica *tibialis* in being brown, but the extreme tips seem to be pale. Williston's specimens were males measuring 10-12 mm., and were therefore as large as females of the var. *dowi.*

NOTES ON THE TICK, *ORNITHODOROS TALAJE* (GUER.), INFESTING A HOUSE IN THE CANAL ZONE

By Lawrence H. Dunn

Medical Entomologist and Assistant Director,
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On February 27, 1929, while at Gatun, Canal Zone, I learned through conversation with Dr. R. P. Curry, Assistant Chief Health Officer of the Canal Zone, and Sanitary Inspector C. A. Roach, of the Gatun District, that a short time previously the occupants of one of the houses at Gatun had complained of their quarters being infested with ticks that were biting them and causing considerable annoyance. They had collected several specimens of these ticks and brought them to the office of the District Physician at Gatun. From there they were sent to the Board of Health Laboratory, at Ancon, Canal Zone, where they were identified as *Ornithodoros talaje*.

Although I had been giving considerable attention to *O. talaje* in Panama for a number of years, this was the first time that I had learned of any definite reports of this species attacking man. Neither had I heard of their being found in houses in the terminal cities of Panama and Colon or in the American villages in the Canal Zone, although many of the rats captured in these places are usually heavily infested with the larval forms of this species. Nymphal and adult forms had been collected only in native huts in some of the interior villages where they were generally found in company with numerous *Ornithodoros venezuelensis* Brumpt. In view of these facts I was greatly interested to learn of this species being present in a dwelling at Gatun and attacking man and wishing to observe the conditions that prevailed, Dr.

Curry, Mr. Roach and I visited the infested quarters. The house was one of the regular Canal Zone type of four-family wooden quarters, and it was in one of the two downstairs apartments that the ticks were located. The occupant of this apartment was an American family, consisting of Mr. X, his wife and a ten year old son.

Mr. X was a civilian employee of the U. S. Army and had been occupying these quarters for a period of about three months. The previous occupant, so far as known, had made no complaint of being annoyed by arthropods in the house.

The X family began to be attacked soon after moving into the apartment. Since these attacks seemed to occur only at night and while in bed, it was at first suspected that the apartment was infested with bedbugs. A search was made which failed to reveal any bedbugs, but did result in several of the ticks being found.

The furniture in the house was all supplied through United States government channels, but there were two single beds in one room that had been used by the former occupant. Believing that these beds might be the source of infestation, Mr. X placed them in a storeroom and purchased new ones.

At the time of our visit, Mrs. X gave me a bottle containing ten of the ticks. These had been found during the thirty-three days that had elapsed since the previous lot had been collected and sent in for identification. Four of these were apparently second stage nymphs and six appeared to be in the third stage. All were flat and seemingly unfed and none had molted while in the bottle. Several of these specimens had been found on the white spreads covering the beds and the family believed that they were dropping from the ceiling.

The bedroom was lined with narrow matched pine boards and had been well painted. There were many crevices between the boards, however, that would provide hiding places for Ornithodoros, but a close search aided with flashlights and probing along in the crevices with toothpicks gave only negative results.

The two single beds, which were of iron, that had been placed in the storeroom were examined, and two cast nymphal skins of *O. talaje* were found in a joint in one of the frames.

Upon inquiry regarding the presence of rats in the house, Mrs. X informed me that when they first moved into the apartment, the place was badly infested with them. Efforts were at once made to get rid of these rodents. A carpenter closed all rat holes that could be found in the apartment. That these efforts proved to be successful was evidenced by the fact that no rats had been seen for some time.

On April 6th, Inspector Roach visited the house, and at this time was given a bottle containing twelve of the ticks. These were also second and third stage nymphs, and had been collected during the thirty-eight days since our former visit.

On May 29th, I again visited the house, and at this time Mr. X was suffering from the effects of the bites of three of these ticks. Two of his fingers were badly swollen and were in bandages. The third bite was on his back and had produced a severe local reaction with swelling, considerable irritation and several large wheals appeared in the surrounding area. Two of the ticks had been found a few days before my visit and both of these were third stage nymphs. Mr. X stated that he had taken one of these ticks after it had dropped on one of the beds from the ceiling. Mrs. X claimed that she had swept several from the cracks in the floor of the bedroom.

On September 20th one more tick was received. This was an adult male that had been taken while feeding upon Mr. X.

No more specimens were received from this house, and upon making inquiries a few weeks later I was informed that the family were no longer being bitten and that no more ticks were being found in the apartment.

The twenty-five ticks that I received from this house probably fell short of the total number that was found during that time. It is quite reasonable to believe that many more were destroyed when found and not collected alive.

I am of the opinion that rats were responsible for bringing the *O. talaje* to this apartment. It is quite probable that after the rodent hosts had been either destroyed or prevented from returning to their hiding and nesting places in the apartment, the engorged larvæ that had dropped from them had, after molting and becoming nymphs, been forced to seek their blood meals from the human inhabitants. Since the larvæ of this species remain attached to the host for several days while engorging and none in this stage had been observed by the X family, it is reasonable to believe that if larvæ had hatched from eggs deposited in the house they were not existing upon human blood.

It seems rather remarkable that during the time these ticks were present in the X apartment, the other parts of the house seemed to be free of them. The families occupying the other three apartments stated that they had not been bitten by the ticks and none had been found in their rooms.

Observing the effects produced on Mr. X by the bites of these ticks I fed seven of them on my left forearm in order to study the reaction upon myself. There was a considerable delay in getting them to start feeding, but after they began taking blood they all became well engorged and secreted coxal fluid. The longest time required by any of the seven to engorge was sixteen minutes. Five of them were induced to feed by placing them one at a time in a tube applied to the same spot on my arm. Thus all five fed on the same site and each of the last four apparently used the same tiny puncture made in my skin by the first one. The reaction from these bites consisted of a slight swelling with a well-marked hæmorrhagic area surrounding the site of each bite and accompanied by a severe itching which occurred at intervals during the three or four days following the bites. Naturally the effects produced by the multiple bites at the same site were much more pronounced than at the sites of the two single bites. Since the reaction I experienced was so much less severe than in the case of Mr. X, I am led to believe that there is a considerable difference in the susceptibility of individuals to the effects of bites from these ticks.

My thanks and appreciation are due Dr. D. P. Curry for information regarding this house infestation, and to

Sanitary Inspector Roach for his kindness in visiting the house on several occasions to secure information and ticks for me.

A NEW SPECIES OF CHRYSOPA

By Nathan Banks

New species of this genus are so uncommon in our country today that the finding of one of the most distinct forms hitherto known merits a separate article.

Chrysopa eureka sp. nov.

A heavy-bodied Chrysopa like *robusta,* but mostly dark and of quite different markings and venation.

Head pale yellowish, unspotted; palpi black; antennae black, basal joint pale. Thorax dark grey, heavily marked with black, underside and pleura mostly black. Pronotum with eight black spots arranged in two transverse rows, black spots on lateral lobes of the meso—and metanotum. Legs dull yellowish, a black band before tip of each femur, and the tarsi somewhat darkened. Wings with mostly black cross-veins, gradates, and apical forks, the longitudinal veins with streaks of black; stigma greyish, with several cross-veins behind margined with dark.

Face broad; antennae rather short and stout; pronotum very broad, but little narrowed in front; rest of thorax very broad; abdomen stout and short; legs stout, much more so than in the common species, the front and mid tarsi more than one-half the length of the tibiae.

Wings moderately broad; venation not dense, about 17 costals, eight connecting veins from the radial sector to radius, seven cubital cross-veins beyond third cell, divisory veinlet ends much beyond the cross-vein, divisory cell of moderate size, about five gradates in each series, the two rows not very near together and the outer one hardly nearer to the margin than to the other row. Length fore-wing 17mm, breadth 5.5mm.

From Hope, Ark., 22 Aug. (L. Knobel), at light. Holotype in Museum of Comparative Zoology.

NEW ANTS OF THE GENUS MACROMISCHA

By C. G. Aguayo

Museum of Comparative Zoölogy

The ants of the remarkable genus Macromischa, besides being among the most beautifully colored of the Formicoidea, are certainly very interesting on account of their extremely localized habitat.

W. M. Wheeler in a recent paper on this genus (1931) has described several new forms, among which were several Cuban species that I had the pleasure of sending to him. As I still have some undescribed new varieties recently collected by Dr. Pedro Bermudez, Colonel George Natenzon and myself, I avail myself of the opportunity given me by the Guggenheim Memorial Foundation to study in the United States, and Dr. Barbour's permission to work in the Museum of Comparative Zoölogy, to publish this small contribution to the knowledge of Cuban ants.

Wheeler raised to generic rank (1931, p. 4), the subgenera Crœsomyrmex and Antillæmyrmex, both of Mann (1920, p. 408), but since among the species described further on *Macromischa wheeleri petri* shows intermediate characteristics between Macromischa s.s. and Crœsomyrmex, he agrees with me in placing them anew as subgenera.

The position of Antillæmyrmex as a genus was more uncertain on account of the intermediate characters shown by some species (Wheeler, loc. cit. p. 4), and it seems to be convenient to consider it again as a subgenus.

I cannot but thank Prof. Wheeler and Dr. Bequaert for their many helpful suggestions during the preparation of this paper.

Macromischa barbouri sp. nov.

Worker. Length 4 mm.

Head (without mandibles) about 1/4 longer than broad, suboval, with rounded posterior corners, broader behind, sides convex. Eyes rather large, oval, situated at the middle of the sides of the head. Mandibles with five distinct teeth. Clypeus convex, with a distinct short and narrow longitudinal carina. Frontal carinæ short. Antennæ somewhat stout, scapes strongly curved at base, surpassing the occipital corners; first funicular joint as long as the two succeeding joints, joint two larger than broad, joints 3-7 slightly transverse. Club 3-jointed, well defined, last joint about as long as the two preceding together.

Thorax stout, less than twice as long as broad, humeri of pronotum large, with rounded angles. No thoracic sutures. Epinotal spines slender, divergent, almost straight, slightly curved downward, about 3.5 times as long as their distance apart at base.

Pedicel long and slender, about as long as the epinotal spines, and three times as long as the node; acutely toothed antero-ventrally. Node in profile about twice as high as long, compressed antero-posteriorly, anterior surface moderately convex, posterior flat; from above two and one-half times broader than long; the upper border twice as broad as the base. Post-petiole in profile decidedly longer than the petiolar node; anterior surface straight, broadly rounded; from above sub-campanulate, about 1 1/5 times as broad as long. Gaster with the first segment slightly longer than broad.

Legs stout, femora strongly swollen at the middle; tibiæ rather incrassated.

Thorax, gaster and appendages very shiny; head moderately so. Mandibles and clypeus coarsely, longitudinally striated. Head minutely and densely punctate, with sinuous longitudinal, interrupted rugæ. Thorax coarsely rugose, the rugæ being transversely irregularly sinuous on dorsum, longitudinally sinuous on pleuræ, and transverse on epinotal declivity. Petiole, postpetiole, gaster and legs minutely punctate.

Hairs white, stiff, erected, moderately abundant, longer on thorax.

Head green, thorax red, with violaceous and greenish reflections in certain lights. Epinotal spines brownish red. Pedicel, base of femora and tip of tarsi yellowish brown. Petiolar node, post-petiole, gaster, remaining of legs and antennæ black.

Described from a single specimen collected by Colonel G. Natenzon in "Pan de Guajaibon," province of Pinar del Rio, Cuba.

Holotype in the collection of the M. C. Z.

This species is related to *M. squamifera* Roger and *M. creightoni* Mann, but readily distinguishable by the longer epinotal spines, coarser sculpture and by the red coloration of the thorax.

It is with pleasure that I name this species for Dr. Thomas Barbour, to whom I am very much indebted for many favors.

Macromischa manni Wheeler var. **villarensis** var. nov.

Worker. Length 5.2 to 5.8 mm.

This form has the same size, sculpture and pilosity as *M. manni,* differing principally by the shape and position of the epinotal spines which in var. *villarensis* are somewhat smaller, much more divergent, V-shaped, closer together at their bases, lacking the sigmoidal curve of *manni,* directed backward, upward and slightly bent inward at their tips; the basal half of each spine is broader and laterally compressed, the dilatation ending abruptly at the middle as in *M. porphyritis* var. *latispina* Wheeler.

Described from many specimens collected by Pedro Bermudez in several localities of Northern Santa Clara, Cuba. They were on limestone cliffs, "with the gaster bent and upraised" (Bermudez).

Type locality: "La Puntilla," Remedios, Santa Clara, Central Cuba.

Also from "Palenque de Taguayabon" in the same region.

Named for "Las Villas," a popular name for the said region.

Cotypes in the M. C. Z. and in the author's collection.

Macromischa (Antillæmyrmex) torrei sp. nov.

Worker. Length 2 mm.

Head longer than broad, rectangular, with evenly convex sides, straight posterior border and rounded occipital corners. Eyes convex, situated before the middle of the sides of the head. Clypeus convex, with rounded anterior border. Frontal carinæ parallel. Frontal area indistinct. Mandibles with denticulate, concave apical border. Antennal scapes scarcely reaching the posterior corners of the head; funicular club large, 3-jointed, longer than the remaining funiculus; joint 2-7 broader than long.

Thorax short, as long as the head with mandibles, broader in front than behind, with regular slightly convex profile, without dorsal thoracic sutures. Epinotal spines about as long as the epinotal declivity, and longer than their distance at the base, directed backward and upward, and very slightly curved downward.

Peduncle short, with a small tooth on its anteroventral surface. Node longer than broad; its anterior declivity in profile slightly concave, its summit flattened, and its posterior declivity almost straight. Postpetiole large, twice as broad as long, almost as broad as the gaster, and three times as broad as the petiole behind, in profile convex above. Gaster small, about as long as the thorax.

Legs small, femora feebly incrassated.

Surface of body shining, head and thorax densely and finely punctate. Gaster smooth. Appendages very finely punctate and shining.

Pilosity scarce. Hairs white, short, erected and scattered on the body; minute on scapes and legs.

Color uniformly testaceous.

Described from one specimen found alive among land shells given to me by Dr. Carlos de la Torre, and it is a great honour to me to associate his name with this interesting species. The shells were collected by Bermudez in "Buenavista," Remedios, Santa Clara Province, Cuba.

The *holotype* is deposited in the M. C. Z.

This small species is typically an Antillæmyrmex and similar in size and coloration to *M. flavidula* Wheeler and Mann from Hayti, but it is very easily separated by its sculpture, shape of petiolar node, shape of the head, position of eyes, etc. It can not be confused with any other species of this genus.

Macromischa (Crœsomyrmex) aguayoi natenzoni subsp. nov.

Worker. Length 3.6 mm.

This subspecies is very closely related to the typical form, but differs by the punctations of the head, which are more abundant in the occipital region; by the less shiny surface of the head, and by the sculpture of the thorax. The thoracic rugæ are longitudinally and regularly disposed both on sides and dorsum, instead of being regularly longitudinal on sides, coarse and irregularly longitudinal on pronotum, irregular on meso and epinotum and transverse on epinotal declivity, as occurs in the typical *aguayoi*.

The color is blue as in the typical form the head being slightly greenish.

Described from one specimen given to me by G. Natenzon, who collected it on a limestone cliff at Guajaibon, the highest mountain in the province of Pinar del Rio, Cuba.

The *holotype* is in the M. C. Z.

Macromischa (Crœsomyrmex) barroi sp. nov.

Worker. Length 4 mm.

Head longer than broad, with rounded occipital corners. Eyes situated at the middle of the sides of the head. Mandibles 5-toothed, with slightly convex external margin. Clypeus convex posteriorly and impressed at middle. Frontal carinæ slightly divergent. Frontal area deeply impressed, with a median carinula. Antennæ slender, scapes extended far beyond the occipital corners, first funicular segment as long as the two following together; all the remainder longer than broad; club 13-jointed.

Thorax about 2.2 times as long as broad, broadest at the pronotum. Meso- and epinotum roof-shaped.

Peduncle of petiole short and stout, shorter than node, with a distinct antero-ventral tooth, very convex above, evenly concave below. Node broader than petiole, evenly curved both in front and behind. Post-petiole slightly longer than broad.

Legs long; femora strongly incrassated.

Surface of the body entirely shining. Scapes finely striated; head densely punctate, except the occipital border and corners; cheeks and mandibles rugose. Thorax rugose; rugæ longitudinal on sides, irregularly longitudinal on pronotum and mesonotum and transverse on epinotal declivity. Sides of petiole with radiating rugæ. Post-petiole, gaster and legs smooth. Hairs white, pointed, erected, scattered over the body and appendages.

Head, thorax and petiole deep metallic green. Head with bluish reflections. Post-petiole, gaster and appendages black.

Described from several specimens found on limestone cliffs at "Soroa," Province of Pinar del Rio, Western Cuba. (Aguayo, coll. IV 1931). Numerous specimens which I refer to this form were taken at "El Mamey," Cayajabos, Pinar del Rio, on limestone cliffs, by P. Bermudez, M. Jaume and G. Aguayo.

Cotypes of this species are in the M. C. Z. and in the author's collection.

I have named this form for my friend M. Barro, an amateur entomologist.

This species belongs to the group of *M. aguayoi* to which it is very closely related, but it can be separated by the following characters: thorax broader; pedicel higher, much more convex above and more evenly concave below; petiolar node longer than broad and more evenly curved in front; head less densely punctate on the posterior half. Sculpture of thorax different. Pilosity more abundant, hairs shorter and stiffer. Coloration different. Gaster and post-petiole less shining.

Agrees with *M. aguayoi* var. *archeri* Wheeler in the punctation of the head and shape of the post-petiole, but differs by the shape of the petiole, sculpture of the thorax, pilosity and color.

Santschi recently described (1931), another species of this group: *M. bierigi,* which comes from "Vinales" the type locality for *archeri,* but the description of *bierigi* agrees so much with the cotypes of *archeri* that I have examined, that if not the same it is only a variety of *M. aguayoi* very close to *archeri.*

Macromischa wheeleri petri subsp. nov.

Worker. Length 4.5 mm.

Head longer than broad, sides slightly convex, posterior corners rounded. Eyes situated at the middle of the sides of the head. Mandibles with 5 teeth. Frontal carinæ short and slightly divergent behind. Antennæ slender, scapes surpassing the occipital corners, first funicular joint slightly longer than broad, club 3-jointed, terminal joint a little shorter than the two preceding together. Clypeus rounded, anterior border concave.

Thorax about $2\frac{1}{2}$ times as long as broad, epinotum armed with a pair of short blunt divergent spine-like tubercles, which are much shorter than their distance at base.

Peduncle of petiole curved, as long as node, with a small blunt tooth beneath in front. Node in profile as long as high, convexly rounded above. Post-petiole campanulate, about as long as broad. Femora incrassated, tibiæ somewhat so.

Body and appendages very shining. Head with sparse piligerous punctures.

Mandibles and cheeks triated, scapes finely so. Thorax and epinotum coarsely rugose. Rugæ sinuous on pronotum, transverse on meso- and epinotum. Petiole longitudinally rugose at sides.

Body and appendages with sparse erected white hairs. Color of body dark brilliant green.

Described from many workers found in several localities of Santa Clara, Central Cuba, by Pedro Bermudez. "They were found walking on big limestone rocks apparently nesting under them."

Type locality: "La Vigia," Mayajigua, Santa Clara.

The *cotypes* are in the M. C. Z. and in the author's collection.

I have also specimens from "El Yigre," Caibarién; Seibabo de Yaguajay, and Chambas.

Named for my friend Pedro Bemudez, its discoverer.

This form is very remarkable on account of the short epinotal spines, which show a transition between the subgenera Macromischa s.s. and Croesomyrmex. The presence of spines is characteristic of the former, but all the remaining characters are those of *M. wheeleri*, which is the genotype of Croesomyrmex.

The female of *wheeleri* has also short epinotal spines, and it is to be noted that intermediate characters have been found in a form of the type species of Croesomyrmex.

Differs from the typical form of the species by the presence of epinotal spines, and by its color which is more deeply green. In all the specimens of *wheeleri* in the collection of M. C. Z., the color is brownish green.

Macromischa foreli nom. nov.

Macromischa petiolata (Forel). Emery, Genera Insectorum, 1920, p. 245 (nec *M. petiolata* Mayr, 1868).

Macromischa petiolata Wheeler, Bull. M. C. Z. 72, 1, 1931.

Leptothorax petiolatus Forel, Ann. Soc. Ent. Bel. 45, 1901, p. 229.

This species was described by Forel as *Leptothorax petiolatus,* in 1901, from specimens collected by Wheeler at "Cuernavaca," Morelos, Mexico, with the suggestion that it might be considered as a Macromischa. Emery (1920) transfers it to the said genus, an opinion accepted by Wheeler (1931). Unfortunately the name was preoccupied by *Macromischa petiolata* Mayr (1868, "Die Ameisen des baltischen Bernstein"). It is true that Mayr's species was transferred by Wheeler (1914) to a new genus, Notomyrmica, but the necessary application of the rules of nomenclature forces us nevertheless to reject any *homonym*, even in the case of so well established a species.

Therefore, I suggest that this species bear the name of the celebrated Myrmecologist. I hope, nevertheless, that in the near future, when a better knowledge of the mainland Macromischa allows us to include them in another genus, Forel's species may again bear its original name.

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NEOPANORPA HIRSUTA (CRAMPTON)

By F. M. Carpenter
Museum of Comparative Zoology

In a recent paper dealing with the morphology of the Mecoptera, G. C. Crampton figured the genitalia of a specimen from India and suggested that "this remarkable Panorpid should be called 'Panorpa hirsuta,' if it should prove to be new to science." At my request, Professor Crampton kindly sent the specimen to me for further study, and since he did not publish a complete description of the insect, which belongs to the small genus Neopanorpa rather than Panorpa, I have prepared the following redescription of the species.

Neopanorpa hirsuta (Crampton)

Figure 1

Panorpa hirsuta Crampton, 1931, Psyche 38, p. 10; fig. 23.

Body reddish brown, except for eyes and first four abdominal segments, which are black; horn on third segment short, extending to about the middle of the fourth segment; seventh and eighth abdominal segments subequal, a little shorter than the sixth. Fore wing: length, 14 mm.; width, 3.7 mm.; membrane hyaline, bands and spots light brown; apical band entire, pterostigmal band forked posteriorly; basal band interrupted; a single basal spot. Markings of hind wings similar to those of the fore. ♂ genitalia: genital bulb rather broad, reddish brown; forceps short, with a prominent basal tooth and covered with extraordinarily long, black hair; hypovalves long, with a rounded basal prominence on the inner margin and a slender apical projection on the outer margin.

Holotype (♂): Mysore, India; in Museum of Comparative Zoology.

This insect is readily distinguished from all described males of the genus by the remarkable development of the hairs on the genital forceps. These hairs are so prominent that they can easily be seen without the aid of a lens. Three Indian species of Neopanorpa have been described from females alone (*zebrata, flava, ocellaris*), but even allowing

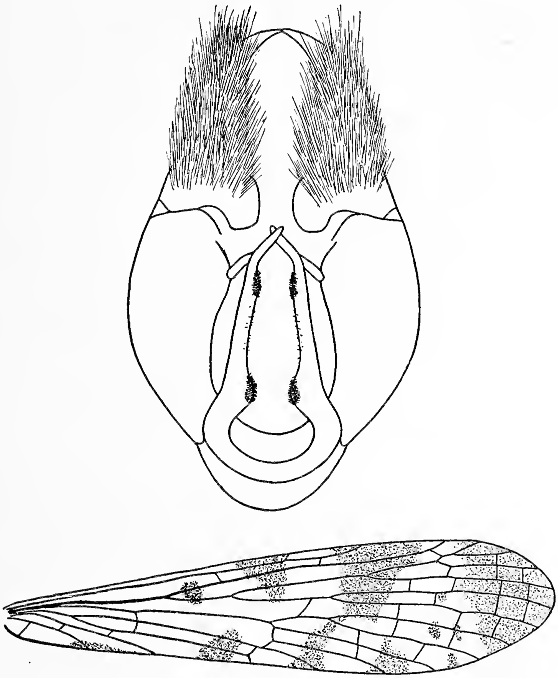

Fig. 1. *Neopanorpa hirsuta* (Crampton), genital bulb and fore wing of ♂ holotype.

for the usual variation in the markings, the differences between the wings of these species and the wings of *hirsuta* clearly show that we are dealing with a distinct species. The wings of *zebrata* (Travancore) are traversed by a number of narrow stripes; those of *ocellaris* (Sikhim) are mostly a dark, smoky brown, with a few small hyaline spots; and those of *flava* (Sikhim) have a reddish yellow membrane. The wings of *hirsuta* are hyaline, as in *zebrata*, but the markings are very different, as shown in Fig. 1.

NOTES ON HIPPOBOSCIDÆ

3. Hippoboscidæ of Yucatan

By J. Bequaert

Department of Tropical Medicine
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The following notes are based mainly upon material obtained in 1929 and 1930 by the Expedition to Yucatan, organized by the Department of Tropical Medicine of Harvard Medical School, under the auspices of the Carnegie Institution of Washington, D. C., and under the leadership of Dr. George C. Shattuck. In Yucatan the Hippoboscidæ are of peculiar interest, inasmuch as one species has been suspected or incriminated as the vector of a human disease.

Subfamily **Olfersiinæ**

Olfersia coriacea van der Wulp

Olfersia coriacea van der Wulp, 1903, "Biol. Centr.-Amer.," Dipt., II, p. 430, Pl. XIII, figs. 2 and 2*a* (described doubtfully as ♀; according to Austen, both specimens seen by v. d. Wulp were males; in part: only the specimen from Mirandilla, Guatemala).

Pseudolfersia coriacea Austen, 1903, Ann. Mag. Nat. Hist., (7) XII, p. 265 (selects van der Wulp's male from Mirandilla as the holotype; states that the male from Presidio, Mexico, is *Olfersia propinqua* Walker). Aldrich, 1905, "Cat. North Amer. Dipt.," p. 656. Speiser, 1907, Ent. News, XVIII, p. 104.

Pseudolfersia meleagridis Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, VII, p. 179, Pl. XXVII,

> fig. 3 (no sex given; on domestic turkey, *Meleagris gallopavo,* in Pernambuco and Sao Luiz do Maranhao; on *Tinamus solitarius* Vieillot in Minas Geraes or Espiritu Santo; all localities in Brazil).

Colonia Santa Maria (near Puerto Morelos), in the northern part of the Territory of Quintana Roo, May, 1929 (G. C. Shattuck). This specimen was received from a Maya hunter, who said he found it on an ocellated turkey, *Agriocharis ocellata* (Temminck). Territory of Quintana Roo ("Herrera, 1919, said to cause a disease in man."—U. S. Nat. Mus.).

I have also seen specimens from Peten, Guatemala (Oliver Ricketson, Jr.; as "bay-sore fly," received through Dr. Thomas Barbour); Uaxactun, Peten, Guatemala, off *Crax globicera* (Linnæus), April 15, 1931 (J. Van Tyne); Upper Chagres River, Panama, off turkey (U. S. Nat. Mus.); Rio Colorado, Bolivia, off *Penelope* sp. (W. M. Mann.—U. S. Nat. Mus.); and Pernambuco, Brazil, off turkey (received from Dr. Ad. Lutz as *P. meleagridis.*—U. S. Nat. Mus.).

The following characters may aid in separating *O. coriacea* from other closely allied species of *Olfersia.* Frons rather narrow, very little wider than an eye. Posterior orbits and postvertex about equally produced behind, the orbits short and divided from the hind margin of the postvertex by a very shallow sinus. Postvertex with a slight transverse depression, dividing it into a short, anterior, dull, alutaceous area and a much longer, posterior, smooth and shiny area. Fronto-clypeus not covering nearly the whole palpi; its apical, interantennal portion rather narrow and not striate; the free, terminal arms short and broad, not appreciably grooved above. First basal cell (*R*) long and narrow, nearly parallel-sided in its apical half; second basal cell (*M*) long, the second section of the fourth longitudinal vein (*M*1+2) being about as long as the first section of the fifth (*M*3+*Cu*1); third and fourth longitudinal veins (R4+5 and *M*1+2) not setulose; first longitudinal vein (*R*1) ending in the costa opposite or basad of the small anterior cross-vein (*r-m*).

I synonymize *Pseudolfersia meleagridis* with *O. coriacea* after carefully studying the description as well as a specimen (probably a cotype), at the United States National Museum, received from Dr. Ad. Lutz. In connection with the possible rôle of *O. coriacea* as a carrier of human leishmaniasis (see below), the statement by Lutz, Neiva and da Costa Lima that their *P. meleagridis* occasionally attacks man, is of particular interest.

Olfersia mexicana Macquart (1843, Mém. Soc. Sc. Agric. Arts Lille (1842), p. 435; 1843, "Dipt. Exot.," II, 3, p. 278. —No sex; Mexico), is possibly the same as *O. coriacea.* If the identity of these two species could be established beyond doubt, Macquart's name would have to be used.

The correct wild host or hosts of *O. coriacea* in Central and South America deserve to be more carefully investigated. Mr. J. Van Tyne's specimen from *Crax globicera* is the first Central American record for which the zoological identity of the host is beyond question. I am therefore under particular obligation to Mr. J. Van Tyne for the privilege of studying this and other hippoboscids collected by him on his recent trip to Guatemala.

In the Peninsula of Yucatan, there are four gallinaceous birds that might possibly serve as hosts to *O. coriacea.* (1) The ocellated turkey, *Agriocharis ocellata* (Temminck), "*pavo del monte*" in Spanish and "*Kutz*" in Maya (according to Gaumer), is perhaps the most common of the four and is particularly abundant in Quintana Roo. (2) The crested curassow, *Crax globicera* (Linnæus), usually called "*Pahuil*" by the natives of Mexico and Guatemala, is a much rarer bird, though occasionally seen in Quintana Roo.[1]

[1] According to a note by the late Dr. G. F. Gaumer (quoted by Boucard, 1883, Proc. Zool. Soc. London, p. 459), the flesh of *Crax globicera* is highly valued as food by the Maya; but the bones are always carefully kept away from the dogs and cats, as they are said to be very poisonous. E. W. Nelson described the young of *C. globicera* as *C. chapmani.* He says that the Maya Indians call this bird the "*Kambul,*" whereas they designate the adult as "*Boloncham*" or "*Bolonchana.*"

(3) The bare-throated guan, *Penelope purpurascens* Wagler, "*cojolito*" in Spanish and "*Kosh*" in Maya (according to Gaumer), is very rare in Quintana Roo. (4) The chacha or chachalaca, *Ortalis vetula pallidiventris* Ridgway, "*Bach*" in Maya, a much smaller bird than the others, is abundant, particularly in Quintana Roo.[2]

The main interest of these birds and their fly parasites lies in their possible connection with the etiology of "bay-sore" or human cutaneous leishmaniasis, a disease of man in the humid, densely forested areas of the Yucatan Peninsula (Territory of Quintana Roo and the southeastern part of the State of Campeche), British Honduras (Belize), and Guatemala (Peten). As a rule the sores are found on exposed parts of the body, and they are particularly frequent on the ears. It can hardly be doubted that some biting insect is the transmitter, but no experiments have as yet been published showing which particular species is involved. Various insects are blamed by the inhabitants of the infected regions. One opinion which enjoys much local popularity, in Yucatan and northern Guatemala, incriminates the bird-fly of the ocellated turkey or of the bare-throated guan. During my visit at Merida, Dr. Abalardo Lara N. showed me some specimens of the fly in question, in which I recognized *Olfersia coriacea*. He also stated that he had transmitted leishmaniasis through the bite of this fly and exhibited some photographs to support his claim.[1] This theory deserves, at any rate, to be investigated with care; even though it seems more likely that in Yucatan, as elsewhere in the New World, cutaneous leishmaniasis is transmitted by one or more species of *Phlebotomus*.

[2] I am under great obligations to Mr. Ludlow Griscom for valuable information concerning these birds. The Spanish names here given for the various gallinaceous birds apply only to Yucatan. In other parts of Central America they may be used for different birds. I have been unable to find out which species is known more specially as "*faisan*," a name sometimes heard in Yucatan.

[1] A discussion of the possible carriers of human leishmania sores in Central America has been given by Farfan y Lopéz, E. 1922. "La leishmaniosis americana o 'ulcera de los chicleros.' " (Merida, Yucatan), 27 pp. Page 13 of this pamphlet shows a reproduction of a photograph of *Olfersia coriacea*, in ventral and dorsal aspect.

Entomologists acquainted with the habits of the Hippoboscidæ might perhaps object to the *Olfersia* theory of leishmaniasis that these flies, as a rule, are not prone to bite man after leaving their normal host. Thus C. M. Wenyon (1911, Parasitology, IV, pp. 292 and 299), in the course of his studies of human Oriental sore at Bagdad, found that the dog-fly (evidently *Hippobosca capensis* v. Olfers, although no name is given), will bite human beings, but that this is an uncommon occurrence. He was only bitten on two occasions, though he lived in close association with a number of dogs, all of which had many of these insects about them. Wenyon did not succeed in inducing these flies to feed on cases of Oriental sore in man. They very quickly died if kept in confinement away from a dog. It is possible, however, that certain species of Hippoboscidæ attack man more readily than others. The European *Cratærina pallida* (Latreille), a common parasite of swifts, for instance, has been observed repeatedly in Germany biting human beings, even indoors, either during the day or at night in bed. Similar observations have been made in France.[1]

Olfersia vulturis van der Wulp

Olfersia vulturis van der Wulp, 1903, "Biol. Centr.-Amer.," Dipt., II, p. 429, Pl. XIII, figs. 1-1*a* (♀ ?; off a vulture; Rio Sucio, Costa Rica). J. Bequaert, 1926, "Med. Rept. Hamilton Rice 7th Exp. Amazon," p. 240. Ferris, 1928, Ent. News, XXXIX, p. 36, figs. A-B (larva).

Chichen Itza, common on the black vulture, *Catharista urubu* (Vieillot), although not all birds are infested. One bird shot on June 1st was free of flies; another, examined the next day, had eight parasites. In Yucatan the black vulture is known as "*sapilote*" in Spanish and as "*Tchom*"

[1] See: Erich Hesse, 1919, Jl. f. Ornithologie, LXVII, p. 408-409; 1920, Zeitschr. Wiss. Insektenbiol., XVI, p. 33; 1929, *Loc. cit.*, XXIV, pp. 70-71. Also E. Christeller, 1924, *Loc. cit.*, XIX, p. 103; J. Guiart and Lesieur, 1912, Paris-Médical, Dec. 12; and F. Moutier, 1928, Ann. Paras. Hum. Comp., VI, pp. 105-106.

or *"Chom"* in Maya. One specimen of *O. vulturis* was also obtained off a sparrow-hawk at Chichen Itza, by Dr. J. Sandground, February 15, 1929.

I have fully discussed this species in 1926. I regard *O. vulturis, O. fossulata* Macquart and *O. spinifera* (Leach) as valid species, separable by structural characters.

Subfamily **Melophaginæ**

Lipoptena mazamæ Rondani

Lipoptena mazamæ Rondani, 1878, Ann. Mus. Civ. Genova, XII, p. 153 (♀; South and Central America; off *"Cervus mexicanus"*). Speiser, 1904, *Loc. cit.*, XLI, p. 334. Aldrich, 1905, "Cat. North Amer. Dipt.," p. 653. Ferris and Cole, 1922, Parasitology, XIV, p. 185, figs. 2*A* and 2*E* (♀ ♂). Ferris, 1930, Canad. Entom., LXII, p. 70. Falcoz, 1930, Encycl. Entom., B, Dipt., V (1929), p. 51.

Lipoptena depressa var. *mexicana* C. H. T. Townsend, 1897, Ann. Mag. Nat. Hist., (6) XX, p. 289 (♀ ♂; Paso de Telaya, Vera Cruz, Mexico; off white-tailed deer, *Cariacus virginianus* var. *mexicanus*); 1897, Trans. Texas Ac. Sci., II, 1, p. 41. Van der Wulp, 1903, "Biol. Centr.-Amer.," Dipt., II, p. 432. Speiser, 1904, Ann. Mus. Civ. Genova, XLI, p. 334. Aldrich, 1905, "Cat. North Amer. Dipt.," p. 653. Speiser, 1907, Ent. News, XVIII, p. 103. Bezzi, 1916, Natura, Riv. Sc. Nat., VII, p. 178.

Lipoptena depressa mazamæ Bau, 1930, Konowia, IX, p. 211, fig.

Lipoptena conifera Speiser, 1905, Zeitschr. Syst. Hym. Dipt., V, p. 354 (♀ ♂; off *Cariacus rufus* Ill. var *simplicicornis* Ill., from South America, without more definite locality); 1908, Zeitschr. Wiss. Insektenbiol., IV, p. 304.

Lipoptena surinamensis Bau, 1930, Stettin. Ent. Zeitg., XCI, 2, p. 175 (♀ ♂; without host; Macaraibo, Surinam).

Chichen Itza, several females and males, off a "deer," February 10, 1930 (obtained from a native hunter by Dr. G. C. Shattuck).

It is unfortunately not possible to state whether the host of these parasites was the brocket or the Yucatan deer; possibly both animals harbor this *Lipoptena*. The brocket, *Mazama pandora* Merriam, "*corzo*" in Spanish and "*Yuk*" or "*Yuk-keh*" in Maya, has short, unbranched antlers in the male. The Yucatan deer, *Odocoileus toltecus* (H. de Saussure) (= *yucatanensis* Hays), "*venado*" in Spanish and "*Keh*" or "*Kieh*" in Maya, has, in the male, antlers with a few ramifications. Both are widely distributed in Yucatan and are known to occur near Chichen Itza. Ferris records *L. mazamæ* from *Mazama sartorii reperticia*, in Panama (collected by L. H. Dunn), and Bau from *Mazama nemorivaga*, in Bolivia.

I have also seen many speicmens of *L. mazamæ* from "deer," obtained at Peten, Guatemala; Kartabo, British Guiana; and Manaos, Amazonas, Brazil. No structural differences can be detected among the four series studied. Rondani mentioned no locality for his type; but, since it came from Bellardi's collection and the host was given as "*Cervus mexicanus*," it was evidently obtained somewhere in Mexico.

My interpretation of *L. mazamæ* is the same as that of Ferris and Cole, who saw specimens from Yacuiba, Bolivia, and from Chiriqui Province, Panama. The species is distinct on structural characters from *Lipoptena depressa* (Say). On the other hand, Townsend's lengthy description of his var. *mexicana* fits, in all essential details, specimens of *L. mazamæ*. Color characters are not of specific value in this genus; they are liable to change in life after hatching, as well as after death, and they may differ according to whether the specimens are kept in a fluid or preserved dry. Moreover, Townsend's notes on the color were written largely from memory. One of the few structural features mentioned by Townsend is the shape of the male organ, which is said to be "moderately stout and blunt at tip." This would seemingly describe the "inner ring-like piece" of the male genitalia of *mazamæ* as figured by Ferris and Cole.

So far as one can judge from Speiser's description, his *L. conifera* is likewise a synonym of *L. mazamæ.* The head is described as follows: "Der Kopf ist durch eine ganz ausserordentlich kurze Stirnstrieme charakterisiert, die wenig mehr ist als ein matter querer Spalt zwischen dem Scheiteldreieck und der sehr breiten Lunula." The unusually wide frontal lunule, with consequent shortening of the medio-vertex (or frontalia), must have been accidental, either due to the mode of preservation or to the incomplete retraction of the ptilinum within the lunule.

There is also nothing in Bau's description of his *L. surinamensis,* supposedly from Surinam,[1] that does not apply to our many specimens of *L. mazamæ* from Yucatan, Guatemala, British Guiana, and Brazil. Bau writes: "In der Bildung des zweiten Abdominal-Tergits gleicht diese Form den amerikanischen Arten *Lipoptena depressa* Say, var. *mexicana* Townsend, *mazamæ* Rondani und *conifera* Spieser. Die beiden ersteren haben auf dem membranösen Teil des Abdomens zwei kleine querliegende Chitinplättchen, welche der *L. surinamensis* fehlen. *L. mazamæ* ist auch kleiner, nur 2¼ bis 2½ mm. lang." The length of dry specimens of *L. surinamensis* is given as 3.25 to 3.9 mm. in the female and about 3 mm. in the male. I am unable to find any trace of transverse chitinous plates on the membranous portion of the abdomen (dorsally) in my several lots of *L. mazamæ* (preserved in alcohol). In the Yucatan lot the females measure from 2.8 to 4 mm. Of course, in both sexes dry specimens give no correct idea of the size of a hippoboscid fly, and in the female the size also depends upon the condition of the larva contained in the abdomen.

[1] I have been unable to locate a locality "Macaraibo" on any of the South American maps I have seen. Perhaps the locality was really "Maracaibo," which, however, is in Venezuela.

500TH MEETING OF THE CAMBRIDGE ENTOMOLOGICAL CLUB

In celebration of the 500th regular meeting of the Cambridge Entomological Club a combined dinner and meeting was held on Tuesday, December 15th, at the Faculty Club of Harvard University. Following an excellent dinner, in which thirty persons participated, the toastmaster of the evening, W. L. W. Field, opened the proceedings by reading from the minutes of the first meeting in 1874. Professor Nathan Banks was the first of the after-dinner speakers, and spoke of the need of specialization and the furtherance of systematic entomology. Vice-President C. W. Collins, who was in charge of the meeting, brought the felicitations of the Bureau of Entomology, and traced the development of economic entomology during the existence of the club. Professor C. T. Brues gave a delightfully humorous talk on some of the peculiar and amusing incidents encountered in connection with his office as editor of "Psyche." Mr. C. W. Johnson sketched the course of the club since its inception in 1874 as an offspring of the Boston Society of Natural History to the present; he also bore the congratulations of the parent organization and its thanks for the cooperation of the members of the Cambridge Entomological Club in contributing materially to the establishment of the extensive and representative collection of New England insects in the Boston Museum of Natural History. Professor A. P. Morse reminisced on the earlier days of the club, giving intimate glimpses of meetings at the home of Samuel Scudder.

Following the after-dinner speeches, an interesting motion picture film illustrating the life history of the yellow-fever mosquito was shown.

The scientific paper of the evening was given by Dr. Joseph Bequaert on "Some Problems of Medical Entomology in Guatemala."

During the course of the evening, a rising vote was passed authorizing a message in recognition of the death of A. G. Weeks, during the preceding week. Messages of respect, remembrance, and affection were also drawn up in honor of Mr. Samuel Henshaw and Professor Roland Thaxter.

It was not until 11:00 P. M. that this, one of the most enthusiastic and highly successful meetings of the Cambridge Entomological Club, was brought to adjournment.

PSYCHE

INDEX TO VOL. XXXVIII. 1931

INDEX TO AUTHORS.

INDEX TO SUBJECTS.

All new genera, new species and new names are printed in SMALL CAPITAL LETTERS.

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J. H. EMERTON

By Nathan Banks

James Henry Emerton was born at Salem, Massachusetts, March 31, 1847, where, as a boy, he attended the local school. He was rather frail and a young helper in his father's drug store, George F. Markoe, interested the boy in outdoor life. They collected plants, insects and shore invertebrates and at the age of fifteen he was frequently visiting the Essex Institute, where he became acquainted with A. S. Packard, F. W. Putnam, John Robinson, Caleb Cooke, and others who later became more or less prominent students of Natural History.

From the first he showed much skill in drawing and made sketches of a great variety of natural objects. He took no lessons in the art, and his later skill in this as well as in modeling was of his own initiative.

In 1868 in the American Naturalist advertiser there appeared the following:—"James H. Emerton, Zoölogical and Botanical Draughtsman, Salem, Mass., is prepared to execute drawings on paper or wood for Zoölogical Subjects. Especial attention given to the delineation of Insects. References: Editors of American Naturalist."

Of these early drawings there are many in Packard's "Guide" and forty quarto plates in Watson and Eaton "Botany of the Fortieth Parallel" published in 1871. He was elected to the Boston Society of Natural History in

1870, and later, 1873-1874 was an assistant in the Museum. While here he prepared the notes to Hentz's spiders of the United States and the article on cave spiders of Indiana and Kentucky (1875).

He had already decided to study spiders, had collected in over 100 localities in the New England states, and had amassed a collection of more than 300 species.

Early in 1875 he left the Boston Society to spend more than a year in Europe. While there he was enrolled as a student for a short time at the University of Leipzig (October, 1875 to April, 1876) and later (May to July, 1876) at the University of Jena, but apparently he spent much time collecting spiders and becoming acquainted with the arachnologists of Europe, particularly Cambridge, Simon, Koch, Thorell and Ohlert. He had taken to Europe his collection of New England spiders and from Leipzig in December, 1875, wrote an article comparing them with those of the European fauna.

Returning, he again engaged in drawing and prepared many of the colored plates in Eaton's "Ferns of North America" and also many in Packard's "Monograph of the Geometridæ."

In 1877, he gave eight lectures on zoölogy and six on spiders at the Summer School of Biology in Salem, and in 1878 delivered another series of six lectures on spiders. He became a curator in the Museum of the Peabody Academy of Science where he spent an hour each day with the visitors and prepared a Guide to the Museum. In 1879 he also gave instruction in the zoölogical laboratory at Salem.

He spent some time at Albany, N. Y., making drawings for Prof. A. Hall, and later (about 1880) went to New Haven, where he was appointed assistant to Professor A. E. Verrill. He made a host of drawings for Verrill, and prepared the famous models of the great squid and octopus now in the Museum of Comparative Zoölogy at Cambridge and in the National Museum at Washington. For these models he was awarded a medal with an elaborately engraved certificate at the International Fisheries Congress in London in 1882. At New Haven in 1884 he married Mary A. Hills, and shortly thereafter moved to Boston, which was henceforth his home. His wife died in 1898.

He did much modeling for medical colleges and made drawings for many persons; as Minot's Textbook of Embryology, Verrill's Marine Invertebrates, Scudder's Butterflies of New England, Peckham's papers on spiders, and many for the U. S. Fish Commission. He was active in various natural history organizations and became an important factor in furthering interest in local science.

Left. J. H. Emerton and F. Blanchard (about 1905). Right. J. H. Emerton, from a later photograph.

He began to travel more widely, visiting the West Indies in 1893 with Alexander Agassiz, going with Morse in 1902 to the Southern States, in 1905 to the Californian Mountains, in 1914 to the Canadian Rockies, in 1920 to the Hudson Bay Region. On these and numerous shorter trips he industriously collected spiders.

He became much interested in a Federation of New England Natural History Societies, and this he considered as the most useful way of stimulating interest in Natural

History. He was the Secretary and principal support of this society until his death.

He was a founder of our Society, for many years an officer, and one of our most regular attendants, often speaking and exhibiting specimens. Some years ago under the auspices of the Club he arranged for two series of public lectures on entomology, giving one lecture himself. He always seemed to be in good health, and collected spiders only a few months before his death, December 5, 1931.

Aside from being a naturalist he was an artist for the sake of art. He painted hundreds of water colors, often depicting the sea, the shore, or ships. For several seasons this was done at Ipswich, and in later years he went regularly in July to Gloucester for painting. He frequently exhibited before art societies, and lived for many years in an artist's studio apartment.

His principal interest and work was on the taxonomy and distribution of the spiders of New England and Canada. His method of sifting leaves, moss and detritus brought to light great numbers of the smaller forms. At first he sent these to the Rev. O. P. Cambridge in England, who described them; later he began his famous series of New England Spiders, publishing the Theridiidæ in 1882. The plates in these papers were especially valuable; those in the second part (Epeiridæ) containing some of his finest drawings. It is these illustrations that give the characteristic appearance of the parts which have given to Mr. Emerton much of his importance as an arachnologist. Cambridge, in reviewing Hentz's Spiders of the United States (Nature, 1876) refers to Emerton's two plates as follows:—"In point of accurate detail and artistic finish these figures are immeasurably in advance of those engraved from Hentz's drawings."

The series on New England spiders was followed by four supplements, two papers on Canadian spiders and numerous smaller articles, describing in all over 350 species, always with useful illustrations. No other writer has so thoroughly figured his species, old as well as new.

In several papers he traced the distribution of certain northern spiders. Several of his early articles dealt with the habits of spiders and, even to the last, he loved to watch each autumn for the flying spiders.

He gave to the Museum of Comparative Zoölogy the first set of the types of his descriptions, his private collection and library he willed to the writer.

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BIOLOGICAL NOTES ON CUBAN WASPS AND THEIR PARASITES

By Richard Dow

The material for the following notes was collected in Cuba during August and September, 1930. Through a scholarship from the Atkins Foundation, I was enabled to spend nearly five weeks at the Harvard Biological Laboratory near Cienfuegos, Santa Clara. The laboratory is located on the Atkins sugar estate, Central Soledad, and the situation is ideal for this sort of work.

I wish to thank the following people who have assisted me by determining material: Professor Nathan Banks, Mr. H. S. Barber, Dr. A. G. Böving, Miss E. B. Bryant, Mr. R. A. Cushman, Mr. Carl Heinrich, and Mr. J. A. G. Rehn. I am also indebted to Mr. S. C. Bruner of Santiago de las Vegas, Cuba, for permission to publish his observation on *Chlorion cubensis,* and Professor Joseph Bequaert, who has read my manuscript and identified all of the Vespidæ. Although the synonymy of these wasps is more or less tangled, I am using the names which will soon appear in a work on the West Indian Vespidæ by Dr. Bequaert and Dr. George Salt.

Chlorion (Ammobia) dubitatum (Cress.)

I found several nests of this species in a shallow clay pit near Belmonte, Central Soledad. They consisted of a vertical shaft, ten or more centimeters deep, and a sloping tunnel, five or six centimeters long, which ended in a single cell. I found extra cells in only one nest, but there may have been several cells in each burrow, which I failed to find because the tunnels were stopped up.

In all the completed cells, the larvæ had spun their cocoons, leaving only a few chitinous fragments of the prey, such as wings, legs, and ovipositors. From an examination of these remains, Mr. J. A. G. Rehn was able to assign them to Conocephalus sp.

The cocoon is composed of three layers. The whitish outer layer is yellowish at the apex, finely woven, and transparent; the middle layer is a thicker envelope of the same material; the brown inner layer is closely associated with the middle envelope and probably formed of some waste secretion. The meconium is apparently voided within the inner layer, and its concave upper surface is smooth and shining like the inside of the cocoon.

In the four adult females which I caught at this locality, none of the abdominal segments are wholly black, and only traces of the typical black coloration remain.

Chlorion (Ammobia) cubensis Fern.

Mr. S. C. Bruner found this species with a paralyzed long-horned grasshopper at Sante Fé, Isla de Pinos, September 6, 1928. The grasshopper, determined by Mr. J. A. G. Rehn, was a mature female of *Neoconocephalus maxillosus* (Fabr.). The wasp was dragging its prey through open piney woods. It was holding the fore part of the grasshopper's body and walking backwards. Mr. Bruner watched the wasp climb the trunk of a tree, still pulling its prey behind it, until it reached a height of about two meters. The wasp and grasshopper were then captured. This suggests a similar habit of *Sphecius speciosus* (Drury), which preys on cicadas. When Sphecius is taking a heavy cicada to its burrow, it frequently drags its prey up a tree, and then, taking advantage of the height attained, flies directly to the nest.

Sceliphron assimile (Dahlb.)

This species and *Sceliphron cæmentarium* are very closely related, and the nests are found in similar places. The nests of *assimile* are common in Soledad; one lot was taken from the palm thatching of a house near Vilches Potrero, and another from the walls of the buildings at the main entrance of the estate.

The prey of this species consists entirely of spiders. Some of the prey from these nests was identified by Miss E. B. Bryant as follows: a large number of Epeiridæ represented by males and females of *Epeira oaxacensis* Keys. and *Epeira fuscovittata* Keys., mostly immature and mostly *oaxacensis;* a few Thomisidæ represented by immature and adult females of Misumena sp.; one adult female of the Sicariidæ, Scytodes sp.; and one immature male of the Attidæ, Phidippus sp.

A few spiders were also collected from nests of Sceliphron in the lighthouse at Punta de los Colorados, near Cienfuegos, on September 4. Since *Sceliphron assimile* is the only species of Sceliphron which I found in that locality, these spiders were probably stored by that species. The prey was determined by Miss Bryant as follows: a small number of immature Oxyopidæ represented by males and females of *Peucetia viridans* (Hentz); two adult Epeiridæ, females of *Epeira prompta* Hentz; and two adult Clubionidæ, a male and female of *Chiracanthium inclusum* (Hentz).

The cocoon of *assimile* is approximately cylindrical, rounded at the apex, and narrowed toward the posterior end. I found one larva which had died after spinning the silken foundation of its cocoon. I cannot be certain that this is complete at the posterior end of the larva, and I am inclined to believe that the meconium is a true stercoral plug, which is excreted after the cocoon is finished. Before the larva begins its resting period, it also secretes a substance which colors the cocoon yellowish brown and makes it brittle in texture. When the mature wasp is about to emerge, it bites an irregular hole in the side of the cocoon near the top, then softens the clay with a liquid secreted from the mouth. The adult also excretes some tiny white elongate pellets, presumably from the anus. This is the fifth distinct excretory or secretory product, the others being the silken part of the cocoon (from the mouth), the meconium or stercoral plug (from the anus), the excretion or secretion which permeates the silk (from the mouth ?), and the secretion which softens the clay cell.

Associated with *Sceliphron assimile* were an ichneumonid parasite, a dermestid beetle, and a vespid inquiline, *Pachodynerus nasidens* (Latr.). The ichneumonid is *Acroricnus cubensis* (Cress.) [R. A. Cushman]. When Cresson described this species, he noted that it was "parasitic upon the larva of *Pelopœus lunatus* Fab." Later on in the same work *(On the Hymenoptera of Cuba)*, he lists *P. lunatus* as a synonym of *P. cæmentarius.* I have not seen any typical specimens of *Sceliphron cæmentarium* from Cuba, so Cresson probably considered *S. assimile* as that species.

The cocoon of *Acroricnus cubensis* is obconical, whitish or yellowish in color, fuzzy outside and smooth within. The meconium is excreted inside the cocoon and is therefore not a true stercoral plug. Sometimes a rudimentary cocoon is formed within that of the Sceliphron, indicating that these larvæ did not gain ascendency over their host until the resting period of its larva. In these examples, the rounded apex of the cocoon is somewhat below that of the host cocoon and attached to its wall. Between the apex and the conical posterior end which is attached in a similar way, there is no apparent indication of any cocoon spun by the parasite.

The dermestid beetles which I found in the nests of *Sceliphron assimile* were determined as Trogoderma sp. [A. G. Böving (larvæ), H. S. Barber (adults)]. The mature specimens are identical with a form reared by J. C. Bridwell from a package of seeds of Sophora stored at Brownsville, Texas, in 1921. Mr. Barber's note is interesting in this connection. "Several other forms of Trogoderma have been reared from cells of mud wasps about buildings and seem to reflect no other connection with these nests than might be expected from the well-known food habits of larvæ of this genus. In the other cases, and probably also in the present instance, it is supposed they chanced to be attracted to the dried animal matter in unsuccessful cells, from a nearby infestation in other material. Attempts to identify the very numerous and usually misdetermined species of this ubiquitous genus have proven very unsatisfactory because a number of species infesting the personal or household effects of colonists or travelers have become established wherever conditions permitted survival, and have received an excessive number of names, associated with misleading or inadequate 'descriptions' to which have been added a great number of records under wrongly applied specific names."

Pachodynerus nasidens (Latr.) [J. Bequaert]

The nests of this vespid were found in the cells of *Sceliphron assimile.* It is apparently a true inquiline, using only the deserted cells of its host. It makes two or more cells out of each one of *assimile* by constructing thin, horizontal partitions of mud, and fills the cells with a species of lepidopterous larva belonging to the Pyraustinæ of the Pyralidæ [Carl Heinrich]. The egg is suspended by a delicate thread. There is no true cocoon, but the larva covers the walls of its cell with a shining, transparent, yellowish layer of silk, occasionally stretching this membrane across the corners.

Polistes incertus Cress. [J. Bequaert]

The entrance to Cienfuegos Bay is a narrow channel about three miles long, which gradually widens toward the sea. Near Punta de los Cocos on the western side, the shore is bordered by thickets of sea grape (Coccoloba), inhabited by the Giant Land Crab *(Cardisoma guanhumi* Latr.). Farther inland the sea grape is replaced by mixed second growth, in which I found a single nest of *Polistes incertus,* on September 3. The nest was hanging from a twig about two meters above the ground. When I disturbed the wasps, they flew away, so I broke off the twig and found, upon examining the nest, that all the cells were empty. This fact probably accounts for the readiness with which the wasps took flight. Hoping they would return, I came back later in the afternoon; with better success than before, I captured a total of sixteen specimens.

In addition to these individuals (9 workers and 7 males), I collected two stray queens; one was taken at Castillo de Jagua on September 5, and the other at Limones Seboruco, Soledad, on September 15. The sexual dimorphism of the female sex is very marked, as may be seen in the following table, where the total length of the head, thorax, and first two tergites of the abdomen is given in millimeters:

Size	Males	Workers	Queens
Mm.	(Sept. 3)	(Sept. 3)	(Sept. 5 and 15)
7	1	—	—
7.5	6	—	—
8	—	2	—
8.5	—	6	—
9	—	1	—
9.5	—	—	—
10	—	—	—
10.5	—	—	—
11	—	—	1
11.5	—	—	—
12	—	—	1

Two of the above specimens were stylopized: one of the 7.5 mm. males had one parasite under the left side of the fifth tergite, and one of the 8.5 mm. workers had one parasite under the left side of the fourth tergite and one parasite under the right side of the fifth tergite.

The nest of *Polistes incertus* was previously unknown. The present example (see plate 1, figures 1 and 2) is fastened to the twig by a single attachment at the base of the uppermost cells. The comb hangs in a vertical plane, but most of the cells are directed downward instead of being horizontal. The comb is irregular in outline, and somewhat curved so that the bases of the cells form a concave surface. The length of the comb is about seven centimeters, and the average width is less than four. There are 227 cells, about thirty of which are incomplete. Some of the cells in the middle of the comb are distinctly deeper than the others, and were probably occupied by the young queens. As previously noted, there were no larvæ or pupæ in the nest on September 3.

Polistes poeyi Lep. [J. Bequaert]

This Cuban wasp has been referred to in the literature as *P. minor*, but Dr. Bequaert tells me that, in his opinion, the true *P. minor* Beauv. does not occur in Cuba.

I collected 44 specimens of this species, most of which were taken at San José, where I also found a small nest on the under side of a large rock. I am not at all certain that the nest was built by *Polistes poeyi*, because the cells were empty and the comb apparently deserted. A female of this Polistes caught at San José on August 30, had captured a female trypetid fly, *Œdicarena tetanops* (Lw.), determined by Mr. Nathan Banks.

Polistes major Beauv. [J. Bequaert]

This species was nesting in exposed situations from three to six meters above the ground, on a cane lift near Arimao. The nests were attached to the under side of the steel girders by a single pedicel, and the combs were horizontal.

Two nests were secured, one on the sixth of September and another on the eleventh. The first was oblong in shape, about fourteen centimeters long, and nine wide. It contained 333 cells, but most of the peripheral cells had been recently constructed and were very shallow. The second nest was smaller and nearly round, with an average diameter of nine centimeters, and about 214 cells.

I captured 3 males and 20 females from the first nest, and 7 females from the second. I took the combs back to the laboratory, and by September 17, 14 males and 18 females had emerged from the first nest, and 10 females from the second. Since the second nest was younger, only females were produced. No parasites were bred from either nest, though two of the males had mites on the sixth sternite. When I returned to the site of the first nest on September 11, the wasps which I failed to catch on my first visit were building a new comb.

Beside the specimens from the nests, I collected a single female of this species at San José in the Trinidad Mountains on August 30.

Polistes cubensis Lep. [J. Bequaert]

This is the commonest species of Polistes around Soledad. I collected five nests from the bat caves at Guabairo, and one on the eastern side of the entrance to Cienfuegos Bay. The latter nest (see plate 1, figure 3) was hanging from a small tree about two meters above the ground. It resembles the nest of *Polistes incertus,* which was found in a similar location, but is one decimeter long and contains 309 cells. The back of the comb is nearly flat, not concave. I captured 46 females from this nest on September 4, and 33 females and one male emerged before September 17. No parasites were bred from the nest, and none of the wasps were stylopized.

The nests from Guabairo were collected in sheltered places under limestone ledges in fairly thick woods. The one in plate 1, figure 4, is typical. The cells are intermediate in size between those of *Polistes major* and *P. incertus.* The back of the comb is concave, and the most recent cells form a sort of apron at the bottom. The base of the pedicel is a black, lichen-like attachment about a centimeter and a half in diameter. The following table will give an idea of the relative size and population of the five nests. The length of the comb is measured on the concave surface, but the width is measured in a straight line. The number of cells includes those which are unfinished.

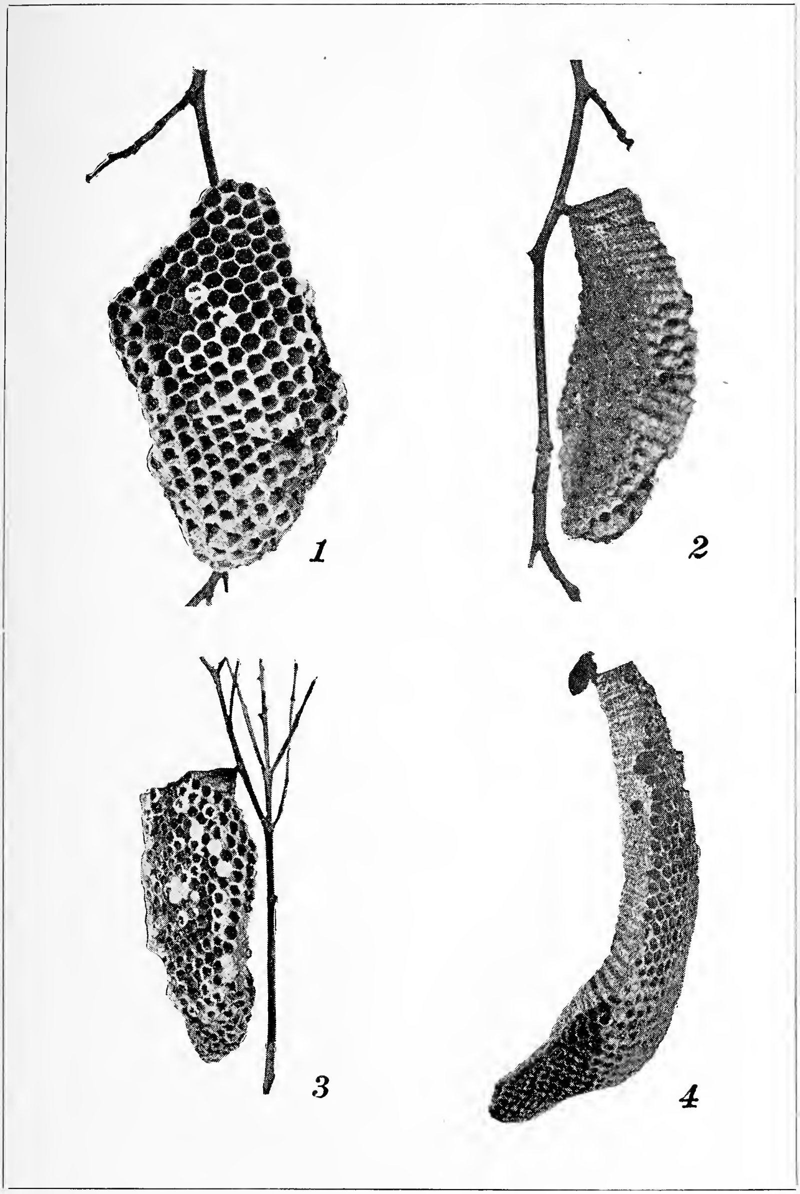
Nests of *Polistes cubensis* from Guabairo,

Central Soledad

	Nest No. 1	Nest No. 2	Nest No. 3	Nest No. 4	Nest No. 5
Length of comb in cms.	19.5	14.5	8.0	11.5	19.0
Width of comb in cms.	7.5	9.0	4.5	4.0	9.0
No. of cells	573	447	130	197	570
Date collected	Aug. 20	Aug. 20	Sept. 7	Sept. 7	Sept. 7
No. of wasps taken with nest	64 ♀ ♀	91 ♀ ♀, 9 ♂ ♂	Nest empty	? (all ♀ ♀)	? (all ♀ ♀)
No. of wasps which emerged before Sept. 17	80 ♀ ♀	3 ♀ ♀, 15 ♂ ♂	—	6 ♀ ♀	10 ♀ ♀, 18 ♂ ♂

It is interesting to note that nest No. 1 failed to produce any males, though it was probably the oldest nest. Five females from nest No. 1 and four males from nest No. 2 were stylopized. Each contained a single parasite as follows: 3 ♀ ♀ with a parasite under the right side of the third tergite, and 2 ♀ ♀ with a parasite under the left side of the third tergite; 2 ♂ ♂ with a parasite under the left side of the third tergite, one ♂ with a parasite under the right side of the third tergite, and one ♂ with a parasite under the left side of the third sternite. Two of the females from nests Nos. 4 and 5 (the wasps which I captured with these nests were not kept separate) had apparently been stylopized, and the parasites had emerged.

Nests Nos. 2, 4, and 5 were parasitized by *Polistiphaga fulvescens* (Cress.) [R. A. Cushman], originally described in the genus Mesostenus. One specimen emerged from nest No. 2 on August 21, and on September 16 two specimens emerged from nest No. 4, and seven specimens from nest No. 5. *Polistiphaga fulva* (Cress.) [J. Bequaert], a North American species of this genus, is parasitic on *Polistes fuscatus* (Fabr.) var. *pallipes* (Lep.) [J. Bequaert]. When collecting a nest of this wasp at Cold Spring Harbor, Long Island, New York, on September 6, 1929, I caught a single female of the parasite. Another



Dow—Cuban Wasps

female emerged on the same day, and a third female on the 7th; two males emerged on the 8th. All five specimens apparently developed from a single larva of the Polistes.

Explanation of Plate 1.

Fig. 1. Nest of *Polistes incertus* Cress., from Punta de los Cocos, Cienfuegos, Cuba.

Fig. 2. The same, showing back of comb.

Fig. 3. Nest of *Polistes cubensis* Lep., from Punta Pasa Caballo, Cienfuegos.

Fig. 4. Nest of *Polistes cubensis* Lep., from Guabairo, Central Soledad, Cienfuegos.

A NEW SPECIES OF DICÆLUS FROM SOUTHERN FLORIDA

By H. C. Fall

Tyngsboro, Mass.

Dicaelus darlingtoni n. sp.

Size, form and general aspect similar to *purpuratus*. Form oblong, moderately elongate; body beneath and head black, prothorax and elytra with deep purpureo-violaceous lustre, becoming rarely slightly bluish, opaque. Head variable in size, the difference being largely sexual in nature; in several measured examples of each sex the ratio of its width to that of the thorax being about .67 in the female and .63 to .64 in the male.

Prothorax about three-fifths as long on the median line as the maximum width; sides convergent apically, typically perceptibly sinuate behind the middle, but varying to continuously arcuate and subparallel posteriorly, the base angles rectangular with rounded vertices; thickened side margins slightly wider and better defined than in *purpuratus*.

Elytral intervals distinctly alternating in convexity, the summits of the more convex intervals narrowly blackish and slightly shining. In *purpuratus* the discal intervals are of uniform convexity; the seventh is cariniform in both species.

Length 22 to 25 mm.; width 9 to 10 mm.

A good series of specimens is before me, all taken at Homestead, Florida, in June 1928 and '29 by Mr. P. S. Darlington, Jr., to whom I take pleasure in dedicating the species. The type, a ♀, and several paratypes remain in my own collection, several paratypes also in Mr. Darlington's collection.

Although most nearly like *purpuratus* in general facies, in the character of the elytral intervals this species agrees more nearly with *quadratus*, to which it would be traced in Horn's table of the genus (Bull. Brook. Ent. Soc. 1880, p. 51). *Quadratus* is however an evidently more robust species, the prothorax relatively larger with sides more nearly continuous with those of the elytra, giving a distinctly more oval outline. In the few specimens seen the violaceous surface tint is less developed than in *darlingtoni*.

The tendency toward a greater development of the head in the female is also observable in my series of *D. splendidus*, and suggests that Casey's *D. speciosus*, said to closely resemble *splendidus* except for its smaller head, is really that species. The fact that Casey's specimens were all males is confirmative evidence.

NEW SPECIES OF CRYPTOCEPHALUS
(Coleoptera; Chrysomelidæ)

By H. C. Fall
Tyngsboro, Mass.

Cryptocephalus pallidicinctus n. sp.

Moderately robust. Head black, a quadrate post-clypeal area, a small spot posteriorly adjacent thereto, and the entire inner border of the eyes narrowly whitish yellow. Antennæ black.

Prothorax orange red, the extreme apical edge pale yellow, the basal edge very narrowly blackish; surface sparsely feebly and very finely punctate.

Elytra black, with narrow whitish yellow basal and lateral margin which at apex does not quite reach the sutural angle; striae moderately impressed, nearly as in *sanguinicollis,* the sutural not reaching the middle of the elytra, 6th very widely interrupted medially, 7th dislocated at basal third.

Entire upper surface polished and strongly shining. Pygidium coarsely punctate, obtusely carinate at middle in basal third. Body beneath black; prosternum whitish yellow, with moderate cuspiform lobe in front, the hind angles with erect spiniform processes tipped with black.

Length 4 mm.; width 2.3 mm.

Palm Springs, California, 3-22-17. A single male.

This species is nearly related structurally to *sanguinicollis,* but differently colored. It differs further in its more distinctly impressed elytral striae, carinate pygidium, and smoother elytral interspaces, which show scarcely a trace of the fine transverse regulosity usually evident in *sanguinicollis.*

Cryptocephalus apicedens n. sp.

Pale yellow with fuscous stripes, the darker color predominating. Antennæ pale at base, infuscate externally. Head yellow with a fuscous inverted V, the branches terminating inferiorly at the bases of the antennæ.

Prothorax with four broad fuscous stripes leaving a narrow sharply defined median line, a very narrow anterior margin, wider lateral margins, and two somewhat oblique basal spots which are produced imperfectly to the front margin, yellow.

Elytra with the suture dark except at base, and each with three fuscous stripes, the two outer in great part confluent. The yellow stripes occupy the 2nd, 4th and marginal interspaces, the two former abbreviated at apex. There is also a short humeral dash between the 5th and 6th striae, and an obscure subapical streak between the 6th and 7th striæ. The striæ themselves are regular except the 5th, which is confused behind the middle, and the 6th which is interrupted medially.

The entire upper surface is highly polished, the thorax with very sparse minute punctures, the elytra without trace of interstitial punctures. Prosternum behind broadly emarginate with prominent elevated lateral angles; apical margin obtusely prominent at middle, behind which is a short erect and acute spiniform tooth (♂).

Length 3 mm.; width 1.7 mm.

Described from a single male taken at Jemez Springs, New Mexico, VI-8-22.

This little species seems most nearly related to *confluens* but the several differences, though in part rather trifling, are in the aggregate I think sufficient to forbid its association with that species. These differences are as follows. The form is less parallel in the present species, the elytra distinctly narrowing from base to apex; eyes less widely separated above; instead of the inverted V of the present species the front in all examples of *confluens* seen is marked with a short median line on the vertex; the 5th elytral stria is quite regular in *confluens* and the

6th is represented as a rule by only two or three punctures just behind the humeral callus; the size in *confluens* is consistently larger; finally and probably most important, the acute lobe or cusp formed by the production of the apical margin of the prosternum in the male of *confluens* and allied species is here replaced by an isolated spiniform tooth posterior to the true margin, which latter is only moderately angularly advanced at middle.

Cryptocephalus merus n. sp.

Moderately stout, subparallel, yellow, highly polished, with brown or reddish brown markings as follows. Head with the usual small vertex and supra-antennal spots; prothorax with four more or less irregular or disintegrated vittae, the two inner ones separated by a narrow sharply defined yellow line; elytra with brown striæ, an elongate spot between striæ 2-3 at base, a similar spot at the apical third between striæ 4-5, behind this another more diffuse, the humeral umbo, and two small spots at basal and apical thirds on the subhumeral interspace. Striæ 5-7 are independent for a short distance at base but become interrupted and partially lost posteriorly.

Head sparsely finely punctate; prothorax with sparse irregularly scattered rather coarse punctures; elytral striæ moderately impressed.

Body beneath yellow with close set punctures, metasternum, and ventral segments in part, brown. Prosternum in front with apically rounded not very prominent lobe; behind emarginate and bilobed as usual.

Length 4 mm.; width 2.3 mm.

El Paso, Texas. Type ♀.

This species is not closely similar to any known to me. In a general way at long range the elytral markings somewhat resemble those of *spurcus*, and for the present it may be placed near the latter. The very sparsely irregularly and rather coarsely punctate thorax has no parallel in any of our previously described species, but occurs again in the following species, which may indeed be no more than a variant form of the present one.

Since writing the above I have received from Mr. D. K. Duncan two examples from "Base of Pinal Mts., Arizona," which are quite surely specifically identical with my El Paso type. They differ only in having the dark shades on the pronotum almost washed out and those of the elytra completely so.

Cryptocephalus cuneatus n. sp.

Moderately robust, elytra distinctly narrowed from base to apex; color pale yellow; prothorax with three rather wide light brown vittæ which do not quite attain the apex; elytra with a narrow common sutural vitta and another scarcely wider from the humeral callus slightly abbreviated at apex, deep black. Antennæ pale at base, infuscate apically.

Head finely sparsely punctate, a narrow vertex line and a spot at base of antennæ light brown.

Prothorax shining, sparsely lightly and very finely punctate, the interstices between the punctures thickly set with very minute punctules. The brown vittæ are subequal in width to the intervening yellow ones; lateral margins finely edged with black except near the base.

Elytra with similar ground sculpture of micro punctulation and with eight discal striæ between the short sutural and the marginal stria, the sixth however imperfect and contained wholly within the lateral black vitta. The basal two punctures of the fourth discal stria are joined by a dark line. Epipleura blackish posteriorly, and externally so toward the base.

Body beneath and legs pale. Prosternum slightly prominent at apex, feebly carinate along the middle, narrowly emarginate and obtusely bilobed behind.

Length 3.4 mm.; width 2 mm.

Tybee Island, Georgia. A single male collected and sent me by the late G. R. Pilate.

This very pretty little species bears an obvious resemblance in size, form and pronotal markings to *trivittatus*, which, however, differs by its much more coarsely and closely punctate thorax, which because of a very fine alutaceous ground sculpture in addition to the micro-punctulation above referred to, is more or less dull in lustre. The elytral vittæ in *trivittatus* are brown instead of black and much less even and clear cut, the lateral ones always more or less disrupted and displaced posteriorly where it extends inward to the fourth stria.

Cryptocephalus ochraceus n. sp.

Upper surface of a nearly uniform deep yellow tint; head with a short vertex line and the bases of the antennæ reddish brown; prothorax with a feeble narrow basal line and faint traces of sublateral shades; elytra with the strial punctures, the sutural edge and an ill defined fascia just before the apex of the same color. Antennæ pale basally, outer joints brownish.

Head sparsely punctate; thorax strongly and conspicuously so, the punctures in great part tinged with reddish brown and separated on the average by about their own diameters; surface moderately shining.

Elytra a little duller in lustre though without perceptible alutaceous sculpture. Striæ not much impressed, the sutural reaching the basal third, discal striæ 1-5, 8, and 9 quite regular, 6th and 7th regular for a short distance behind the humeral callus but much confused beyond that point. Intervals with a single series of widely spaced extremely minute punctures.

Body beneath suffused with reddish brown, tibiæ, tarsi and apical half of femora of same color, basal half of femora yellow. Prosternum not distinctly lobed in front, rather deeply emarginate with prominent angles behind.

Length 4.4 mm., width 2.5 mm.

Dunedin, Florida, IV-5-22: a single female specimen collected by the writer.

This species in size and color somewhat resembles *umbonatus* Schf. but in the latter the striæ are much deeper and the thorax very much more finely punctate. In its relatively coarsely punctate thorax *ochraceus* approaches the species at the end of LeConte's table, more especially *tinctus*, before which and *schreibersi* I would suggest it be placed.

AN EFFECTIVE METHOD FOR COLLECTING ECTO-PARASITES FROM LIVE ANIMALS AND BIRDS

By Lawrence H. Dunn

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The following method for collecting ectoparasites from live animals and birds that has now been used for some time by the writer has proved to be very effective and it is believed that a published description of it may be of interest to parasitologists, entomologists and others that are sometimes engaged in collecting ectoparasites.

This method was first tried out in securing specimens of fleas from a young peccary, or wild pig, *Pecari angulatus bangsi* Goldman. This animal, which apparently was between two and three months of age and weighed about seven pounds, had recently been captured by men engaged in the construction of a new road in the Canal Zone. Through the kindness of Mr. Louis Hulcher, Foreman on the road work, the peccary was brought to this laboratory in order that it might be examined for blood parasites and also to provide an opportunity for collecting specimens of the fleas with which it was heavily infested.

This animal had been quite gentle and was kept as a pet at the camp of the road builders where it had lived for a number of days. On arrival at the laboratory it seemed to be frightened by the strange surroundings and strongly resisted being handled. The vigorous struggles of the pig and the activity of the fleas formed a combination which made the capture of many specimens rather a difficult task. It was evident that unless some method was devised for collecting the fleas, other than by using fingers or forceps or inverting glass tubes over them, our catch was not likely to be a very large one. In view of this, the following procedure was tried out. A narrow strip of adhesive tape wound several times around the snout and under the lower jaw of the pig acted as a muzzle and effectually prevented it from biting. The forefeet were tightly fastened together with a piece of one-inch bandage and after the hind feet had been secured in like manner a short strip of the bandage was used to connect the fore and hind feet. This strip was about eight inches in length and prevented the forefeet from being separated from the hind feet for a distance of more than its length. This permitted some movements of the legs but prevented the animal from using them too freely. The pig was then placed in a sitting position in a large glass anatomical jar with its head above the top of the jar and a towel placed about its neck somewhat after the manner in which a barber's apron is used. This left one side of the towel wrapped tightly about the neck of the pig while the other part was spread out to completely cover the top of the jar. An elastic band stretched around the top of the jar and the outer edge of the towel served to hold the latter closely in place. As the animal rested on its hind feet the bandage connecting them with the forefeet held the latter down in the jar and prevented them from being hooked over the top of the jar or to claw at the towel. One hand grasping the towel at the nape of the neck of the pig sufficed to hold the animal upright with its head above the top of the jar as well as to keep the towel tightly in place about its neck. Chloroform was then liberally sprinkled about on the towel in rather close proximity to the pig's neck but not near enough to permit the liquid to reach the animal's body. The vapor of the chloroform being heavier than air readily penetrated through the towel to the bottom of the jar. The effect of the chloroform vapor on the fleas quickly became evident and in less than a minute many of them were seen leaving the pig and falling to the bottom of the jar. A few that came up on the head of the animal were stupefied and were collected by dabbing them with a small pledget of cotton wet with chloroform. In about four minutes the pig was taken from the jar and after removing the towel from about its neck the animal was given a brief combing to remove the few dead or stupefied fleas that were adherent to the hair or skin. A careful examination of the animal was then made and it seemed to be entirely free from the fleas.

It was very easy to collect the dead and stupefied fleas from the bottom of the jar. Inverting the jar over a piece of white paper caused the greater number of them to fall on the paper from which they were transferred to tubes of alcohol. The few that remained sticking to the inside of the jar were easily picked up on the side of a dissecting needle wet with alcohol.

A total of 148 fleas were collected from the peccary at this time and although the animal was kept at the laboratory for several weeks and was examined at frequent intervals no more fleas were ever found on it.

A short time later there was an occasion to examine a number of marmosets, or squirrel monkeys, *Leontocebus geoffroyi* (Pucheran), for possible ectoparasites before placing them in the animal house at this laboratory. These animals had been recently captured and being vicious biters were difficult to handle in so far as examining them closely for ectoparasites was concerned. Since they were hardly larger than a squirrel and it was necessary to hold them tightly in gloved hands in order to prevent biting, there was but little of an animal's body left exposed for examination. By using the chloroform-jar-method the examination of these monkeys was simplified to a great extent and it was quite surprising to find so many of them infested with fleas. Although the short snout of this species of monkey precluded using adhesive tape as a muzzle the towel and skin when held together at the nape of the neck prevented them from turning to bite or moving to any great extent. When this method is used on animals having prehensile tails, such as monkeys, opossums, etc., the tail is usually fastened to the hind feet in order to keep it away from the top of the jar.

A black spider monkey, *Ateles dariensis* Goldman, that was found to be heavily infested with lice was treated with this chloroform vapor method and *Pediculus* to an estimated number of from 4000 to 6000 were obtained.

Numerous opossums, *Didelphis marsupialis etensis* Allen, have been cleared of fleas with this method and it was also found to be very successful when tried out on Coatis, *Nasua narica panamensis* Allen, and grisons, *Grison canaster* (Nelson), many fleas and lice being obtained from these animals.

When treating animals that have long thick hair or fur after taking them from the jar it is necessary to rub the hair briskly with the fingers or use a comb in order to remove the inert fleas or lice that remain clinging to the hairs.

This method is easily applied to birds and has proved to be very effective in clearing them of lice. The wings are brought up over the back and fastened together with two or three turns of a narrow bandage that is drawn up between the feathers close to the wing. The feet are tied together with a piece of string or with a rubber band or they may be left free to allow the vapor more freely to reach the area between the thighs. After removing the bird from the jar it is held over a large piece of white paper and its feathers vigorously ruffled and drawn upward with the fingers to cause the stupefied lice to fall clear of the feathers. A tinamou, *Tinamus major castaneiceps* Salvadori, when treated in this way recently yielded 603 lice, representing three genera, *Conoides, Ornicholax* and *Kelloggia.* A total of 176 lice, 122 *Columbicola* and 54 *Goniocotes,* were obtained from a domestic pigeon.

This method is now being used as a routine measure on all animals and birds received at this laboratory. The ease with which abundant yields of ectoparasites are obtained by its use leads me to believe that it may be extremely useful if used on a larger scale in clearing domestic fowls, dogs, etc., of fleas, lice and mites. Investigations on its application along more practical lines will be carried out in the future.

The specimens of ectoparasites are in good condition and in much better shape to be studied when collected by this method and are seldom found partly crushed or with many spines or hairs broken off as so frequently occurs when collected with forceps or fingers.

THE THATCHING ANT, *FORMICA OBSCURIPES* FOREL

By A. C. Cole, Jr.
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Formica obscuripes is apparently one of the most successful ants present in semi-arid regions of the West. Its mounds, composed of dried plant material, are successfully able to resist the strong, westerly winds common to that section of the United States.

Wheeler[1] records this species from Wyoming, Montana, Colorado, Arizona and British Columbia. In addition to these localities I have found it in Idaho, Oregon and South Dakota. Wheeler[1] states that colonies of *obscuripes* are most abundant at higher altitudes, from 5,000 to 8,000 feet. Furthermore, the mounds are apparently most abundant in semi-arid localities, especially where sagebrush and its allied flora are growing.

The mounds consistently are composed of twigs and other dry plant material and are more or less dome-shaped (fig. 1). Almost invariably they are centered around a dead sagebrush plant. Parallel with the stem of the sagebrush one or more galleries extend into the interior of the mound. At least one of these external orifices opens at the apical juncture of the mound with the sagebrush stem. Other entrances perforate the mound in widespread places. I have counted as many as 44 and as few as 3 entrances on a single mound.

From observations it is certain that the sagebrush is alive when the ants begin building the mound. When the colony possesses a suitable number of workers the bark is chewed from the base of the plant and formic acid is ejected on the tender cambium layer. Whether this formic acid is required for the destruction of the plant is questionable but it is doubtful whether elimination could be completely accomplished without it. After the plant has been killed it dries and the branches are broken off and disseminated by the wind. This operation takes place very slowly, it requiring sometimes as long as three months for the plant to be entirely eliminated. One can often observe mounds in which the stems have been broken off flush with the apex of the mound. In such cases the operation of destruction is incomplete for eventually the entire

Fig. 1. Typical mound of *Formica obscuripes* composed of wheat straw. Twin Falls, Idaho.

stem is removed. When the operation is complete the center of the mound will be found to possess a large longitudinal gallery, apparently the main entrance to the interior of the mound.

The main brood chambers are located approximately three feet lower than the base of the mound proper, but auxilliary chambers are scattered throughout the remainder of the nest where the brood may be moved upon the occurrence of temperature fluctuations. (fig. 2). In most cases the brood is isolated in separate chambers according to age but often it is intermingled in the same chambers.

The twigs and grasses which comprise the external architecture also extend into the ground for a distance of from several inches to a foot and rest on a crateriform base. Perhaps this provides anchorage for the mound or even aeration of the brood. The slight precipitation occurring

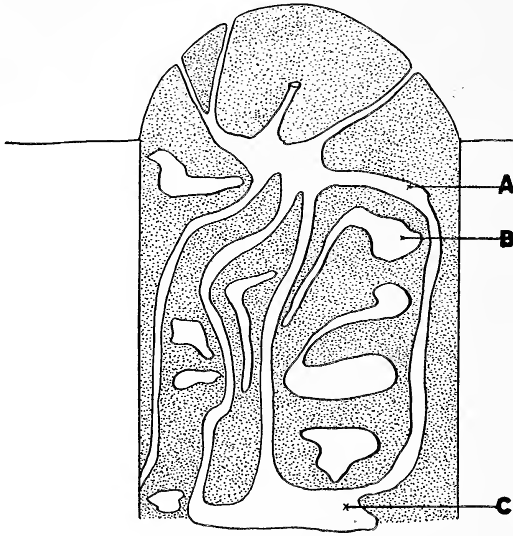

Fig. 2. Diagrammatic longitudinal section of a mound of *F. obscuripes*. Twin Falls, Idaho. A, a main gallery; B, auxiliary chamber; C, main brood chamber.

in the West has little effect on the mounds and there is no great danger of the crateriform base filling up with water.

Colonies of *obscuripes* are always quite populous and include both major and minor workers. Both of these aid in the protection of the colony, ejecting formic acid at the slightest unnatural disturbance. The macrogynous queens in a single colony vary in number, there always being two or more present. Winged males and females appear in large numbers during June and July.

These ants feed chiefly on dead insects and related forms which they usually place in the brood chambers. Occasionally, however, they carry seeds into the mounds. Whether these seeds are used for food is evidently unknown. In a few mounds I observed them intermingled with the brood as is the case with the above food.

Wheeler states[2] that he has observed whole colonies of *obscuripes* attending droves of young Membracids in Colorado. I, too, have observed this association in Idaho and have also seen the ants attending two species of undetermined aphids on sagebrush. Wheeler[2] lists *Euphoria inda* and *hirtipes* as among the synœketes of *obscuripes*.

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TWO BRIEF HISTORICAL NOTES

By J. G. Myers
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I. The Oldest Work on Insect Anatomy

In the first volume of Bodenheimer's monumental history of entomology appears the following statement (p. 327): "Als das älteste Werk anatomischer Insekten-Betrachtung gilt das Apiarium des römischen Arztes Francesco Stelluti (1625)."

Bodenheimer seems entirely to have overlooked the great anatomist, Giulio Casserio (Casserius), the successor of Fabricius ab Aquapendente in the Chair of Anatomy and Physics at Padua.

Although, so far as we know, Casserius published no *separate* works on insect anatomy, yet his descriptions and dissections of cicada anatomy, printed in 1600, are so excellent and faithful that it seems to us that his distinction as the first insect anatomist is indisputable. Several accounts of cicada structure appearing in the present century have been less accurate. The general treatise in which his studies are buried is entitled: *De vocis auditusque organis historia anatomice singulari fide methode ac industria concinnata tractatibus duobus explicata ac variis iconibus aere excusis.* (Ferrara, F. 2 tractatus in 1 vol. Tab. I-XXII et I-XII).

II. Zoophylaxis for Mosquitoes

In view of the present emphasis placed by Roubaud and other workers on the protection from Anophelines, said to be afforded to man by the vicinity of domestic animals in large numbers, it is interesting to notice that Humboldt was apparently the first to remark on this and to describe an instance in which the theory was deliberately put into practice. In his "Personal Narrative" (Ross trans., 1852, vol. II, p. 280) he says, "In the villages of the Rio Magdalena the Indians often invited us to stretch ourselves as they did on ox-skins, near the church, in the middle of the *plaza grande,* where they had had assembled all the cows in the neighborhood. The proximity of cattle gives some repose to man."

A FEMALE INTERMEDIATE BETWEEN *PAPILIO GLAUCUS* AND ITS FORM *TURNUS* (LEPID.: PAPILIONIDÆ)

By Harold O'Byrne
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It is well known that there are two forms of female in *Papilio glaucus* Linn., the black type form and the yellow form *turnus* Linn., and that they are not only sexual forms, but geographical as well. In the southern part of the range of this species, black females are the rule, while in the north, only yellow ones occur; in a considerable region near the middle of its territory, both forms fly together. Missouri is in that intermediate region, though collectors in the neighborhood of St. Louis consider the yellow form somewhat scarce. The males are invariably yellow, and a few closely related species that inhabit the southwestern part of the country and northern Mexico are never black in either sex. To the knowledge of the writer, no breeding has been done in this species with a view toward working out the relations of these forms in the light of genetics. The fact that this condition is linked with sex, and that according to Jordan[1] there is a rarity of intermediate forms, indicates that this is a Mendelian phenomenon.

Knowing of the rarity of intermediate forms, I was surprised to take at Allenton, Missouri, on August 9, 1931, such a female, having the black color of *glaucus*, but heavily suffused with yellow on the upper and lower surfaces of both pairs of wings. This has the effect of making the black stripes very noticeable on the upper side, and in this respect the specimen differs markedly from *glaucus*. This specimen is in no wise comparable to one mentioned by

[1] In Seitz, *The Macrolepidoptera of the World.*

Scudder[2] in which one pair of wings is yellow and the other black. He describes this as a hermaphrodite—really a gynandromorph—while the specimen from Allenton is a normal female with the normal female coloration of both forms and with her abdomen distended with eggs.

Knowing nothing of its antecedents, it is idle to speculate as to the genetic status of this specimen. It probably represents a case of imperfect dominance, but whether this appeared as a mutation is, of course, impossible to say. There is a valuable problem for geneticists.

DENDROIDES CANADENSIS LATREILLE—SYNONYMY

By H. S. Barber
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Those rejecting the adoption in LeConte 1855 of *Dendroides canadensis* Latreille 1810 with *bicolor* Newman 1837 in synonymy as the proper name of our commonest Pyrochroid beetle probably did not realize that Latreille's designation (p. 430) of the type species for his monobasic genus erected in the same work (p. 212) connected his new specific name, *canadensis,* with the diagnosis, thereby making LeConte's use of the name the only proper choice under the International Code of Nomenclature. The misstatements in Lacordaire 1859 evidently led to the synonymy wrongly adopted in Gemminger and Harold 1870, this synonymy being followed by European workers and accepted in Leng 1920. The current synonymy should be reversed and we should go back to the usage reflected in the catalogues by Melsheimer 1853, LeConte 1866, Crotch 1874, and Henshaw 1885, as well as in numerous more local lists prior to 1920. In the admirably brief but important statement by Miss Payne 1931, recording her six years' observations on larvæ which could not pupate except as stimulated by a particular food, her use of the name

[2] Scudder, S. H. *The Butterflies of the Eastern United States.*

canadensis seems to have fortunately been passed over without being standardized into conformity with the last catalogue.

In the following list of works consulted, the asterisk indicates use of the valid prior name (*canadensis* Latreille 1810) instead of its synonym (*bicolor* Newman 1837).

*1810 Latreille, Consid. General.—Crust. Arach. Ins. Paris, p. 212, 430.
*1825 Lepeletier & Serville, Encyl. meth., Ins., vol. 10, p. 169, 261.
1837 Newman, Ent. Mag., vol. 5, p. 375.
*1853 Melsheimer, Cat. Coleop. U. S., p. 148.
*1855 LeConte, Proc. Acad. Nat. Sci. Phila., vol. 7, p. 275.
1859 Lacordaire, Gen. Coleop., vol. 5, p. 603, footnote 3.
*1866 LeConte, List Coleop. N. A., p. 64.
1870 Gemmiger & Harold, Cat. Coleop., p. 2104.
*1874 Crotch, Check List Coleop. Am. N. of Mex., p. 109.
*1885 Henshaw, List Coleop. Am. N. of Mex., p. 129.
1914 Blair, Ann. Mag. Nat. Hist., Ser. 8, vol. 13, p. 313.
1920 Leng, Cat. Coleop. Am. N. of Mex., p. 161.
1928 Blair, Coleop, Cat., Junk, pt. 99, Pyrochroidæ, p. 2.
*1931 Payne, Ent. News, vol. 42, p. 13-15.

A WIREWORM DOUBLE MONSTER (*LIMONIUS CANUS* LEC., ELATERIDÆ, COLEOPTERA)

By Chas. E. Woodworth

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Quite recently it was my good fortune to find and preserve an interesting monstrosity among some newly hatched wireworm larvæ. In the course of examining about eighteen thousand of these, only one abnormal individual was noted. Besides the great scarcity of anomalies in this group the fact that wireworms are of subterranean

Fig. 1. Partial twin, first instar larval wireworm. *Limonius canus* Lec., ventral aspect, actual length 2 mm. Enlarged 60 diameters.

habits makes observation rare indeed. For these reasons it was decided to report this case. In order to insure that this partial twin should not be lost it was killed and fixed as soon as discovered and, as a consequence, growth records were not obtained. It is hoped that another individual will be found so that developmental changes can be noted.

The specific type of anomaly possessed by the individual here reported is classified by Cappe de Baillon[2] as a symmetrical double monster with lateral abdominal doubling. This particular diplopagisity, according to Wilder[3], is believed to be due to wide separation of some of the segmentation nuclei in early embryonic development, perhaps being traceable to the two-cell stage. Had there been complete wide separation there would have been identical twins. In phasmid larvæ Cappe de Baillon found that abdominal doubling was very rare as compared to cephalic or thoracic doubling. In fact very few larval irregularities of any type have been reported. In adults abdominal monstrosities are very rare as compared with other types. This fact is strikingly noticed when the literature of reported cases is reviewed.

This particular larva has a perfectly formed head and thorax as well as the first five abdominal segments as far as external study indicates. The sixth segment is irregular in shape, being double at the bottom but single at the top. The last three segments are apparently normal but duplicated. The digestive tract appears to be double throughout the sixth segment and divides at the junction of the fifth and sixth segments, the irregularity beginning about the middle of the fifth. The fat bodies, the only other internal structures visible, seem to conform to the external arrangement. The length of the larva is the same as the rest of the worms from the same mating if either of the tails are used. The volume would be the same if the duplicated parts were removed and the sixth segment trimmed to normal shape. There does not seem to be any atrophy or hypertrophy except as noted above and each duplicated segment is like the corresponding somite of the other half and of other larvæ from the same mating except the abdominal segment 6.

In 1927 Cappe de Baillon wrote a very excellent book which concerned itself entirely with teratology or monstrosities found in insects. While the principle part of the work deals with a study of *Carausius morosus* Brunner, a phasmid, one that is very prone to irregular development, there is included a 382-title bibliography. Practically all of these references refer to adult irregularities, probably because those forms are the ones found in collections. Most of these malformations take place in the pupal reorganization. How much larger the list would be if larval anomalies such as the one here reported were more often found! In this whole list of references only one deals with elaterids. That one is by Bastine[1] and concerns itself with an antennal irregularity in an adult of *Melanotus rufipes* Herbst in which the second antennal article had two extra growths upon it.

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[2] Cappe de Baillon, P.
1927 Recherches sur la Tératologie des Insectes. Paris, 291 pages, fig. 85, pl. 9, ref. 382.

[3] Wilder, H. W.
1904 Duplicate Twins and Double Monsters. Amer. Jour. Anat. 3: 387-493, fig. 11, pl. 2, ref. 151.

TWO NEW SPECIES OF EAST AFRICAN CLERIDÆ (COLEOPTERA)

By A. B. Wolcott
Chicago, Illinois

Gyponyx pertenuis sp. nov.

Elongate, black, shining, sparsely clothed with long yellowish white pile; antennæ rufo-piceous, five terminal segments darker; labial palpi fulvous; maxillary palpi piceous; elytra black, scutellar area rufous, a median and a subapical fascia white; abdomen black, posterior margin of fifth sternite pale flavous; middle of ultimate sternite rufous.

Head longitudinally rugose; front irregularly coarsely punctate; occiput more closely punctate; labrum provided with a tuft of long yellow hairs at each side. Prothorax slightly longer than wide; sides feebly rounded, rugose and rather densely punctate; base much narrower than apex; subapical transverse impressed line sinuous, distinct; disk with a transverse sulcus before the middle and a longitudinal depression extending from subapical line to behind the middle, this depressed area rugulose and rather coarsely, deeply punctate, elsewhere very finely and distantly punctate. Elytra wider at base than prothorax in any part; humeri obtusely rounded; sides parallel; apices conjointly rounded; basal half coarsely deeply seriately punctate, with numerous irregularly distributed smooth elevated small transverse pale yellow spots; apical half to subapical fascia finely, remotely, shallowly but seriately punctate; apex finely, confusedly punctate; postscutellar area depressed; second interspace expanded and bearing a rather elongate but not prominent tubercle at base; sutural margin in apical half broadly sulcate, the sulcus limited externally by a fine carina; median fascia moderately wide, anteriorly convex, narrowest at sides, its margins somewhat irregular; subapical fascia transverse, slightly wider at flanks than at suture; both fasciæ free from lateral and sutural bead. Pro- and mesosternum black, coarsely, closely punctate; metasternum black, rather finely, sparsely, shallowly punctate. Abdomen moderately coarsely, sparsely, feebly punctate. Legs coarsely, closely punctate. Length 13.5 mm.; width (greatest) 3.4 mm.

Type locality—Kigonzera, Lake Nyassa, Tanganyika Territory.

Type, a male, in collection of the author.

Allied to *G. signifer* Boheman, but differing from that, as well as from the other described species, by the presence of the two very distinct white fasciæ, and by the raised yellow maculations of the basal portion of the elytra. The new species is more elongate in form than is Boheman's species, but agrees very well in this respect with *G. angustus* Schenkling, from which, however, it is distinct in sculpture and in coloration.

The impressed lines or sulci of the pronotum serve to throw into more prominent relief a pair of tubercles each side of the middle, there is also a less conspicuous tubercle at middle before the anterior pair and another similar one at middle behind the posterior pair.

Gyponyx hintzi nom. nov.

E. Hintz (Deutsche Ent. Zeitschr., 1897, p. 287) described as new a species of Cleridae from Usambara, to which he gave the name *Aphelochroa rufa;* Sigm. Schenkling in 1910 (Col. Catal., Cleridae, p. 43) placed this species in *Aphelochroa,* but later on (Entom. Mitteil., IV, 1915, p. 248) he referred it to the genus *Gyponyx* Gorham, retaining the specific name *rufus.*

Hintz in 1902 (Deutsche Ent. Zeitschr., p. 178) described another species from Usambara under the name *Stenocylidrus rufus:* The species was recorded under the same name by Schenkling in 1910 (Col. Catal., Cleridae, p. 18); the same author (Trans. Linn. Soc. Lond., 1922, p. 325, note), transferred this species to the genus *Gyponyx.*

As a result of the fact that both of the species described by Hintz are now known to belong to the genus *Gyponyx,* the *G. rufus* (Hintz) of 1902 becomes a homonym of the species described by Hintz in 1897, and a new specific name is rendered necessary for the *G. rufus* of 1902, and for this the name *hintzi* is here proposed.

Stigmatium mucronatum sp. nov.

Black; prothorax and nearly basal fourth of elytra sanguineous, the former having the apical margin broadly black, and the disk with three very obscure vittæ dark; feebly shining; elytra with an antemedian fascia-like maculation composed of shining silvery white pilosity extending from the lateral margin to the third interspace, and a slightly narrower fascia composed of yellowish gray pile at apical fourth.

Head black, finely and sparsely punctate; the epistomal region coarsely and closely punctate; the front, and the anterior and inferior margin of the eyes clothed with long white hairs, which become very short and inconspicuous on the occiput, where there are also a few long erect black hairs. Antennæ black, eleven segmented; first segment stout, curved; second small, subglobular; third elongate, feebly wider toward its apex, nearly equal in length to fourth and fifth together; fourth rather slender, nearly twice as long as wide at its apex; fifth slightly shorter than fourth, subtriangular; sixth much wider than fifth, its width equal to its length; seventh to tenth slightly shorter but equal in width to sixth, each segment wider than long and truncate at apex, the sides rounded to base; eleventh slightly narrower but one-half longer than tenth, scarcely cultriform, segments six to eleven forming a somewhat depressed, rather compact club. Prothorax one-fourth wider than long; surface remotely and finely punctate, the apical portion feebly wrinkled and rather coarsely, closely punctate; anterior transverse impressed line distinct, a small well-impressed fovea each side; sides broadly and rather feebly rounded; basal impressed line distinct; flanks and red discal area densely clothed with very short yellowish pubescence, with a rather sparse admixture of long semi-erect black hairs. Elytra wider at base than the prothorax, basal portion rather depressed, behind the middle of the length convex; sides very feebly sinuate to behind the middle, thence gradually narrowing to the mucronate apices, the suture dehiscent; scutellar region scarcely depressed. Each elytron with ten rows of striate punctures, the punctures in about basal half coarse, deep and rasp-like; the four lateral striæ are deep and distinct to the subapical fascia, below the antemedian maculation being coarsely, but simply punctate; in apical half the discal striæ are very fine, finely closely punctate, and of the same extent as the lateral rows; the apices posterior to the subapical fascia are finely irregularly rugose, closely and densely punctate, the punctures variable from large to small, and feebly impressed; in the basal half the first five interspaces bear setigerous pustules, and the second interval has a large prominent tubercle near base. Underparts and legs black, moderately clothed with long whitish hairs, those of the abdomen much shorter; the metasternum in large part densely clothed with depressed white hairs. Length 11 mm.; width 3.3 mm.

Type locality—Kigonzera, Lake Nyassa, Tanganyika Territory.

Type, a male, in collection of the author.

This species seems best assigned to the subgenus *Oxystigmatium* Kraatz. The structure of the antennæ is, however, so entirely different from that of any species of *Stigmatium* known to the writer that the desirability of creating a new subgenus for the reception of the species may, eventually, be found to be advisable.

The subgenus *Oxystigmatium* contains, at present, two species, *spinipenne* Kraatz and *cornutum* Hintz, both of which were described from the same locality in northern Cameroon. *S. mucronatum* may be distinguished from both the preceding species by the presence of the prominent tubercle near base of each elytron: It may be separated from *S. spinipenne* by the latter having the first fascia median, narrow and strongly oblique, and the antennæ and base of the femora brown. *S. cornutum* is much smaller (7.5 mm.), the fascia distinctly postmedian and flexuous, and the elytral apices are clothed with golden yellow pile.

AMBLYOMMA DISSIMILE KOCH, A TICK INDIGENOUS TO THE UNITED STATES (ACARINA: IXODIDAE)

By J. Bequaert
Department of Tropical Medicine, Harvard Medical School

A few months ago, Mr. H. L. Stecher, of Staten Island, presented me, through Mr. W. T. Davis, with a female tick which he had taken at Boca Ratone, Palm Beach Co., Florida. It was found on a pigmy or ground rattler, *Sistrurus miliaris* (Linné), and was attached to the left side behind the head. It was at once clear that it did not belong to any of the species known thus far from this country. Further study has shown that it is *Amblyomma dissimile* C. L. Koch, a common parasite of many different reptiles and amphibians throughout Central and South America.

As far as I have been able to find, this is the first authentic instance of *A. dissimile* being found indigenous, on a wild host, within the borders of the United States. It is true that W. A. Hooker, F. C. Bishopp and H. P. Wood (1912, U. S. Dept. Agric., Bur. Entom., Bull. 106, p. 131) saw nymphs and adults collected from iguanas at Brownsville, Texas; but they plainly state that these iguanas had been brought from the Isthmus of Tehuantepec, Mexico, so that this occurrence of the tick in Texas was merely accidental. Moreover, there seems to be no reason why *A. dissimile* should not be found in the wild state in southern Texas.

The Florida tick agrees in every respect with the many examples I have studied from Mexico and farther south. I have seen several lots of *A. dissimile* from Mexico, Guatemala, British Honduras, the Republic of Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Trinidad, Grenada, Tobago, British Guiana, Peru, and Brazil. Neumann includes the Philippine Islands in the range, but I have difficulty in believing that this is correct. This tick attacks many different cold-blooded vertebrates, showing no decided host preference, although being found perhaps most commonly on the large toad, *Bufo marinus* Linné (often erroneously referred to in the West Indies as the "bullfrog"). At the snake farm of Lancetilla, near Tela, Rep. of Honduras, I found the snake pen literally infested with *A. dissimile* at all stages of development. I was told that any snake placed in the pen would soon carry a few of the ticks.

The northernmost localities of *A. dissimile* known to me in Mexico are Perez (in the State of Vera Cruz), on the Atlantic side (many males and females off *Bufo marinus,* collected by S. E. Meek.—Field Mus. N. H.); and the Islets of Tres Marias (opposite the State of Tepic), on the Pacific side (several males and one nymph, off *Constrictor constrictor imperator* (Daudin), from Maria Madre Isl.—M. C. Z.). Robinson (1926) records the species from Frontera in Tabasco.

I may use this opportunity to publish an interesting photograph which I owe to the courtesy of Dr. Thomas Barbour. It shows an *Iguana rhinolopha* Wiegmann bearing on the dewlap an engorged female and a male (to the right of the female) of *A. dissimile.* The host was brought alive from Ruatan Island, Rep. Honduras, to the Museum of Comparative Zoölogy, Cambridge, Mass., where it was photographed by Mr. G. Nelson.

POSTSCRIPT

Since my note was sent to the printer, I have found, at the Museum of Comparative Zoölogy, two females and two males of *A. dissimile,* taken by Mr. G. Nelson, in February, 1909, from a gopher snake, *Spilotes corais couperi* (Holbrook), at Sebastian, Indian River Co., Florida. It would seem therefore that this tick is by no means rare in Florida, but has merely been overlooked.

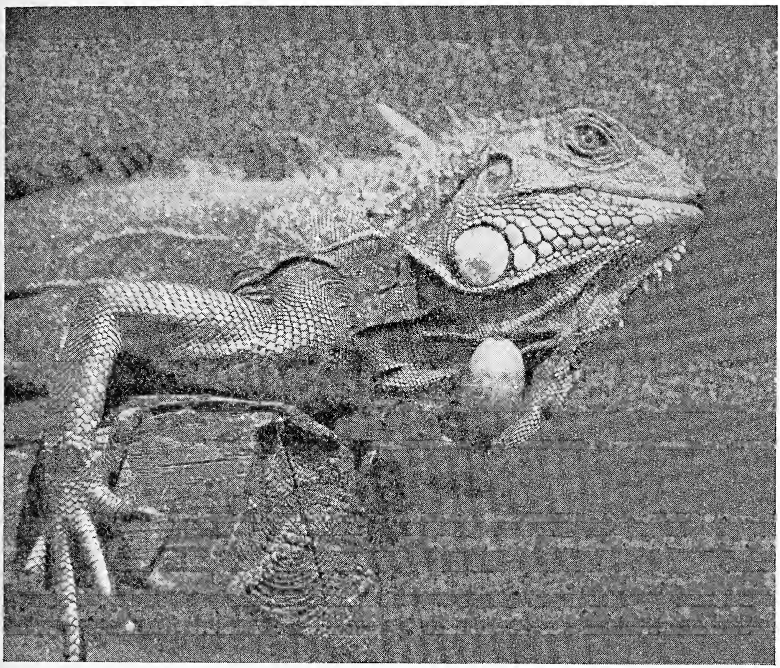

Fig. 1. *Iguana rhinolopha* Wiegmann, of Ruatan Island, parasitized by *Amblyomma dissimile* Koch. Photograph of living animal by Mr. G. Nelson. (Courtesy of Dr. Thomas Barbour).

A GYNERGATE OF MYRMECIA

By George S. Tulloch[1]

Although gynandromorphs of male and female—including winged female, soldier and worker ants—have been noted from time to time, there has been no case recorded of a form exhibiting a gynandromorph-like combination of female and worker characteristics. The absence of such a form has supported the trophic[2] rather than the germinal, or blastogenic hypothesis of caste determination. Such an anomaly, here designated as a *gynergate,* was recently discovered in Dr. W. M. Wheeler's collection and with his kind permission is described below. The specimen is a large Ponerine, *Myrmecia (Promyrmecia) aberrans* Forel, taken in Wagoa, New South Wales by W. W. Froggatt in 1904. The right half of the insect has characteristics of a female[3] while the left half has those of a worker.

In the head (fig. 1) the structure of the opposite sides appears to be quite typical of their respective castes, but the lateral margin of the right (female) side is distinctly concave and the posterior corner angular while the left (worker) side is convex and the posterior corner broadly rounded. The right eye is slightly larger than the left, and the clypeus is prolonged further forward on the right side than on the left.

Structural characteristics peculiar to the component forms are prominent in the thoracic region. The structure of the right (female) side (fig. 2) indicates that this specimen once bore two vestigial wings. The anterior one has been broken off (its position indicated by an insertion, W)

[1] Contribution from the Entomological Laboratory of Harvard University.

[2] Santschi (1920) Bull. Soc. Vaud. Sci. Nat., Vol. 53, p. 177.

[3] The winged forms of the subgenus *Promyrmecia* are unknown; hence, the comparison of the female structures have been made with those of related species of the subgenera *Myrmecia* and *Pristomyrmecia.*

but the hind one (VW) is still retained in the specimen. The structures which accompany wings are present, but reduced. The parascutal ridge (P) and the transcutal suture (T) are present in their usual positions. The plate (S2) covering the metathoracic spiracle may be noted as well as the upper plate (PL) of the metapleuron. The

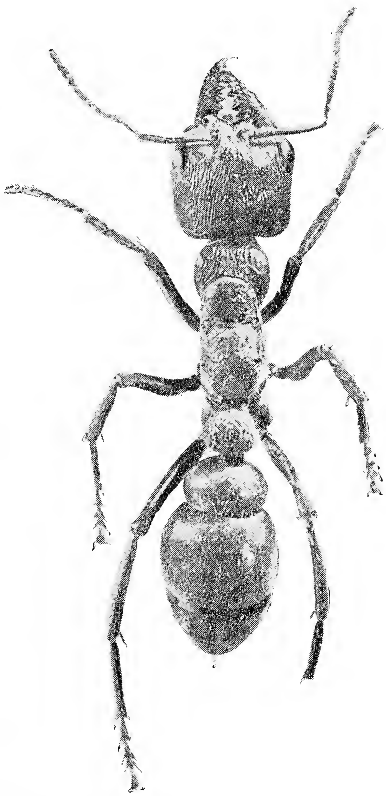

Fig. 1. Dorsal view of gynergate. (Portion of right hind tarsus missing).

left side of the thorax (fig. 3) is distinctly that of a worker. No trace of wings or their accompanying structures can be detected. The large metathoracic spiracular plate (S2), a characteristic of all workers of this genus, is in its usual position. The metapleuron is fused completely with the propodeum. In the dorsal aspect of the thorax (fig. 1), it will be noted that the right side appears to be large and swollen. This is probably due to the presence of wing muscles. A vestige of a scutellum distorted toward the

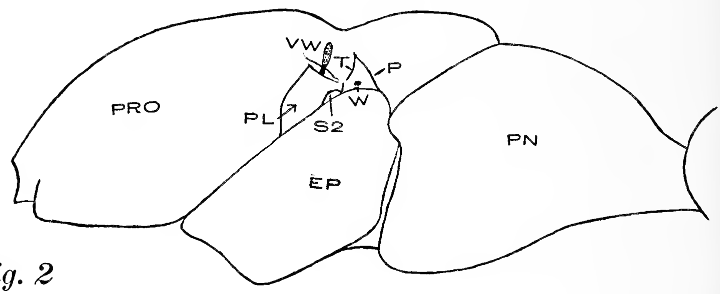

Fig. 2

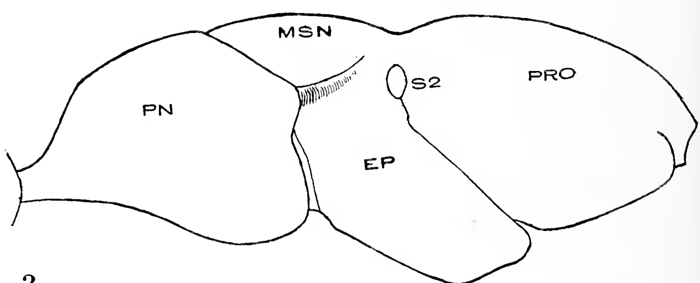

Fig. 3

Fig. 2. Right (female) side of thorax; EP, episternum; P, parascutal ridge; PL, upper plate of metapleuron; PN, pronotum; PRO, propodeum; S2, spiracular plate; T, transcutal suture; VW, vestigial wing; W, wing insertion.

Fig. 3. Left (worker) side of thorax; MSN, mesonotum.

right side may be seen in the specimen as well as a portion of a distinct metanotum.

In the abdominal region the node presents an asymmetrical appearance. The right side is longer and its corners more angular than the left side, so that each side is typical of its respective caste.

The appearance of this gynergate offers some additional evidence in favor of the germinal hypothesis of caste determination. Wheeler[4] in discussing the significance of the dinergatandromorph (soldier-male) and the ergatandromorph (worker-male) stated that although the workers and soldiers are "abortive females they behave in combination with the male like entities quite as distinct and independent as the female. This suggests that the worker and soldier are not products of nutrition but are germinally predetermined." Santschi[5] stated that this hypothesis (germinal) would be definitely determined by the discovery of a form presenting female and worker characteristics. From the finding of this ant, therefore, it would appear that the trophic hypothesis of caste determination may have to be discarded in favor of the blastogenetic hypothesis.

Brathinus varicornis Lec.

An examination of the available lists shows that the above beetle is recorded but once,—in the N. Y. List from Utica, which is apparently the type locality. On May 22, 1930, I literally unearthed a specimen while sifting wet leaves and more or less mud, taken from the edge of a small pool in a small swampy area in park land near the center of the Town of Framingham. By further sifting, and treading about in the mud and water, I secured three more specimens and on May 23 and June 2, I found six more; other visits were not productive. The time was shortly before sunset and when it had become somewhat dark in the shadows of the young trees and alders. Mr. P. J. Darlington gave me a specimen which he had taken at Exeter, N. H., by "swamp treading," June 7, 1925.

Perhaps they are nocturnal prowlers and it pleases my fancy to endow these peculiar ant-like creatures with strange and unusual habits.

C. A. Frost,
Framingham, Mass.

[4] Psyche (1919) vol. 26, pp. 7-8.
[5] *ibid.*

BOOK NOTICE

Classification of Insects. By C. T. Brues and A. L. Melander. 672 pp., 1125 figs. Published by the Museum of Comparative Zoology, Cambridge, Mass. $5.50 (paper), $6.50 (cloth).

This book consists of keys to the known families of insects and other terrestrial Arthropods, as well as some keys to subfamilies and immature forms. The large and representative genera of each family are listed. The text is divided into two parts, the first containing keys to the classes of Arthropods, orders and families of insects; the second including keys to the order and families of other terrestrial Arthropods. Technical terms are reduced to a minimum, but for the convenience of students a glossary of 330 terms and expressions has been added. The usefulness of this work for those who are just entering the field of entomology is increased by the inclusion of all synonyms of names applied to families and higher groups, and of indications of the pronunciation of the names and technical terms. Each key is followed by a bibliography of the important papers covering the subject of the key. In the writer's opinion these bibliographies, which include about 2400 references, will undoubtedly be one of the most useful features of the book. The complete index, containing over 10,000 entries, makes this publication invaluable as a reference work, as well as a laboratory manual. The authors are to be congratulated for the completion of a tedius undertaking resulting in a publication unique in entomological literature.

F. M. C.

PSYCHE

VOL. XXXIX SEPTEMBER, 1932 No. 3

AN AUSTRALIAN LEPTANILLA

By William Morton Wheeler

Harvard University

The very interesting Formicid subfamily Leptanillinæ comprises only two genera of minute, yellow, blind and hypogæic ants, namely, Leptanilla, established by Emery as long ago as 1870 and Phaulomyrma, established by G. C. and E. W. Wheeler in 1930 on a male specimen from Java. This genus probably also includes Santschi's *L. tanit* from Tunis. Of the eleven described species of Leptanilla, four are known only from males; of the remaining seven, five are known only from workers and only two from both workers and females. The geographical distribution of the various species is peculiar. Six of them, namely, *L. theryi* Forel, *vaucheri* Emery, *exigua* Santschi, *minuscula* Santschi, *nana* Santschi and *tenuis* Santschi, were taken in North Africa (Algiers, Tunis, Morocco), two, *doderoi* Emery and *revelierei* Emery, in Corsica and Sardinia (though the subspecies *chobauti* Emery of *revelierei* occurs in Morocco), two, *havilandi* Forel and *butteli* Forel, in the Malay Peninsula and one, *santschii* G. C. and E. W. Wheeler, in Java.

During November, 1931, while I was with the Harvard Zoölogical Expedition in Australia, Mr. D. C. Swan of the Waite Institute at Glen Osmond, S. A., generously gave me some minute ants which he discovered in Western Australia. The collection comprises two dozen workers, a female and a number of full-grown larvæ, which prove to belong to an undescribed species of Leptanilla. They therefore considerably extend the known geographical range of the genus. Owing to the fact that the Leptanillinæ are true members of Silvestri's "microgenton" and that their workers and females are very rarely seen, because they come to the surface of the soil only under unusual conditions, such as excessive rainfall, it is too early to regard the various species at present known as covering the entire range of the genus. We should expect careful collecting with the Berlese funnel to bring additional forms to light in South Africa, Madagascar, Asia Minor and India, or even, perhaps, in the warmer parts of the New World.

Leptanilla swani sp. nov.

Worker. (Fig. 1, a-d.) Length 1.3-1.5 mm. Pale yellow; legs scarcely paler than the body; teeth and borders of the mandibles reddish.

Head flattened above, oblong, fully 1½ times as long as broad, as broad in front as behind, with subparallel sides, rounded posterior corners and feebly concave posterior border. Mandibles narrow, with very oblique 4-toothed apical borders, the terminal tooth curved and acute, the second minute, the two remaining teeth stout and rather blunt, the most basal directed at right angles to the apical border or even slightly backward. Clypeus without distinct posterior suture, its anterior border slightly but distinctly produced in the middle as a broadly rounded lobe, excised at the sides. Antennæ moderately stout; scapes reaching nearly to the middle of the head; basal funicular joint nearly 1½ times as long as broad, ovoidal, with constricted base; joints 2-6 distinctly broader than long; the second basally constricted, the seventh distinctly longer, 8-10 as broad as long, the terminal joint as long as the two preceding joints together. Thorax much narrower than the head including the mandibles, flattened dorsally and not deeply notched in profile at the promesonotal suture; pronotum subovoidal, somewhat broader than the mesepinotum, which is longer than the pronotum, with feebly rounded, subparallel sides. Petiole much narrower than the epinotum, nearly 1½ times as long as broad, gradually narrowed anteriorly, posteriorly with rounded-subparallel sides. Postpetiole rounded-trapezoidal, nearly as long as broad, somewhat broader than the petiole and somewhat wider behind than in front, its ventral surface convex and projecting. Gaster narrow, elongate-elliptical, anterior border of first segment slightly concave. Sting large, retracted. Legs mod-

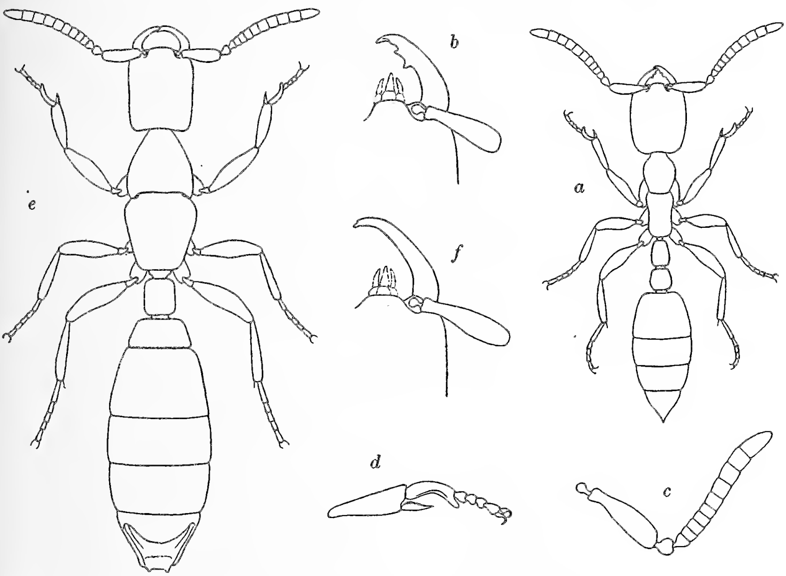

FIG. 1. *Leptanilla swani* sp. nov. *a*, worker; *b*, clypeus and mandible of same; *c*, antenna; *d*, fore tibia and tarsus; *e*, female; *f*, clypeus and mandible of same.

erately stout, tips of fore metatarsi produced and digitiform, but not so narrowly as in *L. nana* Santschi.

Shining, with very fine and indistinct piligerous punctures. Pilosity white, very short, abundant both on the body and antennæ, slightly longer and coarser on the gaster, less conspicuous and more dilute and appressed on the legs.

Female. (Fig. 1, e and f.) Length 2 mm.

Color, sculpture and pilosity as in the worker, but the hairs on the gaster very long, though fine, as in the female of *L. theryi* Forel.

Apterous and resembling the worker in form but differing in the following characters: Head more sharply oblong, with straight and more clearly parallel sides. Mandibles falcate, narrow and tapering at the tips, without distinct basal and apical borders, terminating in two small, indistinct, closely approximated teeth. Clypeus broader and less produced than in the worker. Thorax decidedly longer than the head plus the mandibles, very low and flat above, the pronotum posteriorly nearly as broad as the head, longer than broad, with feebly rounded, anteriorly converging sides, mesepinotum broader than the head, subtrapezoidal, broadest near the anterior end, roundly subtruncate behind. Promesonotal suture pronounced, straight and transverse in the middle. Petiole regularly oblong, about 1¼ longer than broad, as broad in front as behind. Gaster much larger than in the worker, the postpetiole, which forms its first segment, nearly twice as broad as long, subtrapezoidal, with straight anterior border. Genitalia similar to those of *L. revelierei* Emery, but the pygidium with entire, broadly and semicircularly rounded posterior border, not notched in the middle. Hypopygium large, narrowed and bluntly bidentate posteriorly. Legs longer and stouter than in the worker.

Described from 24 workers and a single female taken Oct. 10, 1931 by Mr. D. C. Swan under a large stone at Goyamin Pool, Chittering, Western Australia.

L. swani seems to be most closely related to *L. revelierei,* but the female of the latter has a much shorter petiole. In the long pilosity of the gaster the female of the new form resembles *theryi,* but in this species the petiole is very different, being distinctly cordate anteriorly instead of oblong.

Dr. G. C. Wheeler, to whom I sent the larvæ of *L. swani* for study, writes me that he found them "extremely interesting because of their close resemblance to the larvæ of *revelieri* subsp. *sardoa.* They even have the 'tympanum' which is difficult to detect unless the specimens are stained. This species differs from *sardoa* in the following characteristics: (1) The head is sharply constricted just in front of the middle so that in dorsal view it is flask-shaped or keyhole shaped; the posterior half is circular, the middle half is about half as wide and has subparallel sides. (2) The prothorax is sparsely spinulose while the curious structure on its ventral surface has its base densely and coarsely spinulose. (3) The two extremely long hairs at the posterior end are lacking in all specimens."

Emery, as is well known, regarded the Leptanillinæ as constituting a special tribe of the Dorylinæ, but Dr. G. C. Wheeler and I have raised the group to subfamily rank. Unquestionably, Emery, in his paper of 1904, based his opinion very largely on the singular characters of the female, which he regarded as a true dichthadiigyne and compared with the female of Aenictus. Strangely enough, Emery seems not to have noticed the peculiar falcate shape of the female mandibles, so unlike those of the worker, a character which, taken together with the absence of wings and the single segment of the pedicel, makes the resemblance to the females of the Dorylinæ even greater than he supposed. But the males of the Leptanillinæ and the larvæ, as described and figured by G. C. Wheeler, are so very unlike those of the Dorylinæ that we are bound to regard the striking similarities of the females as due to convergence. Emery's original interpretation of the thoracic segmentation of the female Leptanilla was incorrect, because he regarded the portion of the thorax anterior to the pronounced transverse dorsal suture as the mesonotum, the portion posterior to the suture as the combined metanotum and epinotum. In a foot-note to his section on the Leptanillinæ in the "Genera Insectorum" (1910), he recognized his error and adopted the interpretation which I have also reached, namely, that the presutural portion is the pronotum, the postsutural the combined meso- and epinotum.

The occurrence of indigenous species of Leptanilla on islands like Corsica, Sardinia, Java and Australia is significant. Since the females are apterous and obviously too small and delicate to endure distant transportation in flotsam and jetsom, we must suppose that they have occupied their present habitats since the islands mentioned were connected with the mainland. The Leptanillinæ, therefore, must be very ancient, like many other components of the microgenton (Kœnenia, Pauropus, Scolopendrella, Campodea, Iapyx, etc.) *L. swani* is particularly interesting in this connection, because the extreme southwestern corner of Australia, in which it was taken, is known to possess the oldest and least disturbed fauna of any portion of the continent.

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ON THE SO-CALLED INTRODUCTION OF HELIOTHIS DIPSACEA L. INTO THE UNITED STATES

By Foster H. Benjamin

Bureau of Entomology, United States Department of Agriculture

Throughout the earlier literature there are scattered references of the occurrence within North America of this Palearctic Heliothid. All of these seem to apply to the indigenous *Heliothis phloxiphagus* Grote and the name was dropped from the more recent lists.

A paper by Mr. Fred H. Walker was published in 1928 (Psyche, XXXV, 29-30), definitely stating that the European species actually did occur in Massachusetts.

Through the kindness of Mr. C. W. Johnson one of the Walker specimens was submitted for examination. Both upon superficial characters and upon male genitalia it is the ordinary American *phloxiphagus*.

CONCERNING OUDEMANS' "KRITISCH HISTORISCH OVERZICHT DER ACAROLOGIE" IN ITS BEARING ON NOMENCLATURE OF THE MOSS-MITES

By Arthur Paul Jacot

Monroe, Conn.

As supplements to the Tijdschrift voor Entomologie, vols. 69 and 72 (1926 and 1929), and comprising 500 and 1097 pages of text, Dr. A. C. Oudemans reprints most of the text and figures of *all* literature on the Acarina previous to 1805, adding his comments and interpretations of identities. Since pre-Linnean references are of no systematic or nomenclatorial interest, they are not considered in the present review unless an earlier edition or description throws more light on a post-Linnean species of the *same* author. I have no faith in the descriptions or redescriptions or identifications or reidentifications of any one species by *different* authors in those early days, even though bearing the same specific name. This is an important principle which will be dwelt on more fully where it is a case in point. The following appear first:

Acarus scaber Linné 1758

(Oudemans, part I, pp. 347-348; part II, pp. 771-773)

In this case it is legitimate to go back to the Fauna Suecica, Ed. I (by the same author), although pre-Linnean and nonbinomial, to get the fuller description. This Linné intended us to do. It saved reprinting much material.

The words in this description "podex depressus, bidentatus" fits only some species of Michael's Nothrus, namely: *N. bicarinatus* Mich., *N. biverrucatus* Mich., *N. targionii* Mich. and *N. segnis* Mich. (without the nymphal skin). *N. horridus* is quadridentate. All these are yellow to dull brown (not dark grey), but "rough and . . . thickly strewn with irregular, short, villous processes" and carry much dirt so that "neither colour, texture, nor markings can be seen" (except *N. targionii* Mich.). Thus Linné's color and texture characters are not specific (except that they throw out *N. targionii*), the color *possibly* being that of the extraneous matter coating the back and the scabrousness may also be due to this "stucco."

The only species of this restricted group recorded as found in Sweden by Tragardh is *N. segnis*. Michael (1888, p. 514) says that *N. biverrucatus* is not common, that *N. bicarinatus* (p. 517) is common but arboreal, and that *N. segnis* (p. 521) is "chiefly found at the roots of mosses (on the ground) . . . not very common . . . I have found it in Norway." In connection with Michael's figures it must be remembered that figure 1 (of *N. segnis*) is with nymph skin but that figure 6 (shaded portion) is what the *podex* looks like without the skin, thus being even more conspicuously bidentate than *N. biverrucatus!* Thus, until there is further evidence to the contrary I must regard *N. segnis* Michael a synonym of *A. scaber* L.

Turning to Hermann's *N. segnis* one is struck by the strongly bidentate podex, and the words "d'un cendré noirâtre" which immediately recalls Linné's "obscure cinereum." Finally as Hermann's figure shows the pseudostigmatic organ standing out beyond the body while in the adult they are much shorter, one must conclude that either he had before him some *N. horridus* as well as true *N. segnis* or that he figured a *nymph* of *N. segnis*. This latter seems still more certain from the fact that he omits the prominent rostral bristles. On the other hand, three claws are figured. As the figure is thus very evidently based on more than one individual and even more than one species, I would restrict only that part of the description and figure which refers to color (and pattern), bidentate podex and pseudostigmatic organs as type of Camisia Heyden. *Acarus scaber* Linné 1758 thus becomes *Camisia scaber* (Linné).

Oudemans's only comment is, "This description betrays at once *Camisia biverrucatus* C. L. Koch." This is an opinion, not evidence.

Of the 18 other references given by Oudemans, 17 of them are of relists in compilations and translations, or later editions or reprints and therefore of no systematic or biological interest, and one is *Acarus plantarum* Mayer 1781 which Oudemans considers a synonym.

Acarus plantarum Mayer is not a typical Nothrus because the abdomen is described as "at the breast somewhat compressed, broader and round towards the hind region." If it were *N. biverrucatus* or a related form, the subparallel sides and especially the two horned posterior end would have been mentioned. The color characters recall a *nymph* somewhat like that of *H. bistriata* Michael (1888, pl. 42, fig. 9—but this is "eyeless"!). Certainly it is not an adult, for even the legs are alternately grey and black!

Acarus geniculatus Linné 1758

(Oudemans, part I, pp. 348-353; part II, pp. 775-782.)

Under this head Oudemans marshals about 55 references (to 1805) many of which being non-binomial, later editions, translations and compendiums do not concern the systematist. Nine, however, were distinctly published as original descriptions of formerly unrecognized species, namely, those of 1665, 1668 (see pt. 2, p. 775), 1764 Linné (=1758), 1752, 1763 Scopoli, 1776 Schrank (=1781), 1778 DeGeer, 1799 Rathke, 1800 Shaw. Of these, those of 1665, 1668 and 1752 are not binomial scientific names, and only Linné's is a genotype! Are these really all synonymous?

I cannot determine from these descriptions what resemblance *A. lichenum* Scopoli has to *A. geniculatus*. It is from Carniola (Krain, Austria), not Utrech, Holland.

A. musci Schrank 1781 (described in greater detail in 1776) from the figure looks like still another species and also comes from Austria. It will probably be many years before this species can be properly reidentified.

A. corticalis DeGeer 1778. Presumably Oudemans expects us to identify this species with the species figured by him in part I, p. 351. This can hardly be done because (1) DeGeer's species is shining (not punctured), (2) there is a distinct depression across cephaloprothorax between insertions of legs I, (3) the long bristles on legs are not on apex of tibia, (4) there are more abdominal hairs than in Oudemans's figure. As stated before (Jacot 1929g, p. 417, last paragraph), I consider DeGeer's *Acarus corticalis* as entirely distinct from *A. geniculatus* as the color and shape of femora are different and because *A. corticalis* was described in 1778 when DeGeer was well aware of *A. geniculatus.* Oudemans, on the other hand (part II, p. 779) claims the two to be identical and thinks it "strange" that DeGeer should have used a new name and made no mention of *A. geniculatus.* Since the two are described as different, DeGeer was right in giving his *later* find a new name. Thus we are limited to Linné *only* for the description of *A. geniculatus.*

Trombidium corticale Rathke 1799 is a Norwegian species which will also have to await reidentification. This should be possible by a thorough study of all Oribatids which may be found in the same type of environment in that part of Norway.

Acarus coleoptratus Shaw 1800. A comparison of his figure with that of Hooke 1665, will show considerable difference. Further, Shaw says his species is "somewhat glossy," while Hooke says "indented or pitted with an abundance of small pits, all covered over with little white bristles." Shaw distinctly shows two nails per foot, Hooke but one (yet Hooke saw punctures). The reidentification of Shaw's species will not affect nomenclature.

Thus of the six species placed by Oudemans under one term, we find that on careful examination none are synonymous.

In a similar way one may go through the remainder of his compendium. His task was stupendous and would need years of detailed work in various countries before it could be presented as a final piece of work.

One thing Oudemans has done for which Acarologists should be grateful and that is he has brought together all early references on the group and with this as a broad working basis we can each contribute our share towards clearing up certain species.

A careful perusal of Oudemans's comments on the various species reveals a well marked tendency on his part to state that the description or figures are incorrect if they do not fit the species which Oudemans has decided they should represent. This type of historical criticism carried on without a first hand knowledge of the local fauna concerned is thin ice. Each of these attempts at reidentification will have to be reconsidered without prejudice.

Oudemans has thus brought together for future study 29 pre-Hermannian species, each so poorly described as to require expert knowledge of most species at the locality from which they came or as to require their being considered *nomina nuda.* The list, chronologically arranged, follows.

Acarus coleoptratus Linné 1758; Sweden.
" *geniculatus* same; Utrech, Holland.
" *fungorum* same; Sweden.
" *scaber* same; Sweden.
" *tremellæ* Linné 1761; Sweden.
" *muscorum* Scopoli 1763; Carniola (Krain, Austria).
" *lichenum* same; same.
" *piger* same; same.
" *spinipes* O. F. Muller 1776; Denmark.
" *lichenum* same; possibly an Oribatid; *not* Scopoli.
" *seminulum* same; Denmark.
" *corticalis* DeGeer 1778; Utrech, Holland.
" *marginatus* same; same; *not* Sulzer 1776, a tick.
" *plantarum* Mayer 1781; Germany.
" *confervæ* Schrank 1781; Austria.
" *coleoptratus* Schrank 1781; same; *not* Linné.
" *geniculatus* same; same; *not* Linné.
" *musci* same; Austria.
" *lucidus* Fourcroy 1785; France.
" *scaber* Rathke 1799; Bergen, Norway; *not* Linné.
Trombidium corticale Rathke 1799; Bergen, Norway.
" *coleoptratum* same; same.
" *loricatum* same; same.
Acarus coleoptratus Shaw 1800; England; *not* Linné.
" *infusionum* Schrank 1803; Bayern.
" *planicornis, xylariæ ciliatus, alatus* all same.

The six synonyms might be allowed to die of neglect; their reidentification would not affect subsequent nomenclature. Should a 90 per cent vote to disregard the remaining twenty-three species, cast by present day Acarologists who have studied the Oribatoidea, be considered sufficient opinion to rule these authors out of systematic literature? Or should they be retained as about 23 unavoidable nomenclatural changes for the future?

References not in Oudemans.

Michael, A. D. 1888, British Oribatidæ, vol. 2, pp. xi and 337-657. pls. 25-54.

Jacot, A. P. 1929 (Oct.-Nov.) Genera of Pterogasterine Oribatidæ (Acarina), Trans. Amer. Micro. Soc., vol. 48, pp. 416-430.

MUSCLE VARIATIONS IN THE TIBIA OF SEVERAL SPECIES OF APHIDS

By Forrest W. Miller

Department of Zoölogy, University of Pittsburgh

Uichanco[1], who has studied the muscles and movement of the tarsus of *Myzus persicæ,* states that there is a single extensor muscle which moves the tarsus. He concludes that this condition holds for all species of aphids. Weber[2] reviews the same idea set forth by Uichanco and also gives this condition as generally occurring among the aphids.

A study of several species of aphids shows that there are some variations from the above stated generality. This variation occurs in the number of extensor muscles and, where there is a single muscle, within the muscle itself.

In all the species used for study, several specimens were stained with eosin and mounted in balsam, others were unstained and mounted in euparol. With both of these methods the muscles show up very well after the specimen has cleared. Both alate and apterous forms were included in the study. Examination of mounted material was made under the high power of the microscope (440x), and of live material under the binocular microscope (50x).

The following species were examined: *Aphis sambucifolii, Aphis rumicis, Aphis feminea, Amphorophora cosmopolitania, Eriosoma lanigerum, Drepanaphis acerifolii, Colopha ulmicola, Macrosiphum granarium* and *Schizoneura americana.*

All of these species are characterized by the absence of the flexor muscle[3]. In none of them was the writer able to

[1]Uichanco, L. Muscles and Movement of Tarsus of Aphids. Psyche, Vol. 28, 1921.

[2]Weber, H. Biologie der Hemipteren. Springer, Berlin, 1930.

[3]The muscles and the parts of the legs are named with respect to the appendage when in its natural position.

determine the presence of a proximal elongation of the first tarsal segment, for the insertion of the extensor muscle, as described by Uichanco. The extensor muscle is inserted directly on the endo-proximal edge of the first tarsal segment as may be seen in the drawings. In some cases (Fig. F) this muscle arises on the proximal end of the tibia, where there are two points of origin, one on the endo-proximal, and the other on the ecto-proximal wall of the segment. From this origin the muscle passes outward through the segment as a very thin tendon-like muscle. Just before the insertion on the tarsus, however, this muscle becomes very wide and again abruptly narrows down into a tendonous insertion on the first tarsal segment. (Figs. A, G.) This muscle is called the extensor by Uichanco.

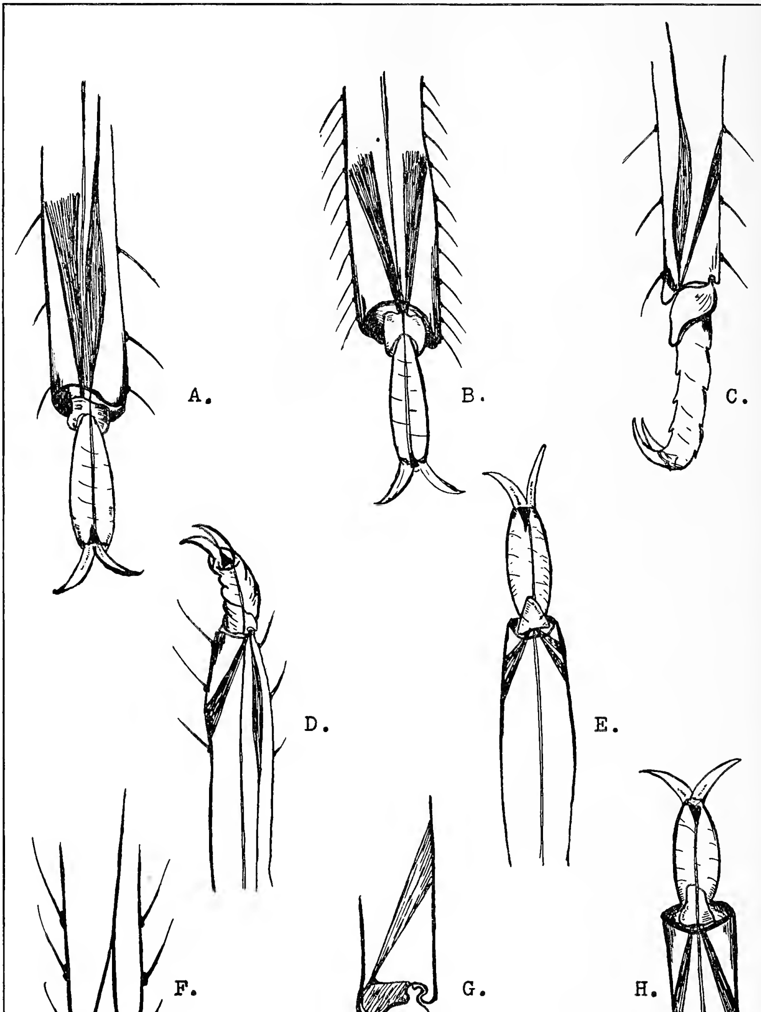
A second muscle (extensor) appearing in the species studied, is very short and much wider than the first muscle mentioned. This one arises on the lateral wall of the tibia, slightly distad from a point midway between the proximal and distal ends of the segment. From this origin, which is rather wide, the muscle passes out to the tendon-like insertion on the endo-proximal edge of the first tarsal segment.

The combination of the above mentioned muscles has been observed in *Colopha ulmicola, Aphis rumicis* and *Amphorophora cosmopolitania.* (Figs. A. D.) In some cases the extensor muscle which arises in the proximal end of the tibia is absent. In this case a short muscle, similar to the second extensor muscle mentioned, replaces it. This is found in *Aphis sambucifolii, Drepanaphis acerifolii* and *Aphis feminea.* (Figs. B, H.) A further variation is found in the muscles of *Eriosoma lanigerum.* Here there are four small extensor muscles. (Fig. E.)

The function of the missing flexor muscle is taken over by "the tension of the wall of the tibia." [1] The fulcrum upon which the tarsus moves is located at the ecto-distal end of the tibia. (Fig. G.) The first tarsal segment increases slightly in width from the proximal to the distal end. When the extensor muscle contracts, it draws the first segment of the tarsus into the cavity of the tibia, and thus, since the tarsus is of slightly increasing greater width, a tension is

[1]All quotations are from Uichanco.

Psyche, 1932 Vol. 39, Plate 2



Miller—Tibial Muscles of Aphids.

placed on the wall of the tibia. "It appears that the wall of the tibia performs the function of the lost antagonistic muscle of the tarsus of aphids." No articular membrane could be seen.

Species represented on Plate II.

A. *Aphis rumicis*
B. *Aphis feminea*
C. *Drepanaphis acerifolii*
D. *Colopha ulmicola*
E. *Eriosoma lanigerum*
F. *Schizoneura americana*
G. Articulation of tarsus and tibia (diagrammatic)
H. *Aphis sambucifolii*

SWARMING CHIRONOMIDÆ

By J. P. Bill

One evening during the spring grass fire season, the writer happened to notice some suspicious streamers of what appeared to be smoke. They proved to be above a large elm tree several hundred feet away, where they caught the quartering light of the setting sun. The children soon found others. In fact, all around us, against the sky, could be seen these columns, slightly swaying in the breeze, and all apparently tenuously anchored to tree tops. The nearest one, over a young elm sapling in our own yard, was close enough to determine the smoke to be columns of myriads of insects.

An aërial net lashed to an apple picker was barely long enough to sweep through this column, which proved to consist of Chironomids. These were identified later by Mr. C. W. Johnson of the Boston Society of Natural History (with whom specimens were left, and to whom my thanks are due) as being *Chironomus modestus* Say, *Cricotopus trifasciatus* Panzer, and *Chironomus nigricans* Johannsen, the latter predominating in the collections, of which three were made on different days.

For the next few days, in travelling about the region of Wayland, these columns were seen at sunset, and were observed by others. One sunset was accompanied by a fitful westerly wind. While the columns were temporarily dispersed, the insects quickly flew back to their position, which they maintained even in the height of the gusts.

Toward the end of approximately a week, during which these columns were seen in the evening, large numbers of them started to appear in the writer's study, where a valved screen frame, backed by a light, is in nightly use to attract insects. Their disappearance at light was coincident with that of the columns.

Whether this phenomenon is one of a modified swarming instinct or nuptial flight is not known to the writer, but its persistence and peculiarity is thought worthy of note. These observations were made during the first week in May, 1931.

A NEW SPECIES OF CHIRONOMUS FROM JAMAICA (CHIRONOMIDÆ)

By Bertram I. Gerry

Department of Agriculture, Boston, Mass.

While examining some chironomid material, collected in Jamaica by W. S. Brooks and donated to the Museum of Comparative Zoology at Harvard University, my attention was drawn to several specimens which appeared to be representatives of *Chironomus varipennis* Coquillett, with a somewhat modified wing spotting.

Since the original description of *C. varipennis* is rather meager, and neither the male genitalia figured nor the ratio between fore tibia and fore metatarsus mentioned; one must rely, almost entirely, upon the wing characters in identifying this species.

Malloch (1915) attempted to add to the original description but since the specimens in his possession, apparently, were badly mutilated, he succeeded in contributing but a single salient fact, namely, that the fore tarsi were much elongated—the basal segment being twice as long as the fore tibia.

Fortunately, I succeeded in finding in the Harvard collection additional material (collected by Professor Nathan Banks at Falls Church, Virginia), which coincided with the original description of *C. varipennis* from the standpoint of wing venation, and with Malloch's statement that, in this species, the fore metatarsus is twice as long as the fore tibia.

This, I believe, definitely establishes *C. varipennis* which I have redescribed in this paper. The material from Jamaica, which differs from *C. varipennis* in respect to body and leg markings; wing spotting, ratio between fore tibia and fore metatarsus, and structural characters of the male genitalia, I hereby submit as a new species.

Chironomus varipennis Coquillett

Male.—Dark brown. Head brown; antennæ yellow, plumes concolorous, scape dark brown; palpi yellowish. Thorax brown, mesonotum and pleuræ with uneven silvery pruinescence; scutellum brown; postnotum brown with two lateral pruinescent spots; halters yellowish white. Abdomen fuscous, the posterior margin of segments narrowly pruinescent; sixth, seventh and eighth blackened dorsally. Legs brown with whitish tarsi; fore femora brown with wide central yellow bands; fore tibiæ brown with distinct pre-apical yellow rings; fore metatarsi whitish, apices narrowly brown, more than twice as long as fore tibiæ (34-15). Mid and hind legs clothed with long yellow hairs; femora yellow, bases brown; tibiæ yellow with narrowly brown apices; tarsi yellowish white, all segments narrowly brown at apices. Wings whitish, with eleven pale blackish spots, iridescent in reflected light and located as follows: three in a row behind the cubitus, one before middle and another in middle of apical margin of (Cu_1), one in base of cell (R_{4+5}), another in cell below it, a third midway between the latter and base of this cell, one in middle and another at apex of cell (R_{4+5}), and a small spot at apex of cell (M_1). Hypopygium with side piece terminating in large blunt cylindrical appendage, not densely clothed with long hairs, the dorsal spine short and inconspicuous.

Female.—Similar to the male in coloration, but in some specimens the thorax may be almost black and the abdominal segments more extensively pruinescent.

Length.—3 mm., coll. by Nathan Banks, Falls Church, Va. June.

Chironomus pseudofasciata sp. nov.

Male.—Blackish brown, shining. Antennæ dark brown; plumes fuscous, scape blackish. Thorax dark brown, shoulders with silvery pruinescence; a median silvery stripe extending half way from prescutum to scutellum; on either side of mesonotum, a narrow silvery stripe extending from silvered shoulder to base of scutellum. The thoracic markings obscure in some specimens. Halters yellowish white. Abdomen blackish; segments with narrow silvery apical bands, widened medially to form V-shaped spots. Legs brown, banded with yellow; coxæ blackish; femora brown with subapical yellow ring; tibiæ predominately yellow, a narrow brown subbasal ring and a second narrow brown ring half way between mid-point and apex; tarsi brown with yellow bands, basal segment brown with wide central yellow band, remaining segments brown with yellow apical ring, these rings often extending beyond joint and involving base of following segment. Fore metatarsi, less than one and one-half times length of fore tibiæ (18-14). Wings with nine black spots; the five large spots at middle forming two false fasciæ, two of the remaining spots at apex (one on either side of media), the other two at base. Distal fascia, located half way between cross-vein and apex; consisting of large squarish spot below apical portion of vein (Cu_1), the second spot directly above in cell (R_{4+5}), the fascia completed centrally by distal portion of large rectangular spot in cell (M_1). Proximal fascia, immediately beyond cross-vein, consisting of squarish spot involving junction of veins (Cu_1) and (Cu_2) and extending to posterior margin of wing, the second spot directly above in basal portion of cell (R_{4+5}), completed centrally by proximal portion of large rectangular spot in cell (M_1). The basal spot in anal area usually circular, the other triangular in outline. Hypopygium with side piece terminating in sickle-shaped appendage, densely clothed with numerous long hairs. A long dorsal spine, ventrally curved.

Female.—Similar to the male in coloration.

Length.—2.50 mm. to 4.00 mm.

Coll. by W. S. Brooks, Moneague, Jamaica. February.

Faded specimens may sometimes resemble *C. varipennis* but the two species are easily separated on the basis of structural characters found in the male gentalia.

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Malloch, J. R. (1915) Bull. Ill. Sta. Lab. of Nat. Hist., vol. X, art. VI, p. 427.

A NEW SPECIES OF THE GENUS MYDAS

By Charles W. Johnson
Boston Society of Natural History

The following species of Mydas from Yucatan and Guatemala were received from Dr. Jos. Bequaert for determination.

Mydas perpolitus sp. nov.

Head black, somewhat shining, pile on the front and vertex black, on the face and sides near the base of the antennæ white, pollen and pile on the occiput white. Antenna black, the enlarged apical portion dark brown. Thorax dull black, in certain light there are indications of three obscure stripes, scutellum black. First abdominal segment dark bluish black, shining, and with fine short black hairs, the other segments are dark blue, highly polished, and with very minute black hairs, the venter has the same color and polish, hypopygium dark brown, with quite long black hairs. Legs black with black hairs, ungulæ brown with black tips, pulvilli yellow, posterior femora thickened, this portion bearing two rows of thickened spines below. Wings brownish black, with lighter streaks in the middle portion of many of the cells, halteres black. Length 22 mm. The paratype measures 19 mm.

Two males from Chichen Itza, Yucatan, Mexico, June 29, 1929. Collected by Dr. Jos. Bequaert. Holotype and paratype in the Museum of Comparative Zoölogy, Cambridge, Mass. In my key[1] it would run to section 4 and follow *M. carbonifer* O. S. from which it is readily separated by its dark blue and highly polished abdomen.

Mydas bitæniatus Bellardi

One male of this species was collected by Dr. Jos. Bequaert at Zacapa, Guatemala, May 9, 1931. It is in the Museum of Comparative Zoölogy.

[1]Proc. Boston Soc. Nat. Hist., vol. 28, p. 133, 1926.

A NEW FEMALE OF ACAMATUS FROM TEXAS

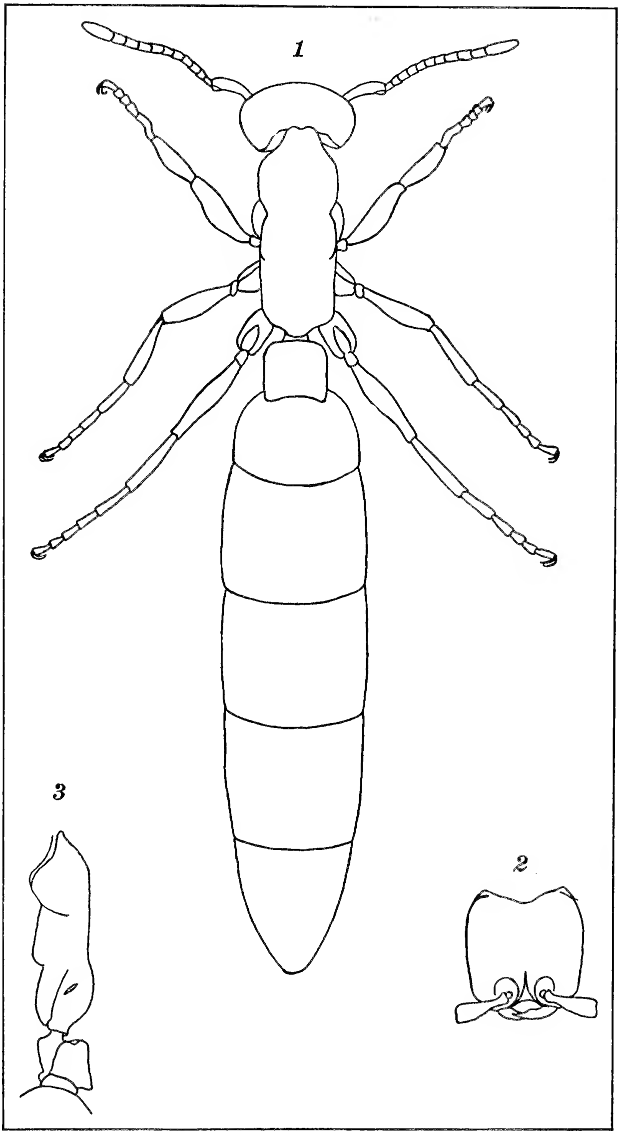
By William S. Creighton
Department of Biology, College of the City of New York

It has now been almost half a century since Ernest André gave us the first description of one of the peculiar apterous females of the New World legionary ants. Contrary to custom the recognition of this caste added further complexity to an already difficult problem since it showed that the female Eciton as well as the male cannot be correlated with the worker caste by the usual structural criteria. Fortunately the female is not likely to be taken alone but the extreme rarity of this caste and the difficulties attendant upon the capture of some of these insects have greatly impeded our knowledge of the sexual forms of Eciton. The activities of a number of investigators, not infrequently undertaken at considerable personal risk, have resulted in the discovery of females belonging to about a dozen species. There remain, however, almost three times this number of species known only from the worker caste and a large number of described but uncorrelated males. Under such circumstances it is very gratifying to have the privilege of describing another female of these curious insects.

Through the courtesy of Dr. Herbert Ruckes of the Department of Biology of the College of the City of New York, the author was given a colony of Acamatus taken by Dr. Ruckes near Ft. Worth, Texas. This colony contained numerous workers and a single female. I wish to thank Dr. Ruckes for his generosity and to congratulate him upon his good fortune in finding one of these rare insects.

A comparison of the workers from the above colony with material in my collection indicated that they belonged to Emery's species *wheeleri.* In order to make certain of this determination specimens were sent to Dr. W. M. Wheeler for comparison with type material. Dr. Wheeler, who very

Psyche, 1932 Vol. 39, Plate 3



Creighton—Female of Acamatus.

kindly made the necessary examination, writes me as follows:

"I have compared your specimens of *Acamatus* with the types of *wheeleri* Emery in my collection. They differ from these types in having a somewhat shorter head with less produced posterior angles and both the head and promesonotum are distinctly smoother and more shining. In the typical *wheeleri* the whole thorax is sculptured and subopaque. I believe, therefore, that your form may be regarded as a new subspecies or the hereto unknown worker of one of the Texan species known only from males."

It is much to be regretted that no males were present in the colony since their absence reduces any attempt to correlate this form with a previously described male to pure speculation. It had best, therefore, be regarded as a subspecies of *wheeleri* until the time when the discovery of a nest containing all the castes will definitely settle the question. In any case the female warrants description since it is markedly different from those of the three North American species of *Acamatus* in which this caste is known.

Eciton (Acamatus) wheeleri subsp. **dubia** subsp. nov.

Worker: Head shorter than that of the typical *wheeleri*, the posterior angles less produced; head and promesonotum smoother and more shining. Otherwise as in the type.

Female: (Plate III, figs. 1, 2 and 3.) Length 13.5 mm. Head, thorax and petiole 4 mm. Gaster 9.5 mm.

Head subquadrate, the sides straight and very slightly convergent in the anterior half, feebly convex in the posterior half. Occiput produced behind into two well-marked lobes each of which passes ventrally to a blunt but distinct angle at the inferior border of the occiput. The middle of the occiput with a prominent, rounded, median groove. Ocelli absent. Eyes consisting of two or three indistinct, unpigmented and depressed facets which lie a little behind the middle of the side of the head. Anterior border of the clypeus evenly concave. Antennal carinæ rather short, the anterior portion partially encircling the antennal fossa, the posterior part fusing with the front a short distance behind the insertion of the antenna. A long, depressed triangular area between the carinæ extends well back behind the posterior borders of the antennal fossæ (about one-third the length of the head). Mandibles linear with a single acute terminal tooth, the outer border feebly convex, the inner border feebly sinuate. Antennal scapes short, strongly curved and very much enlarged toward the tips. The scape, which is approximately one-half the length of the head, is slightly more than one-third as long as the funiculus. First funicular joint notably smaller than the rest, slightly longer than broad; second joint trapezoidal about as long as broad; the remaining joints all longer than broad, gradually increasing in length apically, the terminal joint bluntly pointed and slightly longer than the two preceding joints taken together.

Thorax two and two-thirds times as long as broad, the dorsum entirely without sutures; pronotum from above subpentagonal, its posterior border marked by a prominent impression in the side of the thorax; mesonotum and epinotum from above forming a single rectangular area having slightly rounded posterior angles and a small, rounded, median projection on the posterior face of the epinotum. Seen from the side the thorax is approximately four times as long as high, the pronotum evenly rounded in front and passing without transition to the flat mesonotum. Epinotum slightly higher than the mesonotum, the basal face moderately convex and passing to the short, abrupt declivious face through a broadly rounded angle. Petiole from above quadrate with the anterior edge perfectly straight, the anterior angles broadly rounded. The anterior portion of the node has a virtually flat upper face but in the posterior half it is broadly and feebly concave. Seen from the side the node of the petiole has a straight upper border which passes to the vertical anterior face through a rounded angle and to the very short posterior face through a much sharper angle. Ventrally the petiole is constricted to form a very thick, short posterior peduncle and a much longer subtriangular portion which extends forward under the node and is narrowed in front to form the anterior peduncle.

Gaster slender, the first segment notably broader than long, segments two, three and four only slightly broader than long, the terminal segment somewhat longer than broad. Hypopygium deeply cleft in the middle, the lobes rounded and fringed with abundant hairs; the pygidium bearing two small slender spine-like processes; sting prominent.

Legs rather short, the femora and tibiæ strongly compressed, the tarsal joints of the middle and hind legs all longer than broad. Fore tarsi shorter than the others, the first joint strongly bent, the third and fourth joints as broad as long. Claws well developed.

Smooth and shining throughout. The head with numerous rather coarse, piligerous punctures, those on the thorax somewhat smaller and sparser, abdominal punctures very much smaller and notably sparser. Head covered with short, erect hairs of approximately uniform length. Thoracic hairs sparser and of variable length. Edges of the node of the petiole covered with abundant, long, erect hairs. Hairs on the abdomen long, very slender and appressed, those bordering the edges of the segments somewhat stouter but borne parallel to the surface of the gaster. Apical portion of the middle and hind femora with numerous rather long erect hairs, the remainder of the appendages covered with shorter hairs, these being most abundant on the tarsi and funiculi.

Color, rich reddish brown throughout, the tarsi slightly lighter.

Taken by Dr. Herbert Ruckes about five miles west of Ft. Worth, Texas. Dr. Ruckes notes that the colony, which was a small one, was nesting beneath a large, flat boulder.

The female of *wheeleri* subsp. *dubia* can readily be distinguished from those of *opacithorax* and *schmitti* in the very different structure of the thorax. The prominent, median epinotal groove which is present in both the latter forms is completely absent in the new subspecies. Moreover in both *opacithorax* and *schmitti* the mesoepinotum of the female gradually increases in width from the promesonotal suture rearward. In the female of *dubia* the sides of the mesoepinotum are parallel except near the anterior end where a slight constriction occurs. In addition the head of the female in *opacithorax* and *schmitti* is more narrowed behind and the concavity in the upper face of the node of the petiole is very much deeper and extends entirely across the node to its anterior edge. I have not been able to compare the female of the new subspecies directly with that of *carolinense,* but the excellent figure of the female of that species presented in Dr. Wheeler's publication of 1921 permits me to note the following differences: the sides of the head of *carolinense* are more convex, the occiput only feebly impressed, the epinotum in profile much more angular and no higher than the adjacent portion of the mesonotum.

It seems worth while to note in passing that the figure of the female of *Acamatus schmitti* given by Emery in the Genera Insectorum is incorrect in regard to the length of the legs. In Emery's figure the hind femora are as long as the greatest width of the thorax with the rest of the appendage proportionally shortened. The impression produced is one of a relatively short-legged insect, whereas, actually the legs of the females of *Acamatus* bear about the same proportion to the head and thorax as do those of the worker. Measurements of a female of *schmitti* in my collection show that the hind femora are one and one-quarter times longer than the greatest width of the thorax with the rest of the appendage uniformly longer, especially the tarsal joints which are almost twice as long as those in Emery's figure.

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A NEW CULEX, *CULEX VOMERIFER,* FROM PANAMA (DIPT., CULICIDÆ)

By W. H. W. Komp[1]

Incidental to other duties in connection with malaria investigations in the plantations of the United Fruit Company at Almirante, Panama, the writer made collections of the local Culicidæ as time permitted. Among the many rare and beautiful forms taken a new species of Culex was found. It is a *Mochlostyrax,* belonging to the section *Chœroporpa,* and like most of this group, is a small brown unmarked mosquito, not to be differentiated in any way from dozens of other species of the same group. Nothing is known of the life-history or of the immature stages. The description follows:

Culex vomerifer sp. nov.

Female: Unknown.

Male: A small brown Culex, with rather wide pale bands at the bases of the abdominal segments. Legs all black. Palpi with the last two joints exceeding the proboscis, and clothed with rather long stiff hairs. Terminalia of male: Side-piece rather conically produced, bearing a lobe. Outer lobe undivided, bearing the following appendages: the most mesial is a long simple filament with a sharply recurved terminal hook. Then in order are a small flattened filament about two-thirds the length of the preceding hooked filament. Next in order is a long, sharply acuminate filament, bent at nearly a right angle at one-half its length; this filament is laterally expanded at the bend, with the edges of the expansion directed inwards, forming a cup-shaped hollow in the angle of the filament. Next in order is a flattened filament, just exceeding the bend of the long preceding fila-

[1]Sanitary Engineer, U. S. Public Health Service. From the Gorgas Memorial Laboratory, Panama City, Panama.

ment. Then comes a small slightly flattened filament, with tip somewhat broader than the insertion.

Arising from a separate point of insertion in the outer lobe, and most dorsal in position, is a heavily sclerotized appendage, nearly as long as the mesial hooked filament. This appendage is bent upwards from the point of insertion to about one-third its length, then downwards to two-thirds

FIG. 1. *Culex vomerifer* sp. nov., male terminalia, ninth tergite and tenth sternite.

its length, and then is produced in line with its insertion. The tip of this appendage is flattened dorso-ventrally, thick, and bluntly pointed. A thin membranous expansion arises from a point near the insertion of this appendage, and is attached all along the dorsal edge, to a point about two-thirds the length of the appendage. This flattened membrane is somewhat incurved. The outer border of the membrane is sinuous, the edge arising abruptly from the point of attachment at the proximal end of the appendage, to its greatest elevation about one-third of the length, then curving downwards to form another elevated portion about three-fifths of its greatest height, then curving abruptly down to the distal end of its attachment to the appendage, which is at about two-thirds the length of this appendage. The membrane is an expansion of the dorsal border of the appendage. The appendage, with its membranous expansion, resembles a plough, the heavily chitinized tip forming the share, and the membranous expansion forming the mouldboard. As this is the most prominent and striking feature of the terminalia, I have named the species from this structure.

The inner division of the lobe of the side-piece is undivided, and bears two hooked filaments curved inwards (ventrally) at an obtuse angle. The more distal filament is somewhat longer than the other filament, and is sinuously curved, terminating in an expanded blunt tip. The shorter filament is sinuously curved, following the curve of the distal filament, and terminates in a rather sharper recurved tip. At the base of the inner division of the lobe are two or three setæ arising from conically produced bases.

The clasper is membranous, not much expanded, with pointed tip and appendiculate spine. A small spine arises from a protuberance on the inner aspect of the clasper, about one-fifth the distance from tip to base. The outer edge of the clasper is membranous, with rough torn irregular free margin. Two strong setæ about one-third the length of the clasper, arise from the angle between the clasper and the base of the outer lobe of the side-piece.

The ninth tergites are small, mound-like, rather heavily sclerotized, and are joined by a smooth bar about as long as the width of one of the tergites. The tips of the tergites are smooth, but the bases are clothed with long stiff setæ arising from protuberant bases.

The inner plates of the mesosome are T-shaped, the ends of the cross-pin of the T being produced to form sharp horn-like tips, which are directed mesially. The dorsal tip of the T is longer, thinner, and sharper than the ventral tip. The basal hooks are rather wide and membranous.

The tenth sternites are rather short, with seven or eight blunt teeth, which are long in proportion to the length of the entire sternite.

The type is a male adult, mounted on a double pin mount, the terminalia separately mounted on a glass slide. There are two co-types, also the male terminalia only, mounted in balsam. All have been deposited in the U. S. National Museum.

A NEW CULEX FROM PANAMA (DIPT., CULICIDÆ)

By W. H. W. Komp and D. P. Curry[1]

That the possibilities in the line of discovery of new Culicidæ in Panama are not yet completely exhausted, even after intensive work covering the last 25 years, is demonstrated by the many additions to our knowledge of this group which have been made during the past few years. Among the outstanding accomplishments in this field are the discovery of the larva of *Anopheles* (*Stethomyia*) *nimbus* var. *kompi* Edwards, of the larva and adult of *Anopheles* (*Chagasia*) *bathanus* Dyar, the separation of *Anopheles* (*Arribalzagaia*) *neomaculipalpus* Curry from *A. punctimacula* and *A. apicimacula*, with which it had been confused, the discovery of the occurrence of *Anopheles albitarsis* Arribalzaga, in Gatun Lake, and the separation of *Anopheles tarsimaculatus* Goeldi into two forms, a freshwater and a salt-water form, *A. aquasalis* and *A. aquacælestis*. In addition to these greater accomplishments, a minor one was incident to certain observations on Anopheles made in Mojinga Swamp, at the base of the peninsula whose tip is Toro Point, opposite Cristobal on Limon Bay. Here the authors made incidental collections of male Culex. Among the material a new species was found, which is here described.

Culex (Upsiloporpa) haynei, new species

Female: Unknown.

Male: A small brown Culex, unmarked in any distinguishing manner. The palpi exceed the proboscis by the length of the last two joints.

[1]From the Gorgas Memorial Laboratory, Panama City, R. de Panama.

Male terminalia: Side-piece somewhat conically produced, bearing a lobe. The outer division of this lobe bears appendages as follows: A long thick filament, with strong recurved hooked tip; two curved flattened filaments, about half as long as the preceding filament; a large membranous leaf, inserted near the base of the outer lobe, and nearly as long as the longest filament. This leaf is twisted about a quarter of a turn on its long axis, is finely striate, and curved outwardly (dorsally) and over the long filament.

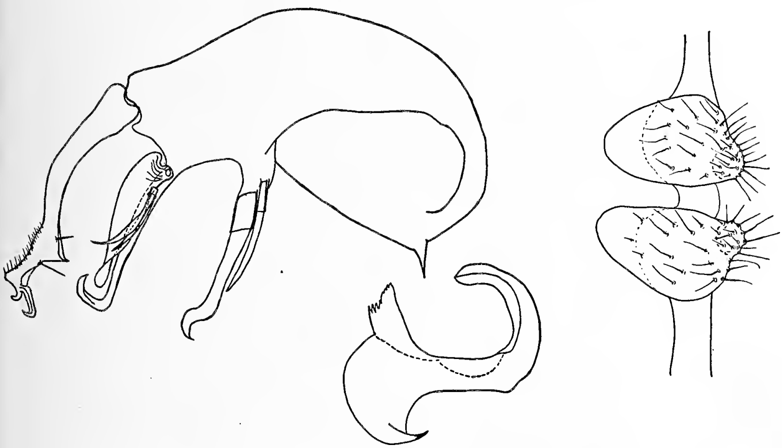

FIG. 1. *Culex haynei* sp. nov. Male terminalia, ninth tergite and tenth sternite.

The inner division of the lobe of the side-piece is undivided, short, stout, and bears two filaments, the outer long, strong, and with curved hooked tip. The inner filament is about two-thirds the length of the outer, and is straight and much thinner.

The clasper is unique among those of the Culicidæ of the New World, and is sufficiently different from that of the other members of the genus Culex to warrant the erection of a section coequal with Helcoporpa, Dinoporpa, Mochlostyrax and Melanoconion. We propose therefore the name Upsiloporpa. The clasper is long and slender, narrowing slightly at about three-quarters of its length, and then expanding to form a somewhat Y-shaped furcate tip. The arms are unequal, the inner being the shorter. The crest is markedly pilose outwardly. The appendiculate spine is attached near the terminal upcurving horn, and is unusually long, with a recurving hooked tip. There are two spines arising from small prominences, one at the junction of the furcation and the other proximal to the inner arm of the Y-shaped tip. The peculiar shape of the clasper can best be noted by reference to the figure.

The ninth tergites are ovoid, closely approximate, but not touching, with bare rounded tips. The bases are conically produced mesially, and bear numerous prominent tubercles, from which arise long, strong setæ.

The tenth sternites are rather long, with 7 or 8 strong blunt teeth.

The paired inner plates of the mesosome are T-shaped, the middle portion of the cross-bar of the T being somewhat rounded and elevated. The inner arm of the cross-bar is produced into a long pointed downcurving horn, while the outer arm consists of a short process set at an angle of about 45 degrees with the plane of the plate, and terminating in a truncate tip which is serrate, with four or five ragged teeth.

The type slide has been deposited in the U. S. National Museum.

NOVEMBER OBSERVATIONS ON *PIERIS PROTODICE VERNALIS* EDW. IN MISSOURI (LEPID. PIERIDÆ)

By Harold O'Byrne

Webster Groves, Missouri

The spring forms of some species of butterflies are occasionally seen in the fall. Scudder[1] says that the butterflies of *Pieris protodice* Bdv. & Lec. appearing late in the fall approach in coloration the spring type, and he attributes this to the cool nights. Comstock[2] mentions a similar occurrence in *Eurymus eurytheme* Bdv.; late fall individuals, presumably affected by the cold while in the pupal state, develop into the spring form *autumnalis* Ckll. instead of the summer form *eriphyle* Edw.

A noteworthy instance of this occurred in November, 1930, on the Ranken Estate near Valley Park, Missouri, when large numbers of *Pieris protodice* were seen, all of which had the coloration of the spring form *vernalis* Edw. Many of both sexes were observed on the mornings of November 9th, 16th, and 23rd, and all of the butterflies seen on the three days were flying in one small area; the west slope of a small valley that was exposed to direct sunshine and protected from the wind. Random collecting showed that there were nearly equal numbers of both sexes on each day of observation; nevertheless the eagerness of the males to mate caused them to cluster about the females as they were issuing from the pupæ, and make unsuccessful attempts to mate with them, even though their wings had just begun to expand. Several pairs were found *in coitu* on stems just above the voided pupal skins of the females, whose newly inflated wings were still soft.

Although the nights were chilly, this was an unusually mild November, and warm, sunny days continued nearly to the end of the month. If the coloration of the form *vernalis* is due to the effect of cold on the pupæ, then the observed occurrence of this form can be regarded as a direct effect of the cool nights, while the late fall emergence was no doubt caused by the warmth of the sun on the sheltered hillside where the butterflies were seen. This was, therefore, an abnormal emergence of a brood that should have remained in the pupal stage until spring.

Any caterpillars resulting from the matings could hardly have been able to endure the cold weather and lack of food, though it was an unusually mild winter. However, such a winter would be very favorable to the survival of the adults, the females of which, having already been fertilized, would be able to oviposit quite early.

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[2]Comstock, John A. The Butterflies of California, p. 51.

PSYCHE

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THE ENTOMOLOGICAL PUBLICATIONS OF C. W. JOHNSON

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In presenting the following list of the entomological writings of the late Charles Willison Johnson, I sincerely hope that no important titles have been omitted. This list has been checked with the libraries of J. M. Aldrich, C. T. Brues and myself, the Zoological Record, Biological Abstracts and several bibliographical references. Finally Mr. Richard Dow has compared it with the collection of reprints in the Boston Society of Natural History, verified the dates of publication and added many missing titles.

In addition to the cited titles, Mr. Johnson issued numerous brief notices in the Bulletins of the Boston Society of Natural History. Only the more important of these are included, but an Index to Bulletins 1-50 was issued in October, 1931.

A biographical account of Mr. Johnson has been given by W. Sprague Brooks in Bulletin 65 of the Boston Society of Natural History, October, 1932.

As a fellow dipterist I wish to record my sorrow in the passing of Johnson and my appreciation of having shared his friendship. In the formative days of my career his generosity in furnishing determined specimens gave that stimulus helpful to the beginner. A few days ago I had occasion to study some specimens of the Johnson collection now located at the Harvard museum. The methodical arrangement of his insects, his neatly written labels and the suggestions of many collecting trips given by the locality labels make it hard to comprehend that this collection has been completed and that the mind and the hand of the curator are forever stilled.

1893

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1894

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1895

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1897

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1898

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1900

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1901

Variation in the venation of *Amalopis inconstans* Osten Sacken. Ent. News, vol. 12, pp. 305-307 (1901).

1902

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1903

A new genus and four new species of Asilidæ. Psyche, vol. 10, pp. 111-114 (1903).

Some notes and descriptions of three new Leptidæ. Ent. News, vol. 14, pp. 22-26 (1903).

Two new species of the family Pipunculidæ. Ent. News, vol. 14, pp. 107-108 (1903).

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1904

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When to collect Tabanidæ. Psyche, vol. 11, p. 35 (1904).

Some of the Diptera to be collected during April and May. Psyche, vol. 11, pp. 37-38 (1904).

Merope tuber. Psyche, vol. 11, p. 38 (1904).

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A revised list of the Diptera of Bermuda. Psyche, vol. 11, pp. 76-80 (1904).

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1905

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A note on Calotarsa, and descriptions of two new species of Callimyia. Psyche, vol. 15, pp. 58-59 (1908).

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A new species of the genus Mydas. Psyche, vol. 39, p. 72 (1932).

NOTES ON SOME AMERICAN TINGITIDAE (HEMIPTERA)

Carl J. Drake,

Ames, Iowa

The present paper is based almost entirely upon a small collection of American Tingitidæ kindly loaned to the writer by Nathan Banks of the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts. In addition to *Corythucha decepta,* described below as new, this collection is represented by *Monanthia monotropidia* Stäl, Gamboa, Canal Zone, July 9, 1924, collected by Nathan Banks; *Teleonemia prolixa* Stål, Barro Colorado, July 23, 1924, N. Banks; *Teleonemia albomarginata* Champion, Barro Colorado, Canal Zone, July 19, 1924, and Rio Frio, Mgd., Colombia, P. J. Darlington; *Teleonemia sacchari* Fabr., Bella Vista, Panama, July 7, 1924, N. Banks; *Acalypta ovata* Osborn and Drake; Smoky Mts., N. C.—Tenn., Newfound Gap, Elevation 5,000—5,200 ft., collected in moss by Nathan Banks; *Acanthocheila armigera* Stål, Bella Vista, Canal Zone, July 7, 1924, N. Banks; *Gargaphia nigrinervis* Stäl, Rio Frio, Colombia, May 15, P. J. Darlington; *Corythaica planaris* Stäl, Red Tank, Canal Zone, N. Banks; *Corythucha padi* Drake, Hood River, Oregon, Sept. 5, 1917, F. R. Cole; *Corythucha obliqua* Osborn and Drake, Carmel, Cal., June 22, 1918, C. L. Hubbs; *Corythucha spinosa* Duges. The writer is indebted to Mr. A. A. Nichol for the specimens of *Corythucha sagillata,* n. sp., from Arizona.

Corythucha decepta, n. sp.

Moderately large, testaceous, the pronotum and a more or less distinct band near the base of the elytra brown. Hood long, much smaller and placed a little farther forward on the pronotum than in either *C. setosa* Champ. or *C. eriodictyonæ* Drake. Pronotum finely punctate, moderately swollen; lateral carinæ not strongly elevated, the areolæ very small, terminating anteriorly just behind the tumid area. Antennæ and legs as in *C. setosa.* Paranota large, rather closely reticulated, the lateral spines wanting except along anterior margin. Median carina very low, not distinctly arched, uniseriate, the areolæ very small. Elytra broad, with lateral spines along the costal margin; tumid elevation very small, not very distinct. Costal area broad, widely reticulated, irregularly triseriate, with some of the nervelets near the base darker and forming an indistinct band. Wings a little longer than abdomen. Areolæ hyaline.

Length, 3.65 mm.; width, 1.82 mm.

Holotype, male, and *allotype,* female, San Miguel, Hidalgo, Mexico, collected by Dr. W. M. Mann, Museum Comparative Zoology. Paratypes, 13 specimens, taken with the type. The smaller hood, unarmed, paranota and elytra, and much smaller tumid elevations of elytra separate this species at once from *C. setosa* Champ., *C. eriodictyonæ* Drake, *C. pacifica* Drake and *C. sphæraceæ* Drake. The lateral carinæ are formed as in *C. setosa* and not as in the other species mentioned above. The hood is not abruptly constricted and much more elevated than the median carina.

Corythucha sagillata, n. sp.

Moderately large, whitish testaceous, conspicuously marked with brown and fuscous. Hood moderately large, strongly and abruptly constricted near the middle, very strongly compressed and narrowed in front; posterior portion mostly brown, inflated and elevated. Median carina about half as high as hood, arched, there biseriate and with a brown patch. Lateral carinæ whitish, raised anteriorly, terminating a little behind the hood. Paranota with brown markings, rather closely reticulated. Antennæ testaceous, clothed with a few extremely long bristly hairs, the apical segment pale brown.

Elytra moderately constricted, with the usual cross-bands; costal area somewhat irregularly triseriate, areolæ (except in transverse bands) hyaline; tumid elevation large, with large brown spot. Wings longer than abdomen. Rostrum extending almost to end of rostral channel, the tip blackish. Legs testaceous. Nervures of elytra, carinæ, hood and paranota with a few erect spines.

Length, 3.51 mm.; width, 2.10 mm.

Holotype, female, and two *paratypes,* females, Santa Catalina Mts., Arizona, July 15, 1925, alt. 5000-6000 ft., collected on *Vauquelinia californica* (Torr.) Sarg. by A. A. Nichol. This is a very pretty and elegantly marked species. It is perhaps most closely allied to *C. elegans* Drake, differing in the larger tumid elevations, more constricted elytra and the different formed hood. The types are in the collection of the author.

OVIPOSITION OF THE ICHNEUMONID *ITOPLECTIS CONQUISITOR* (SAY) IN A LARVA OF *PYRAUSTA NUBILALIS* HUBN.

By Milton F. Crowell

During the summer of 1932 I was fortunate enough to see a female of *Itoplectis conquisitor* (Say) parasitize a larva of the European corn borer, *Pyrausta nubilalis* Hubn.

When first observed the female hymenopteron was running up and down over the upper part of a corn stalk, perhaps a foot below the tassel. Closer examination revealed that she was paying attention to a short section of the stalk just above a hole opening into a tunnel of the corn borer. She approached the hole, felt around it with her antennæ, then proceeded to explore with her antennæ the stalk just above it. After a short time, during which she felt over most of the area of the stalk for perhaps three inches above the hole, she stopped and thrust her ovipositor vertically into the corn stalk. She remained motionless for an estimated time of fifteen to twenty seconds. She then withdrew her ovipositor and flew away.

Cutting open the stalk I found a mature larva of *Pyrausta nubilalis* in the burrow, directly under the spot where *Itoplectis conquisitor* had thrust her ovipositor into it.

CONCERNING THE GENUS NOTIOBIELLA (NEUROPT.-HEMEROBIIDÆ)

By Nathan Banks

In recent years several genera have been made for forms agreeing with *Notiobiella* in having but one series of gradate veins in the fore wings.

Buxtonia Petersen 1928 (Insects Samoa) was based on males with enlarged veinlets in the stigmal area.

Vaja, Navas 1925, from Java and *Ganchetus,* Navas 1929 (Insecta Nova XIII) from Kamerun were based on an elongate pronotum, together with certain slight venational points.

Having a species of *Notiobiella* from the Malay Peninsula which has a long pronotum I have gone over the material in this genus available to me.

Notiobiella was published in 1909 with five species, four from Australia and one from the Fiji Islands. Shortly afterward Needham published a genus, *Annandalia* from India based on one species—*curta.* In my original description of *Notiobiella* I mention *N. unita* as type, so that the genus must be interpreted in this sense. The length of the pronotum varies from much broader than long to almost as long, fully as long, and plainly longer, and one specimen with a pronotum nearly twice as long as broad. This point therefore should not be used as a generic character. The size of the veinlets in the stigmal area used by Petersen for his *Buxtonia* is only developed in the males of certain species; his statement that my *N. stigmatica* would go in his new genus is correct; but I suspect that *N. stigmatica* is the male of *N. unita,* the type of the genus.

Navas mentions that in *Ganchetus* there is in the hindwing a "venulis externis." I have a species from Madagascar that has two such veins in one hind wing, and only one in the other, moreover an Indian species with short pronotum also has a "venulis externis" in each hind wing.

In examining the material I notice that in some species the subcosta and radius are close together and no apparent cross-vein between them, in fact so close together there is no room for a cross-vein; in other species the subcosta and radius are wide apart and with one or two cross-veins. All the species with an elongate pronotum belong to the section with the subcosta and radius close together; these forms also normally have a "venulis externis."

These characters will readily divide the old genus *Notiobiella* in two sections which I shall call genera.

N. unita Bks. the type of the genus has the subcosta and radius close together, the pronotum is hardly elongate in the female, but in *N. stigmatica,* which is a male and may be the male of *N. unita,* the pronotum is narrow in front. *N. viridis* Tilly. also goes here, likewise the species from Madagascar, *N. viridineris* Bks. and *N. valida* Bks., as well as other forms. In all of these forms the face is more elongate than in the species with the radius widely separate from the subcosta. *Annandalia curta* Needham has the radius and subcosta widely separated and connected by two cross-veins. The pronotum is extremely broad; the face is short; the male genitalia are shorter than in *Notiobiella* and in the hind-wing there is rarely a "venulis externis." To this section belong several species, all however from the Old World, and this genus will be Annandalia.

To each genus I can place the following species:

Annandalia Needham 1909.

A. iniquus Hag. (*curta* Needh., *khandalensis* Navas). Common in India.
A. maindronia Navas, may be the same, from India and Formosa.
A. externa Bks. (Notiob.). Australia.
A. obliqua Bks. (Notiob.). Australia.
A. pretiosa Bks. (Notiob.). Fiji Islands.
A. minima Bks. (Notiob.). Malay and Philippines.
A. affinis Bks. (Notiob.). Philippines.
A. jeanneli Navas (Notiob.). East Africa.

A. antennata Navas (Notiob.). Congo Belge.
A. galloisi Navas (Notiob.). Japan.

Notiobiella Bks. 1909.
N. unita Bks. Australia.
N. stigmatica Bks. Australia.
N. viridis Tilly. Australia.
N. viridinervis Bks. India, Malacca, Philippines.
N. valida Bks. Borneo.
N. fulva Petersen (Buxtonia). Samoa.
N. tumida Navas (Vaja) Java, Malacca.
N. africanus Navas (Ganchetus). Kamerun.
N. nitidula Navas. East Africa.
N. subolivacea Nakahara, Japan.
N. mexicanus Bks. Mexico.
N. rubrostigma Navas. South America.
N. bella Navas. Congo Belge.
N. decora Kimmins. Ugana, E. Africa.
N. costalis Bks. Gold Coast, W. Africa.

Besides these I add the following two new species.

Annandalia hageni sp. nov.

Head pale, a black stripe each side from eye toward the mouth; last joint of palpi black; antennæ pale. Thorax and abdomen pale brown, legs pale yellowish, hind tibia with a short dark stripe each side near middle. Wings pale, veins brown, a black dot near base of median vein, and the gradate series dark, stigma not marked. Wings longer than in *A. iniquus,* more than twice as long as broad, the subcosta and radius wide apart as in that species, and a cross-vein one-third way out; first radial sector at its first fork is connected to radius by a cross-vein and the second radial sector is twice forked before the marginal fork; most of the costal veinlets are forked but once, and one or two simple. There is a cross-vein between radius and second radial sector in the fore-wing beyond the stigma (not in other species) and also a cross-vein between the upper branch of the first radial sector and the lower branch of the second radial sector out near the tip close to the marginal forks.

The hind-wing has no markings, and no cross-vein (venulis externis) near tip, and a very short one in the disc between the radial sector and median vein; the radial sector is three branched.

Length of fore-wing 4 mm.

From Ceylon (Hagen Coll.); sent him by Nietner. Type M. C. Z. 17026.

Notiobiella peterseni sp. nov.

Head pale yellowish, a black mark each side from eye to mouth, a rounded black spot below each antenna; vertex with faint dark marks in middle behind; antennæ pale, faintly reddish beyond the base. Pronotum plainly longer than broad, pale, with lateral margins dark; thorax pale, with a dark mark above the base of each fore-wing; legs very pale. Wings pale; veins pale, but with a few dark spots or streaks; stigma not marked, the base of the second radial sector and the connection to the first sector broadly black, also the cross-vein beyond the stigma from the radial sector to radius is broadly black, elsewhere there are several forkings of veins dark, and a cross-vein between cubitus and cubital fork black. In the hind-wings the radial sector is black between its first and second forking. In one hind-wing there is one, and in the other wing two cross-veins between the radial sector and radius beyond the stigma; radial sector with two branches, no cross-vein between fork of median and the cubital veins.

Length of fore-wing 7 mm.

From Tananarive, Madagascar (Challiat). Type M. C. Z. 17027.

Differs from *nitidula* Navas (Engl. E. Africa) as well as others by the mark on face, and mesonotum, mark on radial sector of hind-wing, and the radial sector of forewing arises nearer to the base than Navas figures, and many more costal veinlets.

SOME MISCELLANEOUS GERRIDÆ IN THE COLLECTION OF THE MUSEUM OF COMPARATIVE ZOOLOGY (HEMIPTERA)

By C. J. Drake and H. M. Harris,

Ames, Iowa

Through the courtesy of Mr. Nathan Banks, curator of Entomology in the Museum of Comparative Zoology at Harvard University, the writers have received for study a collection of miscellaneous Hemiptera from North and South America. The present paper is based upon the members of the family Gerridæ in this collection. It includes notes on fifteen species, two of which are described as new. The types of these new species are deposited in the museum.

Gerris remigis Say

Guerrero Mills, Hidalgo, Mexico, 3 specimens, collected by W. M. Mann. This is one of the commonest and most widely distributed gerrids in North America. It exhibits marked variation in both size and color. *G. orba* Stål and *G. robusta* Uhler are both synonyms of *remigis* Say.

Gerris nyctalis Drake and Hottes

Three specimens, Nicholsville, Newfoundland, Aug., collected by G. K. Noble; and one specimen, Sand Cove, Newfoundland, Aug. 25, Fernald. Heretofore known only from the Rocky Mountain regions of United States and Canada.

Gerris dissortis Drake and Harris

Romaine Brooks, Newfoundland, Aug., G. K. Noble.

Gerris incognitus Drake and Hottes

Moscow, Idaho, A. C. Burrill, collector; and Metlakatla,

B. C., Keen, collector. This species is quite common in western North America.

Gerris buenoi Kirkaldy

Several specimens, Romaine Brook, Newfoundland, August, G. K. Noble. The range extends from coast to coast in North America.

Gerris chilensis (Berg)

Curico, Chile, 4 specimens. This insect is quite common in Argentina and Chile.

Gerris cariniventris Champion

Furcy, Hayti, 2 females, collected by W. M. Mann.

Gerris carmelus, n. sp.

Moderately large, clothed above with extremely fine golden pubescence. Head black, its sides and under-surface and a transverse patch above at the base ochraceous, sometimes these markings more or less replaced with black. Antennæ brown, darkened apically, the first segment with a few short setæ near its tip; formula, 40:30:30:27. Rostrum ochraceous, distal segment black, extending beyond apex of mesosternum. Pronotum black, the sides and a median elongate spot on disc of anterior lobe ochraceous; the apex rounded, attaining middle of mesonotum. Mesonotum ochraceous, strongly raised, tumid, almost rectangular in outline. Sides of thorax ochraceous, the meso and metapleura with a longitudinal blackish stripe, this at times extending on propleuron. Legs brownish, the intermediate femora each produced at the apex into two conspicuous, sharp, claw-like spines. Abdomen above blackish. Venter ochraceous. Length (♂ ♀), 7-8.5 mm.; width 2-2.6 mm.

(Male). Anterior lobe of pronotum strongly raised and sharply delimited from posterior lobe. Front femora somewhat incrassate and bowed, the inner surface a little behind the middle strongly dilated into a prominent blackish tubercle. Venter indistinctly carinate along the median line, the sixth segment about as broad as the fifth; its apical margin deeply and roundly excavated at the middle. First genital segment very long, slender and cylindrical.

(Female). Broader than male. Anterior lobe of pronotum only feebly raised above posterior lobe. Metanotum with a prominent, raised callosity on each side, these callosities pale and conspicuously hairy. Connexivum broader than in male, clothed along apical half with brownish hairs, these becoming longer and more numerous distally; the apices strongly produced into long, upwardly curving, hairy processes. Mesosternum and venter carinate down the middle. Sixth segment without carina, more thickly pilose than the fifth and more than twice as long.

Holotype, no. 17024, M. C. Z. apterous male, and *allotype,* apterous female, Jamaica, near Troy, May 12, 1909, A. E. Wight, collector. *Paratypes,* 6 males and 8 females, taken with type.

This species apparently is nearest related to *G. cariniventris* Champion. Its color markings are somewhat variable. From *cariniventris* it may be recognized by the larger, more prominent tubercular dilations of the anterior femora and the more deeply excavated sixth segment of the venter in the male, and the strongly produced connexival apices in the female.

Limnogonus guerini Lethierry and Severin

Gerris marginatus Guerin, Icon. R. An. Ins., 1844, p. 351, pl. 57, fig. 2; in Sagra, Hist. de Cuba, Ins. 1857, p. 173.

Limnogonus guerini Lethierry and Severin, Cat. Gen. Hem., III, 1894, p. 61.

Many apterous and alate specimens:—Port Antonio, Jamaica, Jan. 1, 1906, A. E. Wight; Grande Anse, Haiti, P. R. Uhler; St. Moore, Haiti, Jan. 1913, W. M. Mann; San Domingo, P. R. Uhler; Rio Bayamo, Cuba, Dr. Thomas Barbour; Bajo, Calif., one female, N. Banks.

This species is widely distributed and is very common in the West Indies and Central America. Long series of specimens from Honduras, Guatemala and the islands of the West Indies show that there is variation in size and considerable modification in the color markings. The female specimen from Baja, California, Collection of Nathan Banks, greatly extends the range of the species. The record indicates that the form from California described by Stäl as *Limnogonus (Gerris) franciscanus* may be *L. guerini.*

Limnogonus aduncus, n. sp.

Apterous Male: Dark brownish to black. Size and general aspect similar to *Limnogonus recurvus* D. & H. Head and pronotum with markings as in that species. Antennæ dark brown; proportions, 104:88:68:87. Rostrum dark-brown, the apical segment blackish, reaching upon the anterior portion of mesosternum. Front legs dark brown, stout, the femora slightly bowed and flattened beneath. Pronotum black, indistinctly margined with fulvous; anterior lobe moderately tumid, with two short ochraceous lines on the disc; posterior lobe broadly rounded behind, extending upon base of metanotum, with a median ochraceous line. Abdomen above with a median longitudinal ochraceous line. Body beneath yellowish brown with grayish pubescence, the mesosternum large, the venter with a broad, blackish, submarginal stripe. Legs proportioned as in *recurvus*. Connexivum moderately broad, slightly produced at apex, segments two, three, and four each with a prominent pale spot. Venter somewhat flattened, hairy along posterior margin, the last segment almost twice as long as the preceding. Genital segments large, dark brownish, segment I depressed on each side of a median raised portion which becomes narrowed posteriorly and ends in a distinct, recurved, blackish hook. Length, 9 mm.; width, 1.62 mm.

Apterous Female: Broader and stouter than male, brownish black. Finely pubescent, the sides of pronotum, the intermediate and posterior acetabula, and second and third segments of connexivum silvery. Antennæ brownish; proportion, 92:72:III and IV absent. Abdomen above with a broad, median, longitudinal flavous to fulvous stripe. Connexivum distinctly, triangularly produced behind. Anterior legs slightly bowed. Last segment of venter nearly twice as long as preceding, its hind margin convexly sinuate at the middle. Length, 8.82 mm.; width, 2.15 mm.

Winged Male: Pronotum with the humeri raised and prominent, the anterior lobe with a distinct indentation at the middle of each pale stripe. Hemelytra brownish black, reaching beyond tip of abdomen. Antennæ mutilated.

Holotype, no. 17025, M. C. Z. apterous male, San Fidelio, Brazil, February, Thayer Expedition. *Allotype,* apterous female, Rio Janeiro, Brazil. *Paratype,* winged male, taken with holotype.

This species is most closely allied to *Limnogonus recurvus* D. & H., from which it may be separated by the proportional lengths of the antennal segments and especially the structure of the male genitalia. In the former the first genital segment bears a large prominent and strongly tumid protuberance in front of its apical hook.

Metrobates denticornis (Champ.)

Trepabotopsis denticornis Champion, Biol. Centr.-Amer., Rhyn. II, 1898, p. 158, pl. IX, fig. 26.

Two specimens, Los Amates, Guatemala; collected by Kellerman.

Metrobates tumidus Anderson

Metrobates tumidus Anderson, Jour. Kansas Ent. Soc., V, 1932, p. 57.

Metrobates cubanus Drake and Harris, Ann. Carn. Mus., XXI, 1932, p. 86, pl. II, figs. 2 e, 4 e.

Several examples, Grand Ainse, Haiti; collected by P. R. Uhler.

Platygerris depressus White

Ten specimens, all apterous, Los Amates, Guatemala, collected by Kellerman.

Trepobates trepidus Drake and Harris

One female, with mutilated wings, Los Amates, Guatemala.

Trepobates pictus (Herrich-Schäeffer)

A single apterous female, Pt. Antonio, Jamaica, A. E. Wight.

Trepobates taylori (Kirkaldy)

Kallistometra taylori Kirkaldy, Entomologist, XXXII, 1899, p. 28; Kirkaldy and Bueno, Ent. Soc. Wash., X, 1907, p. 212.

Trepobates pictus Uhler, Proc. Zool. Soc. Lond., 1894, No. XV, p. 213.

Trepobates comitialis Drake and Harris, Fla. Ent., XII, 1928, p. 7; Bul. Brook. Ent., XXVII, 1932, p. 117.

The type of *Kallistometra tayloi* Kirk. (♀, St. Andrew, C. B. Taylor, Sept., 1898) in the Kirkaldy collection, U. S. National Museum has been examined. It is a typical species of *Trepobates* Uhler and belongs to the group having the posterior margin of the mesonotum in the apterous form subtruncate and not produced at the middle. The type specimen is badly mutilated, having the appendages all wanting on the right side, the last two segments of the left antennæ missing and also the tarsi of the second and third legs. As the data on the locality, date, and collector labels and type specimen in the Kirkaldy collection of the U. S. National Museum agree with the original description (except length of legs), there seems to be no question regarding identity of the type specimen of *Kallistometra taylori;* furthermore, the labels are written in Kirkaldy's own handwriting. After carefully studying this type (genotype) and numerous other examples the writers feel that the genus *Kallistometra* Kirkaldy must be suppressed and considered identical with the genus *Trepobates* Uhler. *Trepobates comitialis* D. & H. should be treated as a synonym of *taylori.*

In the Kirkaldy collection there are also two specimens (♂ and ♀) of *Metrobates tumidus* Anderson (=*Metrobates cubanus* D. & H.) labeled in Kirkaldy's handwriting "cotype," "Jamaica, C. B. Taylor." These specimens were not mentioned in the original description.

Several specimens are also in the Museum collection from Cuba, Ch. Wright; S. Domingo, P. R. Uhler; Mandeville, Jamaica, A. E. Wight; and Martinique. These specimens are all apterous (some nymphs) and in rather poor condition of preservation.

NOTES ON THE GENUS DYSDERCUS (HEMIPTERA-HETEROPTERA) IN TRINIDAD, B. W. I.

BY E. O. PEARSON

The work on which this paper is based was carried out partly at the Imperial College of Tropical Agriculture, Trinidad, between February and June, 1930, and partly at the Museum of Comparative Zoölogy, Harvard University, during the present year. The author is indebted to these two institutions and also to the United States National Museum for access to their collections, and to Mr. W. E. China, of the British Museum, for assistance and advice with regard to the identification of the species.

The first record of the genus from Trinidad is contained in Ballou's (1906) paper on the West Indian Cotton Stainers, in which he describes a new species, *Dysdercus howardi,* and its variety, *D. howardi* var. *minor,* from material collected in the island.

D. howardi var. *minor* has recently been synonomized with *D. ruficollis* L. by Hussey (1929) and in the same paper *D. andreæ* L. is recorded from the island. The latter error is apparently based on a reference by Myers (1927) to this species in the Trinidad Mountains of Cuba. Apart from a number of papers dealing with the life history and bionomics of the genus from an economic point of view (Guppy and Thornton, 1911; Urich, 1916; Withycombe, 1924; Hewison and Symond, 1928) no further work has been done on the nature of the species occurring in the island.

There are, in point of fact, four well marked species in the island and in view of the fact that in certain cases these species have been inadequately described and that in every case an examination of the material in the collections mentioned above has shown the distribution of these species to be considerably wider than that previously recorded, these have been re-described below.

Dysdercus howardi Ballou

Dysdercus howardi Ballou, West India Bull., VII, 69 (1906).[1]

The head, except the black eyes, antennæ, except the piceous terminal joint with a basal eburneous ring, rostrum, except the piceous terminal joint, anterior callus and lateral flanges of the pronotum, episterna, each margined anteriorly with a fine black line, legs, except the black distal joints of the tarsi, ferruginous (5'i-7'i-9'i) * the upper surface of a redder tone than the lower; the posterior disc of the pronotum pale luteous (21"d), margined anteriorly with a very fine impressed black line, posteriorly with a narrow black fascia which is itself narrowly albido-limbate; the scutellum fulvous (13'-13'i); the hemelytra luteous (19"), membrane black, the apex narrowly albidolimbate; the anterior collar of the pronotum, margined posteriorly by a fine impressed black line, the epimera and the acetabula, eburneous; the abdominal sternites pale luteous, frequently with a greenish tinge (21"d-23"d-25'"d), margined anteriorly on the second to sixth visible abdominal sternites with a narrow black line, broader on the posterior segments, the fifth and sixth sternites of the male with a fulvous band (13') covering all but the extreme posterior margin.

The anterior collar and posterior disc of the pronotum, the clavus and the corium, thickly punctate; the epimera and acetabula more sparsely punctate, the rest of the body impunctate.

The rostrum reaching in the female to the middle, in the male to the posterior margin of the second visible abdominal sternite.

The male parameres with two spurs projecting downwards toward the ventral surface; the distal one projecting

* In order to define these colors more exactly the specimens have been compared with the plates in Ridgeway's "Color Standards and Color Nomenclature" (1912), to which these numerals and letters refer. The words used to describe the colors, however, are those in common use and do not refer to Ridgeway's names.

nearly twice as far as the proximal one, narrow, cylindrical, acute, perpendicular to the axis of the paramere; the proximal one in the same plane, broad at the base, the apex forming a backwardly directed hook; the shaft of the paramere with a lateral flange arising from the outer ventral surface; the distance between the tips of the spurs roughly twice as great as that between the tip of the proximal spur and the apex of the lateral flange.

Length, from the apex of the clypeus to the tip of the membrane of the hemelytra: ♀♀ 12.5-15.0 mm. ♂♂ 11.5-12.5 mm.

Maximum breadth of the pronotum: ♀♀ 3.4-3.8 mm. ♂♂ 3.0-3.4 mm.

These measurements were made on only seven specimens; from measurements made in Trinidad on a longer series it appears that the limits of size are greater than those indicated above.

Localities: Trinidad, B. W. I.[1]
British Guiana (Georgetown).
Brazil (Bonito, Prov. Pernambuco; Natal).

The color is subject to some variation. In some specimens from Trinidad the head, disc of the pronotum, scutellum and hemelytra, except the extreme costal margin, are more or less infuscate, the antennæ, rostrum and legs being castaneous, verging at their apices to black. Occasionally a faint fuscous spot is developed towards the inner angle of the corium and the infuscation on the head and pronotum may take the form of irregular patches. Specimens from British Guiana follow the same course of variation. Those from Brazil are somewhat smaller than the above, more deeply infuscate and sometimes have the head completely black. The shape of the parameres, however, is a sure guide to the identity of the specimen.

Specimens of *D. discolor* Walker from the Lesser Antilles have parameres which differ only very slightly from those of *D. howardi* and whilst in general the coloration of this species is distinct, it is of interest to find that specimens, particularly from those islands closest to Trinidad, (Grenada, Bequia, St. Vincent and St. Lucia), occasionally are found in which the usual sanguineous suffusion is lacking, these specimens in color approaching very closely to Ballou's species. *D. discolor* Walk. and *D. howardi* Ballou are thus evidently very closely related species, derived from a common South American continental stock and exhibiting progressive differentiation as they are followed up the line of the Lesser Antilles.

In Trinidad this species has been found feeding and breeding on the seeds and unopened bolls of all varieties of cultivated cotton, on the local "wild" cottons *(Gossypium purpurascens* and *G. peruvianus)*, on the seeds of the ripe pods of the silk cotton tree, *Eriodendron anfractuosum*, on the capsules of *Hibiscus cannabinus* and *Hibiscus sabdariffa*, and on the fruits of *Malachra capitata* and *Thespesia populnea.*

Dysdercus maurus Distant

Dysdercus maurus Distant, Trans. Ent. Soc. Lond., 590 (1901).[1]

Dysdercus howardi var. *minor* Ballou, West India Bull. VII, 70 (1906).[2]

Dysdercus howardi var. *minor* Ballou=*Dysdercus ruficollis* L., Hussey, Gen. Cat. Hem., Fasc. III, 101 (1929).

The head above, antennæ, except the basal eburneous ring of the terminal joint, rostrum, except the castaneous base, and legs, black; the anterior callus and lateral flanges of the pronotum ferruginous (5'i); the posterior disc of the pronotum pale luteous (21"d), margined anteriorly by a very fine impressed black line and posteriorly by a broader black line, which is itself posteriorly narrowly albido-limbate; the abdominal sternites pale luteous, sometimes with a greenish tinge (21"d-23"d-25"'d), the second to sixth visible sternites with a very narrow black anterior margin, finer on the discal region and broader as a whole on the posterior sternites; the head below, the episterna, each margined anteriorly by a fine black line, coxæ and trochanters, lateral flanged margin of the abdomen, the whole of the fifth and the anterior half of the sixth visible abdominal sternite in the male, fulvous (13'-13'i); the anterior collar of the pronotum, margined posteriorly by a fine impressed black line, the epimera and the acetabula, eburneous; the hemelytra, except the extreme costal margins, which are luteous, deeply infuscate, with a small spot towards the inner angle of the corium, accompanied by a streak following the course of the radial vein, black; the membrane black, the apex narrowly albido-limbate.

The anterior collar and posterior disc of the pronotum, the epimera and acetabula, sparsely punctate; the clavus and the corium thickly punctate; the rest of the body impunctate.

The rostrum reaching to the posterior margin of the second visible abdominal sternite.

The male parameres with two spurs projecting downward toward the ventral surface, both short, of approximately equal length, obtuse, cylindrical, the distal one perpendicular to, the proximal one forming an acute angle with the axis of the paramere, the shaft of the paramere with a strongly dorsally reflected flange arising from the outer ventral surface, the distance between the tips of the spurs roughly equal to that between the tip of the proximal spur and the apex of the lateral flange.

Length, from the apex of the clypeus to the tip of the membrane of the hemelytra: ♀ ♀ 9.5-12.5 mm. ♂ ♂ 7.5-11.5 mm.

Maximum breadth of the pronotum: ♀ ♀ 2.5-3.1 mm. ♂ ♂ 2.0-3.0 mm.

Based on measurements of a series of thirty-five specimens from Trinidad.

Localities: Trinidad, B. W. I.[2]
Brazil (Quipapa, Pernambuco;[1] Joazino, Queimada and Portello, Bahia; Paô d'Assucon; Campinas; Ceara Mirim; Independencia; Natal).
Colombia (Cali; Santa Marta).
Argentine (Tucuman).

The color of this species is exceedingly variable. In the pallid forms the head, rostrum, antennæ, legs, posterior disc of the pronotum, scutellum, clavus and corium are identical in color with the same parts of the body of *D. howardi* Ballou, which they also approach in size. They may be distinguished from the latter species by the relatively narrower anterior black margins to the abdominal sternites and very readily by the male parameres. These pallid forms appear to be characteristic of the species as it occurs in Trinidad, but every grade of color exists between such forms and the extreme melanic type, which differ from the description given above in that the entire posterior disc of the pronotum and the hemelytra are black. The specimens from Brazil correspond more closely than those from Trinidad with the description given by Distant, the abdomen below being uniformly of a pale luteous color with no trace of a greenish tinge, while the episterna, coxæ and maculæ of the two posterior abdominal sternites in the male are pale ochraceous (15'b) and not fulvous.

D. maurus has some affinities with *D. howardi* in the shape of the parameres as well as in the color of the more pallid forms and the two species are also related in the same manner to two distinct but undescribed species occuring in Brazil, Paraguay, Bolivia and the Argentine Republic. The four species form a complex which, judging from the synonomy and from a number of incorrectly determined specimens, has long been confused with *D. ruficollis* L. I have not had the opportunity to examine any type material of Linné's species, but there can be little doubt that Fabricius' species *Lygæus annulus* (1803) is a color form of Linné's species. This fact is placed beyond reasonable doubt by Stäl's statement (1866) that *L. annulus* Fabr. is a variety of *D. ruficollis* L. with the hemelytra distinguished by a black hinderpart or a black fascia.

I have examined Linnaeus' type in the Museum of Upsala. The identity of *L. annulus* Fabr. is clear from the figure given by Hahn (1834) for *Pyrrhocoris annulus*=*L. annulus* Fabr., which is distinguished by the shape of the pronotum and by the fact that the transverse impressed line between the anterior callus and the posterior disc of the pronotum is not straight, as in most species, but has an anteriorly directed nick on the mid-dorsal line.

D. ruficollis L. would be intermediate between Hahn's vars. *b* and *c*, having the black head of the former and the immaculate hemelytra of the latter. I have examined a number of specimens, some of them already determined as *D. annulus* Fabr. by Uhler, and I am satisfied that these represent the true *D. ruficollis* L. and its synonyms, *D. annulus* Fabr. and *D. fulvo-niger* DeGeer. These all possess characteristic and identical genitalia, distinct from those of other New World species. All these specimens have a basal eburneous ring to the terminal joint of the antennæ, as in the original descriptions and since this character appears to be of first class taxonomic value in the genus it is impossible to accept the statements of Burmeister (1835), Stål (1870) and Distant (1883) to the effect that specimens of *D. ruficollis* L. sometimes occur in which the terminal joint of the antenna is unicolorous. Distant, in particular, appears to have been very much in doubt as to the identity of the species, for in Biologia Centrali Americana, Hemiptera-Heteroptera, Vol. I, Tab. XXI, he figures as *D. ruficollis* L. a specimen of *D. mimus* Say (fig. 20) and a pallid color form of *D. flavolimbatus* Stål (fig. 19), while nineteen years later (Distant, 1902) he describes as a new species, *D. clarki,* what is apparently none other than a somewhat melanic specimen of the true Linnean species *D. ruficollis.*

D. maurus Dist. differs little in its bionomics in Trinidad from *D. howardi* Ballou. It occurs on the same food plants, usually in smaller numbers than the larger species, although at times it is more numerous.

It would appear, from Withycombe's reference (1924) to a small, dark or otherwise aberrant form of *D. howardi* and also from a number of specimens identified by him in the Coll. Imperial College of Tropical Agriculture, that he considered *D. maurus* to be merely a seasonal or diet-produced phase of *D. howardi.* The characteristic genitalia, however, show that this is not the case.

Dysdercus mimus Say

Capsus mimus (excl. vars.) Say, Heter. N. Harm. 20 (1832).[1]

Dysdercus albidiventris Stål, O. V. A. F. XI, 236 (1854).[1]

Dysdercus lunulatus Uhler, Proc. Ent. Soc. Phila. I, 24 (1861).[1]

Dysdercus albidiventris Uhler, Bull. U. S. Geol. Geogr. Surv. I, 314 (1876).[2]

Dysdercus albidiventris Distant, B. C. A. Het., I, 229 (1883).[3]

Dysdercus ruficollis (excl. syn.) Distant, B. C. A. Het., I, 233; Tab. XXI, fig. 20 (1883)

Dysdercus albidiventris Hussey, Bull. Brookl. Ent. Soc., XXII, 235 (1927).

Dysdercus mimus Hussey, Gen. Cat. Hem. Fasc. III, 95 (1929).[4]

The head, except the black eyes, and the anterior callus of the pronotum, ferruginous (8'h), the latter with a slightly yellower tinge than the former; the episterna, coxæ, femora, proximal joints of the rostrum and the maculæ covering, in the male, the anterior part of the disc of the fourth, the greater part of the fifth and the anterior half of the sixth visible abdominal sternites, and in the female the anterior half of the fourth, fifth and sixth visible abdominal sternites, orange-ferruginous (11'i); the posterior disc and lateral flanges of the pronotum, the clavus and the corium, luteous (17''); the abdominal sternites pale luteous (21''d); the anterior collar of the pronotum, margined posteriorly by a fine impressed black line, the epimera and acetabula, eburneous; the antennæ, scutellum, distal joints of the legs and rostrum, the very narrow anterior margins to the second to sixth visible abdominal sternites, and the membrane, black, the last named narrowly albido-limbate at the apex.

The clavus and corium thickly punctate, the anterior collar and posterior disc of the pronotum, the epimera and the acetabula, more sparsely punctate, the rest of the body impunctate.

The rostrum reaching the posterior margin of the second visible abdominal sternite.

The male parameres with two spurs projecting downward toward the ventral surface; the distal one perpendicular to the axis of the paramere, dorso-ventrally flattened, tapering to a point; the proximal one in the same plane as and with its distal edge parallel to the distal one, but broader, laterally flattened and with the apex forming an acute, sharply recurved hook, and with a tooth on the proximal edge which is transverse and chisel-like; the shaft of the paramere with a dorsal longitudinal ridge and a lateral flange arising ventrally on either side, the inner one prominently projecting; the axis of the proximal spur roughly midway between that of the distal spur and the anterior margin of the inner lateral flange of the shaft.

Length, from the apex of the clypeus to the tip of the membrane of the hemelytra: ♀♀ 10.5-13.0 mm. ♂♂ 8.0-10.5 mm.

Maximum breadth of the pronotum: ♀♀ 2.7-3.5 mm. ♂♂ 2.1-2.8 mm.

Redescribed from material collected in Trinidad, 1930.

Localities: U. S. A. (Arizona,[4] California,[2,4] Texas[2,4]).
British Guiana (Georgetown).
Mexico[1,4] (Tampico, Vera Cruz).
Guatemala[3,4] (Alta V. Paz, Ayutla, Los Amates).
Honduras[4] (La Ceiba, Tegucigalpa).
Salvador.
Nicaragua.[3,4]
Costa Rica.[3,4]
Panama[2,3,4] (Ancon and Mt. Hope, C. Z.).
Colombia[4] (Aracataca, Santa Marta).
Ecuador[4] (Chimbo).
Bolivia (Prov. Sara).
Brazil (Igaripe and Manaos, Amazonas; Para).
British Guiana (Georgetown).
Venezuela (Cumaragua).
Trinidad, B. W. I.
Cuba (Santiago de las Vegas).

The variation amongst Trinidad specimens is not striking, running usually towards the production of smaller, more sordid forms, in which the color of all parts of the body is infuscate, this infuscation on the posterior disc of the pronotum occasionally taking the form of an irregular patch. The specimens examined from Cuba, Colombia, Venezuela, British Guiana, Bolivia and Brazil are similar to those from Trinidad. Specimens from Panama are usually larger in size, with a more pallid coloration, little infuscation, the membrane brownish and the scutellum frequently yellowish and not black. Possibly they represent a distinct geographic race. I have been fortunate in being able to examine a long series from the same locality in Guatemala (23 ♀♀ and 34 ♂♂), in which every shade of variation occurs between specimens which are identical with those from Trinidad, with the hemelytra immaculate, and specimens which agree with the descriptions given by Say (1832) and Stäl (1854), having the whole posterior disc of the pronotum infuscate and a large, inwardly directed, black fascia on the corium.

Specimens from Mexico, Honduras, Salvador and Costa Rica follow the same course of variation, while in a number of specimens from Ecuador the fascia on the corium covers the whole of the apex.

All these different color varieties share the characteristic parameres described above and may be recognized on superficial examination by the unicolorous antennæ, the fact that the lateral flanges of the pronotum are luteous and not, as is usually the case, the same color as the anterior callus, by the infuscation of the discs of the posterior abdominal sternites in the female and usually by the black scutellum. It may be remarked that forms of *D. mimus* Say with the hemelytra immaculate may be difficult to distinguish from similarly pallid forms of *D. mimulus* Hussey, but it is possible to do so from the fact that *D. mimulus* rarely has the disc of the pronotum immaculate, there being usually a sharply defined posterior black margin, whereas in *D. mimus* the black fascia, where it occurs, merges indefinably into the paler color. Moreover, in *D. mimulus* the black anterior margins to the abdominal sternites are relatively broader and more sharply defined than in *D. mimus*.

An examination of the male parameres, of course, reveals the nature of a doubtful specimen immediately.

In Trinidad this species is found feeding and breeding on the same plants as support the two preceding species, but it is distinguished by its penchant for the low-lying weeds of the genus Sida (Malvaceæ), which are common along the sides of roads and traces and in other rather exposed and dusty situations. With the exception of one occasion on which a number of migrants of *D. maurus* Dist. were found, *D. mimus* was the only species ever taken on Sida and indeed it was unusual to find an association of these plants which did not support a small colony of the species.

D. mimus is a much rarer species in Trinidad than either *D. howardi* or *D. maurus*.

Dysdercus fernaldi Ballou

Dysdercus fernaldi Ballou, West India Bull., VII, 68 (1906).[1]

The head, antennæ, except the basal eburneous ring of the ultimate joint, rostrum, legs, anterior callus and lateral flanges of the pronotum, rufous (9'); the color of the lateral flanges encroaching onto the sides of the posterior disc of the pronotum, which is pale luteous (21"d), with a sub-basal fuscous margin, itself posteriorly narrowly albido-limbate; hemelytra buff-yellow (19"d): abdominal sternites, epimera, acetabula and the pronotal collar, eburneous; scutellum, episterna, the lateral flanged margins, the incisures, very narrowly, the whole of the fifth and the anterior half of the sixth visible sternites of the abdomen, orange-rufous (11'); the membrane fuscous, narrowly albido-limbate.

Clavus and corium thickly punctate, anterior collar and posterior disc of the pronotum, epimera and acetabula, more sparsely punctate, rest of the body impunctate.

Rostrum reaching to the middle, if not to the posterior margin of the third visible abdominal sternite.

The male parameres with the shaft in the form of a prism, of which the ventral surface is hollowed out and the dorsal ridge is extended distally to form a long, downward curving, cowl-shaped structure, of which the outer edge is toothed like a saw and bears at the proximal end a long, curved spine.

Length, from the apex of the clypeus to the tip of the membrane of the hemelytra X Maximum breadth of the pronotum:

Grenada	♂♂	10.5-11.5 mm. X 2.8-2.9 mm.
	♀	12.5 mm. X 3.0 mm.
Trinidad	♂	11.8 mm. X 2.9 mm.
Brazil	♂	11.8 mm. X 2.8 mm.
	♀♀	10.0 - 12.0 mm. X 2.6 - 3.0 mm.
Colombia	♂	14.0 mm. X 3.7 mm.
Bolivia	♂♂	12.2 - 14.0 mm. X 2.8 - 3.7 mm.
	♀♀	13.0 - 14.0 mm. X 3.3 - 3.7 mm.

I have been able to examine so small a number of specimens that I have not felt justified in giving an average figure for the above measurements.

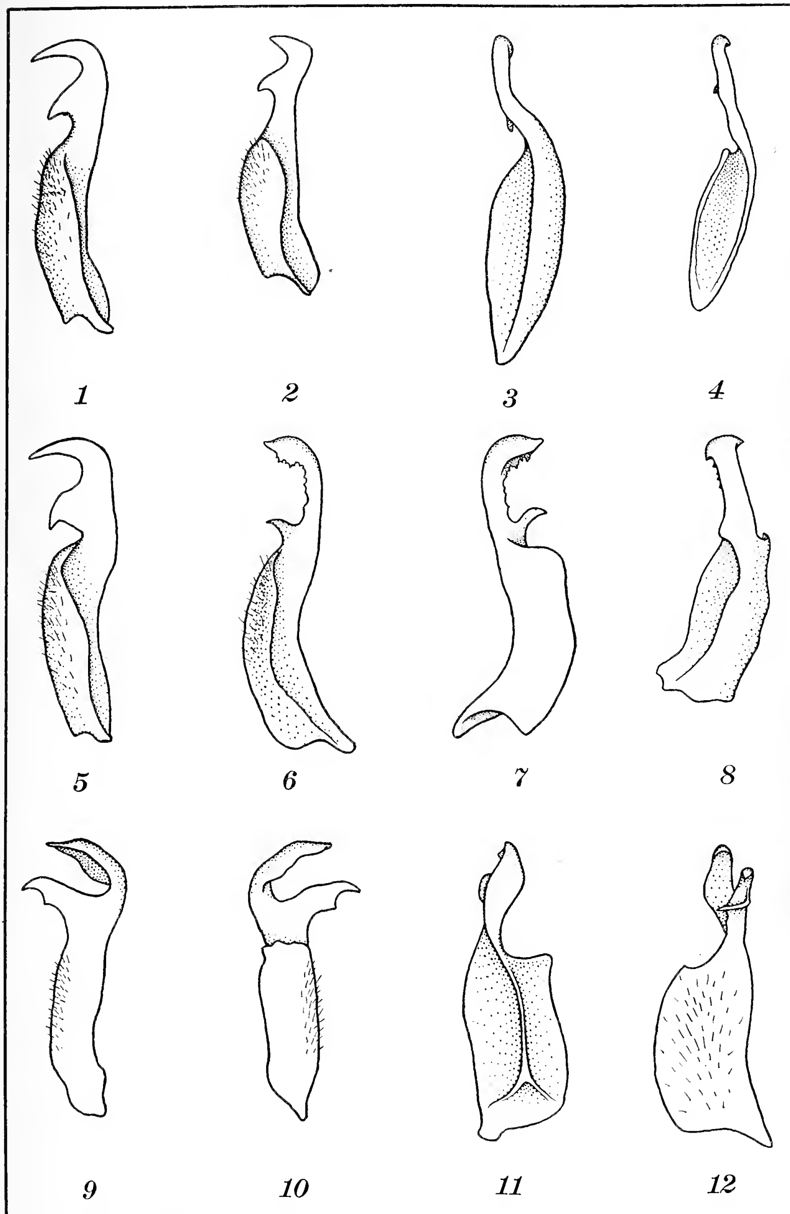
Localities: Grenada, B. W. I.[1]
Trinidad, B. W. I.
Colombia (Cali).
Peru (Chanchamayo, Lucma).
Brazil (Manaos; Para; Porto Velho, Matto Grosso; Rio de Janeiro).
Bolivia (Prov. Sara).
Argentine (Tucuman).

The specimens from Grenada, all of which correspond very closely with the type specimen in the U. S. N. M., are of a richer color than that described above, which is based on a single male specimen from Trinidad in the M. C. Z., Harvard University. In Grenadan specimens the head is a clearer red (7), the hemelytra orangeochraceous (14'), the posterior disc of the pronotum more or less suffused with black, the legs and antennæ verging castaneous distally, the apical angle of the corium suffused with black and the incisures of the abdomen frequently narrowly black.

The Brazilian specimens are identical with the one from Trinidad.

The specimens from other parts of South America are larger than the preceding and show some distinctions in the color, being generally of a duller shade and having, in some cases, broader black fasciæ where in the specimens described above such fasciæ are very pale and narrow. They possess, however, the very characteristic parameres in an unmodified form and share with specimens from the type locality the peculiarity that the reddish color of the anterior callus and lateral flanges of the pronotum en-

Psyche, 1932 Vol. 39, Plate 4.



Pearson—Dysdercus

croaches onto the sides of the posterior disc. They have therefore been regarded as belonging to Ballou's species, the range of which is thus considerably amplified.

I did not, to my knowledge, take this species in Trinidad and can therefore give no information as to its food plants. There is, however, a single male in the Coll. M. C. Z. from Port of Spain, Trinidad and no doubt the similarity in coloration to *D. howardi* and pallid specimens of *D. maurus* has caused it to be overlooked by collectors. I understand, nevertheless, that even in Grenada it is rare.

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EXPLANATION OF PLATE 4.

1. *D. howardi* Ballou (Trinidad). Right paramere, right side.
2. *D. maurus* Distant (Trinidad). Right paramere, right side.
3. *D. discolor* Walker (Grenada). Right paramere, dorsal surface.
4. *D. maurus* Distant (Mirim Ceara, Brazil). Right paramere, dorsal surface.
5. *D. discolor* Walker (Grenada). Right paramere, right side.
6. *D. fernaldi* Ballou (Trinidad). Right paramere, right side.
7. *D. fernaldi* Ballou (Trinidad). Right paramere, left side.
8. *D. fernaldi* Ballou (Grenada). Right paramere, dorsal surface.
9. *D. mimus* Say (Trinidad). Right paramere, right side.
10. *D. mimus* Say (Trinidad). Right paramere, left side.
11. *D. mimus* Say (Guatemala). Right paramere, dorsal surface.
12. *D. mimus* Say (Honduras). Right paramere, ventral surface.

All approximately 40 times natural size, drawn with camera lucida under low power of microscope.

LOCAL DISTRIBUTION OF *FORMICA ULKEI* MOUND-NESTS WITH REFERENCE TO CERTAIN ECOLOGICAL FACTORS[1]

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Introduction

The existence of a number of mound-nest colonies of the ant *Formica ulkei* Emery at Palos Park, Illinois, has been known for several decades. In recent years various phases of ecology and physiology of this ant and its nests have been analyzed and published. Holmquist (1928) reported at length on its life-history and hibernation; Orlando Park (1929) discussed certain myrmecocoles associated with it in the nests; Thomas Park (1929) reported the occurrence and behavior of a thief-ant intimately found in the mounds, and Dreyer (1932) has analyzed certain aspects of the respiratory behavior of this ant in relation to its hibernation. Up to the present time no accurate description of the extent and distribution of these mounds has been attempted. In this paper they will be discussed with reference to their individual form, their distribution, and certain environmental factors correlated with this distribution.

[1] The authors take pleasure in acknowledging their appreciation to Professor W. C. Allee, of the University of Chicago, for his kindly aid and criticism of this work.

Field Survey

The Palos Park region lies in the Valparaiso moraine about twenty miles southwest of Chicago. It is a rolling upland, situated to the south and east of the Des Plaines river, traversed by the Sag[1], a small stream flowing in a westerly direction into the Des Plaines. Most of the region is covered with a thick growth of the mesic oak-hickory type of subclimax forest characteristic of the morainic uplands of the Chicago region. (Cowles 1901). The mound-nests of *Formica ulkei* found here are concentrated in an area of approximately one quarter mile square in which the forest is cut up by a number of open lanes of swampy meadow providing for local drainage towards the west. Several temporary ponds are present in the spring but by early summer there is no surface water except at times of rain. The substratum consists of a thick layer of glacial drift, yellow clay and boulders, with a thin layer, two to six inches, of black humus surface soil.

A careful survey of this area in which all the mounds were tabulated according to size, location, and activity, reveals the presence of 435 mounds of *Formica ulkei.* These vary in size from mounds about one foot in diameter and six inches in height to five feet in diameter and three feet in height. Typically, the mounds have a somewhat matted thin surface layer composed of finely divided soil and organic debris such as twigs, stems, bits of leaves, and fragments of insects. The surface is perforated with many entrances to the interior which is finely ramified with well defined galleries, one to two centimeters in diameter. These extend throughout the mound and into the substratum down to the soil-water level from one to five or six feet below the surface. (Holmquist 1928). In most cases the mounds are free from living vegetation. The smaller mounds are round to oval at the base and bluntly conical in shape. The larger mounds are in general somewhat elongated and consequently show a definite orientation in that the long axis is east and west. In addition, the south face has a longer more gentle slope with considerably greater surface

[1] At the present time the Sag canal is used for drainage.

area (sometimes double that of the north slope) than the shorter, steeper north slope. Among the 435 mounds tabulated, sixteen are dead or inactive colonies. In these cases the mounds possess a weather-beaten appearance. The surface layer is not so evident, and vegetation has begun to invade the soil of the mound.

In the enumeration and mapping of the mounds it was observed that their distribution in the area is definitely

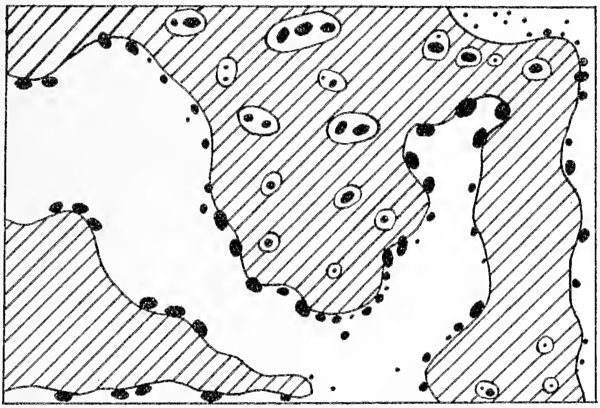

Fig. 1. Sample of typical distribution of *Formica ulkei* mound nests. Small, medium, and large mounds are indicated by the size of the black dots. The forested area is ruled with parallel lines. Clearings are shown by the circles around the dots in the interior of the forest. Scale is ½ inch = 25 yards.

limited. The majority, 48.7%, are located along the margin of the forest where it is traversed by open lanes or where it adjoins open meadow to the east, north, west, and southwest. This number includes mounds of all sizes, classified as small, medium, and large, although the two latter classes predominate. A small percentage, 17%, nearly all of the small type, are located in the open, i. e. 10 to 40 yards from the forest margin. The remainder, 34.3%, invariably occur in small open clearings in the interior of the forest. As in the case of the marginal nests the medium and large sizes predominate. The following table gives the complete classification of the mounds as to size[1], and distribution on the margin, open, or in a clearing. The accompanying figure, showing a typical portion of the map on which all the mounds are located, clearly illustrates this sort of distribution.

	Margin	Open	Clearing	Total
Small[1]	54	56	33	143
Medium	74	11	48	133
Large	84	7	68	159
Total	212	74	149	435
Per cent	48.7%	17.%	34.3%	100.%

Relation of Mound Distribution to Certain Environmental Factors

In addition to mapping and classifying the mounds of this particular region, some attention was directed towards the status of the local environmental factors in order to detect any correlation between the particular conditions and the distribution of these nests. Inspection shows a relation between the nest distribution and light since all colonies are situated to receive direct sunlight for the greater part of the day. Also, the mounds themselves are so constructed that the maximal surface area is exposed to the sun rays while the perpetually shaded north side of the mound becomes, in many instances, a steep slope from the apex of the nest to the ground. This suggestion of light as a factor is further substantiated by the fact that wherever nests appear within the forest, rather than along the margins, they are located within an actual clearing, which permits practically the same amount of light to fall upon the mounds as does on the marginally located nests and those of the open territory. Using the Macbeth Illuminometer, the intensity of the light was measured in foot-candles, to ascertain if the margins and clearings, where mounds are found, are actually receiving more light than the shaded forest floor. This is summarized in the second table.

[1] Small mounds are those 6 inches to 1 1-2 feet in diameter; medium mounds, 1 1-2 to 3 feet in diameter; large mounds, 3 to 5 feet in diameter.

Test-location	Date	Time	Foot-candles
Open margin	8-21-31	9:45 A. M.	2400
Open margin	8-26-31	9:45 A. M.	1750
Forest clearing	8-21-31	9:55 A. M.	2260
Forest clearing	8-26-31	9:55 A. M.	1665
Shaded forest	8-21-31	10:05 A. M.	44
Shaded forest	8-26-31	10:05 A. M.	18

The data of the table indicate that both margins and forest clearings are receiving essentially similar sun-radiations, while the shaded forest floor receives very low foot-candle intensities. There is no difference between the open meadow and the open margin of the forest. Relating these data to the fact that active nests are abundantly found along the open forest margins, in the open, or in clearings and are not located in the shaded forest areas, the conclusion is suggested that light intensity plays a definitely positive role in that a certain range of light intensity, i. e. of unobstructed sun, is favorable to mound building.

Such a distribution of the nests with respect to light in the visible range, also connotes a correlation between nest location and temperature; the latter being, in part, an expression of sunlight. The relation of temperature to mound nests of *Formica exsectoides* which are essentially similar to those of *Formica ulkei* has been treated by Andrews (1927). This investigator found that the temperatures of the upper part of the mound were higher than those of the lower part, and that these internal temperatures vary daily being due to heat received from the sun. These observations are in accord with our own. Andrews (1926) has also noted that *Formica exsectoides* nests increase in sunny regions and decrease in shaded areas; a further indication of the role of sunlight and temperature in connection with ant mound distribution.

The effect of soil moisture content on the nest distribution becomes a limiting factor only in the region of the marshlands which exist in some of the lanes between the forested areas. Here the surrounding substratum, for some thirty feet about its center, is too moist to permit nest building. Apparently the greater soil moisture of the lower land confines the nest building to the narrow strip along the forest margin. It thus exerts a negative or phohibitive influence which prevents the further spread of the mounds into the open where similar sunlight intensity prevails. It may be further noted in this connection that the greater number of mounds in the open are of the small type, the galleries of which do not extend far below the surface of the ground. Inspection shows soil conditions, other than moisture, to be quite similar in various parts of the area. There has been little erosion or deposition and the morainal drift is uniform in character. The ants build mounds and subterranean galleries with facility in both the loose surface soil and the hard clay below.

The relation between the presence of a colony and damage to surrounding vegetation has not been studied but a possible correlation is suggested in the well developed clearing surrounding all colonies in the interior of the forest. Andrews (1928) reports damage of mound building ants to vegetation. In this instance, however, consideration of the light conditions and the complete absence of either mounds or clearings in the denser parts of the forest indicate that the clearing is a cause rather than an effect of mound presence.

An interesting aspect of the problem not yet investigated, is the extent to which *Formica ulkei* modify the fauna of the region, or the extent to which certain species are absent or present here in comparison to similar areas not so populated by these ant colonies. Finally, observations on the unequal activity of mounds of the various sizes recorded indicate the need for careful analysis of the relations between size, age, and population of ant mounds. Such an analysis depends on subsequent periodic observations of these mounds, announcement of which will be made when their significance becomes apparent.

Summary

1. A survey of Palos Park, Illinois region records the presence of 435 mound-nests of *Formica ulkei* Emery in an area one quarter mile square.

2. Measurement of light intensity with the Macbeth Il-

luminometer shows an average of 2047 foot candles on the open margin and 1963 foot candles in the forest clearing as opposed to 31 foot candles on the shaded forest floor.

3. The distribution of the mounds is directly correlated with light intensity and attendant temperature conditions. Apparently a certan range of light intensity is a positively limiting factor in the location of these ant mounds.

4. Soil moisture limits the distribution of the mounds in such a way that it is considered in the role of a negatively limiting factor.

5. Several other interesting aspects of the complete ecological analysis of this unusual group of ant mounds are suggested for further study.

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PHORIDÆ ASSOCIATED WITH ANTS AND TERMITES IN TRINIDAD[1]

By Charles T. Brues

The following notes and descriptions of Phoridæ are based on a small collection secured by Dr. J. G. Myers in Trinidad, British West Indies. As Dr. Myers intends to publish observations which he has made on the biology of the several species, I am taking this opportunity to present descriptions of two forms not previously known, together with notes that extend the known distribution of two other species.

Diploneura *(Dohrniphora)* **conspicua** Borgmeier

Vozes de Petropolis, vol. 17, p. 628 (1923)
Arch. Mus. Nac. Rio Janeiro, vol. 25, p. 99 (1925)

Two males, taken by Dr. Myers in Trinidad in company with the following species. The species was described as termitophilous by Borgmeier as his types were taken in a nest of Eutermes in Minas Geraes, Brazil.

This species resembles the North American *D. incisuralis* for which I mistook it at first glance, but the bristles outside the seam on the hind tibia lie much nearer to the hair-seam.

Diploneura *(Dohrniphora)* **myersi** sp. nov.

♀. Length 1.6 mm. Body black; antennæ dark brown; palpi somewhat lighter brown; proboscis honey-yellow; legs dull brownish yellow, their coxæ almost black, except the front ones which are brownish; wings hyaline, with piceous venation. Front shining, slightly higher than broad; supra-antennal bristles inserted close together, strongly diver-

[1](From the Entomological Laboratory, Harvard University)

gent; lower row of bristles (antial and first lateral bristles) forming a row strongly curved downward medially, the median ones twice as far from one another as from the lateral bristle; middle row nearly straight and equidistant; ocellar tubercle scarcely evident. Cheeks with a bristle at the lower angle of the eye and one below at the oral margin. Antennæ small, oval; arista pubescent. Palpi moderate, each with five bristles at apex. Proboscis rod-like, as long as the head height beyond the basal bend. Eyes uniformly pubescent, postocular cilia rather short. Mesonotum shining; scutellum twice as wide as long, with a pair of bristles at each side, the anterior one much smaller and almost hair like. Hairs of mesopleura reduced to a small group near the spiracle; one large macrochæta on the propleura below the spiracle. Abdomen with five chitinized tergites, the second lengthened and without bristly hairs at the sides; fifth more or less subtriangular or narrowly trapezoidal; following segments membranous. Front tibia with a series of four bristles on the fore side, one at the basal fourth, one at middle, one at apical fourth and one just beyond. Middle tibia with a pair of bristles externally near base and a hair-seam extending to the middle, beyond which is an area of six imbricated transverse rows of minute bristles. Hind tibia with a complete dorsal hair-seam and a row of bristles just next to it inwardly. Costal vein extending slightly beyond the middle of the wing; costal divisions 25:7.5:3, the first therefore nearly two and one half times longer than the other two together; costal cilia very short and closely placed; first vein distinctly thickened beyond the middle and the third from near the middle; second vein leaving the third at a very acute angle so that the cell formed is more than twice as long as wide on the costa with the veins bounding its sides very thin; one small bristle on the third vein at its base; fourth vein originating at the base of the second, gently curved at base and nearly straight beyond; seventh vein weak, but clearly defined. Halteres black.

Type: Trinidad, B. W. I., November 25, 1928; one specimen taken by Dr. J. G. Myers, hovering over a termitarium of Eutermes during a raid made by ants on the termites.

It would seem probable that the species is termitophilous as such is known to be the case among some other species of the genus.

In spite of the numerous species, several of which are termitophilous, that have been described from the American tropics, this species is undoubtedly undescribed. From several forms that are similar, it is distinguished as follows: from *D. knabi* Malloch by the shorter first section of the costa which is 2½ times as long as the other together, instead of 5 times, and by the nearly straight middle transverse row of frontal bristles; from *D. obscuriventris* Borgm. by its entirely black color; from *D. intrusa* Borgm. by the presence of 5 abdominal tergites and the black halteres (although there is a disagreement here between the original description and a subsequent key to species); from *D. anterodorsalis* Schm. by the longer first section of the costa.

Megaselia juli Brues

Three specimens collected in the act of attacking and ovipositing in a large millipede and one later reared from the same host; Trinidad, Dec. 19, 1928 and Jan. 4, 1929.

These specimens seem to be indistinguishable from the North American *Megaselia (Aphiochæta) juli* Brues in spite of the widely separated localities. A South American species, *M. mucronata* Borgmeier from Petropolis near Rio de Janiero is very similar, but differs in its much longer ovipositor and more nearly equal first and second constal divisions in the wing.

The ovipositor shows the same striation on both the apical and basal sections as Borgmeier has described and figured for *M. mucronata* (Arch. Mus. Nac. Rio de Janeiro, vol. 35, 142 (1925).

In both *M. juli* and *M. mucronata* the mesopleura has one strong macrochæta in addition to minute hairs. An European species *M. styloprocta* Schmitz has the body black and the mesopleural hairs all minute, although otherwise very similar.

Cremersia Schmitz

There is a species of this peculiar genus in the collection.

The female possesses a most remarkable asymetrical ovipositor that shows such striking similarity to the hypopygium of the males of certain other Diptera that specimens of this sex were first mistaken for males. Borgmeier has, however, more recently found the male (Arch. Biol. São Paulo, vol. 1, 1928) and thus shown conclusively that this organ is in fact an ovipositor of very unique type.

Cremersia minor sp. nov.

♀. Length 1.4 mm., including ovipositor. Black or piceous, lighter on the mesonotum, pleuræ and legs. Front, abdomen above and ovipositor black; antennæ and mesonotum fuscous; palpi and legs testaceous, the pleuræ considerably stained with brown; halteres piceous, with paler stalk. Wings hyaline, heavy veins piceous, light ones strongly colored, but very delicate. Lowest pair of frontal bristles separated by one-fourth the width of the front, stout and but little divergent; second row of two large bristles set very close to the eyes; third row of four equidistant, curved downward medially, placed high on the front, with the lateral bristles but little below the level of the lower ocellus. Antennæ small, bluntly oval, the arista short, stout and scarcely pubescent. Palpi very small, with four weak bristles at the tip; cheeks each with two rather strong bristles below the lower corner of the eye. Mesonotum long and narrow, with one pair of small dorsocentral bristles placed close to the hind margin; surface clothed with conspicuous fine hairs, and side margins with several conspicuous bristles just before the base of the wing as well as a large one on the scapula. Scutellum about semi-circular, with one pair of very short bristles and an extremely minute bristle in front of each of these. Propleura with two bristles next to the spiracle and another near the insertion of the fore coxa. Mesopleuræ entirely bare. Second segment of abdomen lengthened, the three following subequal, not greatly narrowed. Fourth tergite with a subapical series of delicate bristles, growing stronger laterally; fifth tergite on the margin with a series of four large bristles on each side and a series of about four small, delicate ones between. Sixth tergite much narrower than the fifth, convex and rounded at apex, with two cross rows each of five long, curved bristles, the anterior row on the right side and medially somewhat overlapping the posterior row (which is on the left side) as the anterior row extends well to the left of the median line; all these bristles curved toward the righthand side. Fifth sternite with a close series of about six stout bristles. Legs long and slender; front tarsi not modified in any way. Front tarsi with the first joint almost as long as the tibia; second and fifth joints each half as long as the first; fourth one-fourth shorter. Hind tibia with a dorsal hair-seam and a series of very minute setulæ just internal to this, these setulæ not much larger than the hairs that clothe the inner surface of the tibia; tibia at apex with one small bristle inside the seam; hind femur simple, without long hairs below. Ovipositor of the usual hypopygium-like form; shining black in color with a long finger-like process above that curves to the left and is provided near its base with two transverse bristle-like spines that extend horizontally to the left; below with a short process apically, terminating in a twisted hook. Wing similar to that figured by Borgmeier for *C. pilosa.* Costal vein extending to slightly beyond the basal third of the wing its bristles long; first section more than twice as long as the second and third together; third not quite half as long as the second; fourth vein entering the margin at tip of the wing; fifth lying very close to the fourth.

One female collected by Dr. J. G. Myers in Trinidad, B. W. I., November 25, 1928, "hovering constantly close over the backs of ants engaged in raiding a termitarium (Eutermes)." So far as is known the numerous South American species of this genus are ecitophiles.

In Borgmeier's key to the Brazilian species of this genus (Arch. Inst. Biol., São Paulo, vol. 1, p. 161, 1928) this species will run to *C. brasiliensis* from which it differs in the bristling of the terminal abdominal segments, especially in the very stout, straight bristles on the sixth sternite. It is also a much smaller species.

NOTES ON SOME TROPICAL PHORIDÆ[1]

By Charles T. Brues

The following notes and descriptions are based on material contained in several small collections of Phoridæ received for identification from correspondents.

Diploneura Lioy

Diploneura *(Diploneura)* **scoparia** sp. nov.

♂. Length 2.5 mm. Thorax and most of abdomen yellowish brown; head and abdominal markings black; wings tinged with brown and distinctly infuscated apically. Antennæ brown, palpi reddish yellow; pleuræ and legs brownish yellow, the hind femora tipped with black; scutellum piceous; abdomen above rather bright yellow with a lateral spot on the second to sixth tergites; these increase in width behind. Those on the second small and those on the sixth are nearly coalescent; posterior borders of the tergites yellow; hypopygium black; wing veins very dark brown, the infuscated area of the wing including the apical fourth and most of the cell anterior to the fourth vein. Front as high as broad, its bristles all very large and strong; two postantennal bristles, inserted very close together and widely divergent; lowest row of four equidistant, the middle ones placed distinctly lower than the lateral ones which are almost as far from the eye margin as from the inner bristles; upper frontal row of four equidistant, curved upwards medially with the lateral one close to the eye. Ocelli large, the occipital ridge sharp, but not elevated; postocular cilia very strong; cheeks each with two conspicuous, downwardly directed bristles, also a smaller bristle inside the eye-margin just below the antenna. Palpi stout, broadened

[1] (From the Entomological Laboratory, Harvard University).

apically, each with an irregular row of six or seven short, stout bristles at the tip. Antennæ small, oval; the arista longer than the head-height, with very short pubescence. Mesonotum finely pubescent, with one pair of dorsocentral macrochætæ and some strong bristles along the lateral margins. Propleura with two large bristles (one above the other) below the spiracle; also a fan-shaped series of four or five above the base of the coxa, the anterior one large and the others rapidly becoming smaller. Mesopleura entirely bare. Front tibia with a large bristle externally just before the middle and a series of about seven on the apical half, the latter small but clearly bristles and not strong hairs. Middle tibia with a pair of strong bristles externally at the base and two hair-seams with a groove between which bears a scattering row of hairs; the inner hair-seam is complete, but the outer one extends only to a little beyond the middle; beyond this there are several oblique rows of comb-like bristles and a series of small bristles that lie near the hair-seam and form the apical part of the row of hairs in the groove. Hind tibiæ with two complete, strong hair-seams on the dorsal edge, connected by eight strongly oblique rows of strong comb-like bristles; in addition with a series of scattering bristly hairs in the groove between the seams, these not very easily noticed on account of the conspicuous oblique rows of bristles that extend across them. Scutellum with four equally strong bristles. Sides of second segment of abdomen bare; third to fifth tergites subequal in length; sixth twice as long. Costa extending nearly to the middle of the wing, its bristles fine and closely placed; first section four and one-half times as long as the other two together since the first, second and third veins enter the costa very close together, the second almost midway between the first and third; fourth vein lying unusually near the costal margin, gently arcuate and strongly recurved at the tip; fifth and sixth veins very little curved; seventh strong. Halteres pale brownish yellow.

Female. Resembles the male, except that the four tergites of the abdomen are entirely yellow. The third and fourth are small and no fifth one is visible.

One specimen of each sex; male from Sydney, New South

Wales (H. J. Carter) and the female from Brisbane, Queensland (A. J. Turner).

This species does not fit very well into any of the subgenera adopted by Schmitz. The armature of the hind tibia consists really of two distinct hair-seams, but the space between these bears the numerous oblique comb-like rows of bristles as described above. This condition might also arise from the presence of three hair-seams in which the middle one became broken up into a number of separated oblique groups. As the species does not resemble the only one of the two species of which I have specimens that are placed in the subgenus Tristœchia and as it does resemble a certain one placed in Diploneura s. str. I have placed it there. Another striking character is the extremely short second section of the costa.

Syneura Brues

Syneura cocciphila Coquillett

This species appears to be widely distributed in the warmer parts of America. I have recently seen specimens sent by Dr. M. D. Leonard reared from *Icerya purchasi* at San Juan, Porto Rico, and there are also in my collection others reared from Icerya in Arizona. Several South American species have been described by Borgmeier, one of which is I think without doubt the same as *S. cocciphila.* This is *S. infraposita* Borgm. (Deutsch Ver. f. Wissensch. u. Kunst in São Paulo, Jahrg 3, p. 133 1922, (1923) and Arch. Mus. Nac. Rio de Janeiro, vol. 25, p. 227 (1925). The very complete descriptions given by Borgmeier agree closely with a single cotype specimen and the above mentioned examples reared from Icerya. Unfortunately the old descriptions of Coquillett and myself omit certain of the characters more recently used in classification and no complete description was available to Borgmeier. This is the only one of the neotropical species with the mesopleura hairy above.

Homalophora Borgmeier

Vozes de Petropolis, vol. 17, p. 849 (1923).

Deutsch Ver. Wiss. u. Kunst, São Paulo, Jahrg 3, p. 177 (1923).

This genus is based upon a single South American species, *H. reichenspergeri* described in the publications mentioned above which has been found living with the termite, Conitermes.

Several years ago I received through Mr. S. W. Bromley two wingless phorids which he had taken in a nest of the large Cuban leafcutting ant, *Atta insularis* Guér. at Santiago de las Vegas near Havana. These are undoubtedly referable to Homalophora, although they represent a distinct species from the termitophilous form. The apterous female of Homalophora resembles the two widespread genera, Puliciphora and Chonocephalus, but is readily distinguishable from the former by the absence of a curved slit in the fifth abdominal tergite, and from the latter by the presence of ocelli.

Homalophora cubensis sp. nov.

♀. Length 1.1 mm. Dark brown, the antennæ, mouthparts, thorax, legs and membranous parts of the abdomen testaceous. Front somewhat longer than broad; four nearly equal, erect and laterally divergent post-antennal bristles, the upper pair much farther apart than the lower ones. Occipital row as in *H. reichenspergeri.* Ocelli very small and forming a small triangle, the posterior ones very close to the two ocellar bristles which are set between them. Mesonotum twice as wide as long; with a strong backwardly directed bristle near, but clearly inside of the lateral margin just behind the middle; near the posterior margin with four bristles, each inner one twice as far from the other as from the adjacent lateral bristle, which in turn is twice as far from the lateral margin as from the adjacent inner bristle; these bristles of equal size, or with the lateral ones somewhat stronger. Six abdominal tergites, clothed with sparse, minute hairs, but without stout hairs or bristles along the hind margins; first half as long as the mesonotum; second tergite twice as broad as long, nearly twice as long as the thorax; third but little narrower than the second, but not much more than half as long; fourth narrower but nearly as long as the third, a little more than twice as wide as long, fifth smaller, twice as wide as long, half as wide as the second, without a slit, but with a slight transverse impression at the base; sixth very small. Abdomen slightly, but not greatly flattened, the membranous segments (1-6) visible at the sides, slightly on second, but broadly behind, with scattered hairs set in minute black spots; anal tube very pale and soft. Eye in lateral view about half as high as the head. Antenna smaller than the eye, with strongly pubescent arista; palpi small, with several long, but delicate bristles, directed mainly laterally. Proboscis as long as the head, rather thick and not heavily chitinized. Legs rather stout, of the usual form.

Described from two females from a nest of *Atta insularis* Guér. at Santiago de las Vegas, Havana, Cuba (S. W. Bromley).

This species differs from *H. reichenspergeri* Borgm. by the brown, not black, abdominal tergites and comparatively larger second tergite; also the outer bristle on the hind margin of the mesonotum is not weaker than the inner one. Since the size of the abdomen varies, the greater extension of the membrane cannot be regarded as a specific character.

Ptochomyia Silvestri

Boll. Zool. Gen. Agr., Portici, vol. 14, p. 272 (1920).
Ibid., l. c., p. 275 (1920).

This most remarkable form was described from Camerun, Nigeria and French Guinea where it lives in the nests of Ancistrotermes. I have a single female specimen sent to me some time ago by Dr. Alfred Emerson, who received it with the termites of the American Museum Congo Expedition, 1909-1915. It was collected at Niangara, Belgian Congo, May 20, 1913 by Herbert Lang, in a nest of *Macrotermes (Bellicositermes) natalensis* Haviland.

Ptychomyia is clearly related to Termitoxenia and Termitomyia, especially the latter, differing in the form of the proboscis in which the labium is greatly enlarged and swollen. The present specimen agrees closely with Silvestri's description and figures although the abdominal bristles are much weaker than they are shown in his figures. However, in the description these are referred to as "*setis minimis*" which suggests that their size may have become accentuated in the reproduction of the drawings. Otherwise I cannot find any striking differences as the form of the head, which serves to distinguish three varieties, falls within the range figured by Silvestri. The mesothorax is considerably wider than long, whereas in *P. afra* it is described as about equal in these two dimensions; one of Silvestri's figures (Fig. III, 1), however, shows it as more elongate.

The acquisition of further specimens may perhaps show that the present specimen really represents a second species as the host termite belongs to another genus.

NOTE ON *HAPLODICTYUS INCERTUS* NAVAS

By F. M. Carpenter

Museum of Comparative Zoology, Harvard University

In 1926 Navas published a description of a Mecopteron, *Haplodictyus incertus*, belonging to the family Bittacidae.[1] Following the description he gives the type locality as "Wilmerding Pa. A. Heine", and then adds, "Wahrscheinlich aus Africa". The similarity of the locality mentioned to Wilmington, Pa. (Pennsylvania) leads to doubtful suspicions, especially since Navas himself was apparently not quite certain that the place referred to was in Africa; and an examination of his figures of the genitalia and fore wings shows that *incertus* is in fact *Bittacus apicalis* Hagen, which inhabits the eastern part of the United States, from Georgia to New York. Inasmuch as the genitalia and wing markings of this species are very distinctive (cf. the figures in my revision, Bull. Mus. Comp. Zool., *70*, 1931), there can be no doubt that *incertus* is a synonym. The fact that Navas placed *apicalis*, a perfectly typical Bittacus, in the genus Haplodictyus Navas substantiates Esben-Petersen's contention (Selys coll., Monograph Mecoptera, 1921) that Haplodictyus is only a synonym of Bittacus.

[1] Trichoptera, Megaloptera and Neuroptera aus dem Deutsch. Entomolog. Institut. (Berlin-Dahlem). 2nd ser. Ent. Mitteil., *15*(1): 57-63. 1926.

THE EFFECT OF TEMPERATURE AND RELATIVE HUMIDITY UPON THE OLFACTORY RESPONSES OF BLOWFLIES

By Cyril E. Abbott

Morgan Park, Ill.

Introduction

It appears that almost no effort has been made to determine the possible conditioning of insect olfaction by other external factors. This may be due to the fact that studies in the relation of these factors to insect metabolism are comparatively recent. In 1917 Headlee discovered that atmospheric moisture, through its relation to the water optimum of the insect body, directly affects development. In the same year Hamilton found that above 20° C soil insects are especially sensitive to evaporation. Shelford (1913) observed that insects resisted drying more effectively that most other animals. Beattie (1928) has made some interesting experiments with *Calliphora erythrocephala.* She finds that a relative humidity of 70 is optimum for the species, and that saturated or dry air lowers the thermal death point. Miller (1930) finds that at 37.5° C the percentage of surviving adult Mexican bean beetles, irrespective of humidity, is high. At 42.5° C the percentage is low at all humidities, while at temperatures between the extremes, the greatest percent of survival is at a relative humidity of 73. Marchand (1920) observes that *Blatta, Chionea* and various species of mosquitoes orient to heat. According to Herter (1923) *Formica rufa* distinguishes temperature changes as low as ¼° C. Miller and Gan were able to make *Cremastogaster lineolata* orient to radiant heat. Lodge (1918) finds that *Musca domestica* has its feeding reactions affected by changes in temperature and humidity.

The following study was suggested by Kennedy's (1927) statement that the olfactory powers of certain Hymenoptera appear to vary with relative humidity. Under normal conditions, adults of *Lucilia sericata* Meig. react to ethyl butyrate by an extension of the proboscis and regurgitation of fluid (Fig. 1). This is a definite feeding response to olfactory stimulation. The problem was to determine to what extent this response is dependent upon temperature and relative humidity.

Fig. 1. Extension of proboscis and regurgitation by *Lucilia sericata*.

Materials and Methods

Adult flies were kept in small cages and fed a solution of cane sugar and what juices they could obtain from hog's liver. The latter was replaced every alternate day, and any eggs removed to flower pots about two-thirds full of sand. These containers were covered with muslin. The maggots pupated in the sand and as soon as adult flies began to emerge in a given container, the latter was transferred to one of the cages.

Flies were tested individually and discarded after each test. The insect was placed in a chamber consisting of a test tube fitted with a rubber stopper having two inlet tubes. During the test, this tube was kept in a constant temperature bath composed of an aquarium fitted with two Lolag heaters, a thermostat, a stirring device, and two U-tubes which served to equalize the temperature of the air drawn into the fly chamber. One of these tubes was connected with the "check" apparatus; the other with the "test" apparatus. When properly adjusted, the temperature of the tank never varied more than 1/5° C. Each of the units used for the control of humidity consisted of two bottles arranged so that air was drawn through solutions they contained; in addition, the "test" set had a vessel containing ethyl butyrate shunted between these bottles and the U-tube. This vessel was held at a constant temperature of 30° C. in all tests.

Relative humidity was controlled by chemicals. A concentrated solution of a given compound gives the air with which it comes in contact a definite relative humidity. Four were used:

Chemical	Relative humidity
H_2O	98-100
NaCl	73
NaOH	30
N_2SO_4	0-4

The general method was to change the humidity, the temperature being constant. The tests at the four humidities were then repeated for another temperature. Three temperatures were used: 20° C., 30° C., and 40° C.

Flies were collected in the afternoon and were kept without food for five hours. They had free access to water. Sixty-four flies were used in each test. The method of procedure was as follows: a fly was secured on the end of a galvanized iron wire by wrapping its wings and the end of the wire with adhesive tape. The opposite end of the wire was fixed in the lower surface of the rubber stopper of the test chamber. This last, containing the stopper with the attached fly and tubes was placed in the constant temperature bath for one minute. One inlet tube was attached, by means of a rubber tube, to the "check" apparatus. The other inlet tube was similarly attached to a water-pump. The fly was observed for thirty seconds. If it did not respond (which was generally the case) the tube attached to the "check" apparatus was transferred to the "test" apparatus. Again the fly was observed for thirty seconds. If it extended the proboscis within this time, it was considered "positive." Sexes were used in about equal numbers. Percentage of response was based upon the number of insects giving a positive reaction at a definite temperature and humidity.

Results

The results of the foregoing tests are embodied in the following graph (Fig. 2). Neither at 20° C. nor at 40° C. was the percentage of response very high. The highest (57%) took place at 20° C. in a saturated atmosphere. At 30° C. there was a rise in percentage of response almost directly proportional to the increase in humidity, until the latter reached 73%, after which it fell slightly. At 30° C. and a

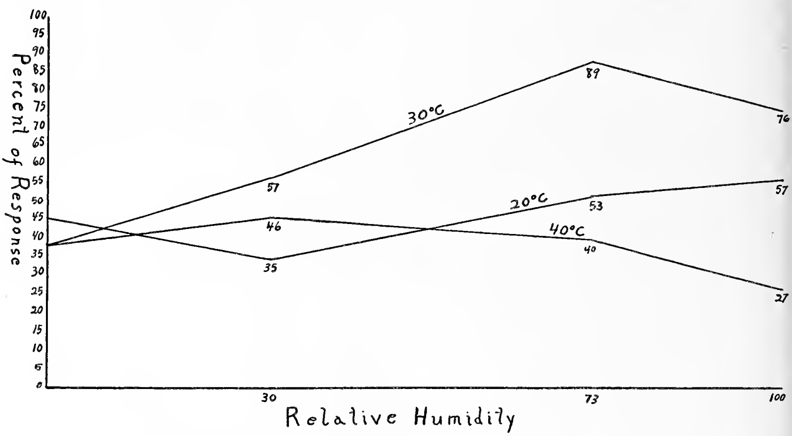

Fig. 2. Olfactory responses of blow-flies.

humidity of 73% the percent of response was 89; at a humidity of 100% it was 76. There was no indication of sex differences in these responses. The fact that there were practically no responses to the "check" indicates that it was really the vapor of ethyl butyrate and not air currents that brought about the responses.

General Conclusions

Several months of breeding and general observations indicate that the most favorable temperature for the metabolism of *L. sericata* is about 30° C. In the light of this fact, the discrepancies between the behavior of flies tested at that temperature and those tested at other temperature ranges can be easily understood. Apparently it is only at the temperature of metabolic optimum that humidity has much effect on their olfactory responses. At that temperature, the optimum for humidity is 73%.

It is a pleasure to thank Dr. C. H. Kennedy, Dr. W. M. Barrows, and Dr. D. F. Miller for many suggestions, materials, and aid in carrying this problem to a successful conclusion.

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NOTES ON THE PREY AND INQUILINES OF *PODALONIA VIOLACEIPENNIS* FORM *LUCTUOSA* (F. SMITH)

By Charles H. Hicks,

University of Colorado, Boulder, Colorado

The digger wasp, *Podalonia violaceipennis* form *luctuosa* (F. Smith)[1], captures cutworm larvæ and stores them as food for her young. The prey is usually dug from the soil and paralyzed by stinging. Later, after a cell has been constructed, it is placed in the earth, an egg is attached to its side and it soon becomes food for the waspling.

The prey, large, mature or nearly mature cutworms, are found and overcome by the wasp but usually, not without some difficulty. The hunt and capture has been described by Newcomer[2], who also has given an account of the wasp's habits, and later by Hicks[3]. The larvae hide by day, concealed beneath the soil or some suitable object, and it is a task for the wasp to find them.

A study of the cutworms, taken by the wasp, shows that several species are involved. The wide geographical distribution of *P. luctuosa,* (found according to Fernald[2], "practically everywhere in the Northern United States and Southern Canadian territory"), would suggest this probability and the facts thus far bear it out. A consideration of certain data follows.

[1] Kindly determined by Professor H. T. Fernald.

[2] Newcomer, E. J. Notes on the Habits of a Digger Wasp and Its Inquiline Flies. Ann. Ent. Soc. Amer., 23: 552-563, 1930.

[3] Hicks, Charles H. The Hunt and Capture of the Prey of a Digger Wasp. Bull. So. Calif. Acad. Sci., 30: 75-83. 1931.

——————On the Digger Wasp, *Podalonia luctuosa* (F. Smith). Pan-Pacif. Ent. 8:49-51. 1931.

[4] Fernald, H. T. The Digger Wasps of North America of the Genus Podalonia (Psammophila). Proc. U. S. Natl. Mus., Vol. 71, pp. 1-42. 1927.

In Colorado, although no specific determinations were made, it was nevertheless evident from the diversity of structure and markings of the prey, that a number of species of moth larvae had been taken by the wasp. In California, a few species were reared to maturity or otherwise identified.

It appears almost impossible, under the present imperfect conditions, to rear to the imago the inert and stung prey, in order to learn the species of moth used. The cutworm, if the wasp egg be removed and if it contains no serious internal parasites, usually lives for a time, wastes away and finally dies. It seems possible that a suitable antidote might be prepared and injected into the prey to counteract the poison of the sting but as yet, to my knowledge at least, this has not been advanced nor perfected.

The prey has been taken away from nesting females, from time to time, preserved and studied. In this manner, many larvæ have been secured. To supplement this phase of the work, live, normal cutworms have been collected from the field, taken to the laboratory and reared to adults. These larvae have been found hiding beneath old boards, under rocks in the soil, or in the earth around the roots of plants. One reared specimen was *Lycophotia saucia* Hubn.[1] It was taken from a wild tobacco plant, *Nicotiana glauca* Graham, upon the leaves of which there was evidence of it having been feeding. This individual pupated February 1st and emerged mature February 23rd. Another species, determined from a larva sent to Carl Heinrich at Washington, is *Chorizagrotis agrestis* Grt., a prey of *P. luctuosa.* A moth, concerning which there remains some doubt as to whether or not its young is often used as prey, is *Lycophotia margaritosa* Haw.[2]

One group of wasp cells, dug and provisioned by a single mother over a period of time, numbered seven. They had been stored with moth larvæ, representing three undetermined species. These had been used in as nearly equal numbers as possible. The ratio here, as also

[1] Determined by Dr. John A. Comstock.

[2] Determined by Dr. H. G. Dyar.

found elsewhere, would seem to follow the law of chance and not be due to a definite selective action on the part of the huntress.

The observed females of *P. luctuosa* have appeared to use, nevertheless, some selection in the individual cutworms chosen for their young. Whether this is a wise and consistent discrimination, or a chance and sporadic habit, it would be difficult to say.

The wasp rather frequently malaxates her prey after it has been stung to quietness. She pinches its neck and laps up the juices issuing from its mouth. This appears usually to be tasteful to her and may play a part in her life's economy. A rejected prey may or may not have been one previously malaxated. In one instance, at least, she stored a prey, which from malaxation was found to be highly distasteful to her, and that with no ill effects to her young.

The rejection of certain prey does not always seem to have been prompted by the small size of the victim, for often it is large and plump and in the matter of size the wasp is not exceedingly exact. She apparently never stores more than one cutworm to a nest but the particular cutworm may vary somewhat in actual dimensions. Although she exercises great freedom of choice, it is yet possible she does sometimes unearth one too small for her needs.

The wasp appears wholly unable to recognize a parasitized prey. This is shown by the fact that she not infrequently stores such a one for her young to eat. It then presents grave danger or dire disaster to her progeny. Two such prey were used in quick succession one afternoon by the same digger, the wasp larvae of which escaped seemingly only by a miracle. These nests were taken in my own backyard at Pasadena, California on April 30, 1928. The two nests were both provisioned in a total time of but little more than one hour.

Each larva, with an attached wasp egg, was obtained at once after the wasp had stored it in her nest. They were kept in a warm room where development was hastened and recorded. During the first day nothing unusual was noted but on the second a number of small larvae were found issuing from one. We will trace the subsequent history of each prey separately.

The small larvae were coming to the outside of the cutworm through holes made in its body wall. These punctures were formed rather generally over the body surface and consisted of seventeen in all. Fortunately, they were all some distance from the point where the wasp's egg had been attached. The larvae soon began spinning cocoons in the fine cotton on which the cutworm was resting. Two days later the last of these cocoons had been finished. These remained until May 11th when the adults began emerging. The insects were small ichneumonids, *Meteorus vulgaris* Cress.[1] which cut circular caps off the anterior ends ends of the cocoons in order to get out. The cocoons empty, their size and structure could more readily be noted. They were somewhat oblong in form, measured about 4.5 mm. in length and 2 mm. in width, through the center, and were light in color. Coarser strands of silk held the cocoon proper attached to the cotton threads. The anterior end possessed a distinct broad, blunt and thicker cap; the posterior end somewhat larger and more pointed, contained within the meconium or splotch of excrement, expelled from the larva after the cocoon had been formed.

The egg of the wasp, attached to the cutworm from which the larval ichneumonids emerged, hatched in due season, the larva began feeding and continued to eat the prey so long as any remained. The food exhausted, it soon spun a cocoon in which to pupate. On May 25th, an active female, *P. luctuosa,* cut away the end of the cocoon and crawled out. She was apparently normal in every respect, with the exception that she was smaller than the average. Thus the cutworm from the first nest had provided food for seventeen internal parasites and later furnished enough for the growth and development of the wasp in addition.

The cutworm from the second nest met a somewhat similar fate. Three days after capture by the wasp, eight fly magots squeezed their fat bodies through small holes in the cutworm's body. The wasp larva (the egg of which had

[1] Kindly determined by Mr. A. B. Gahan.

already hatched in this instance) was not injured, although one fly larva came through the wall very near to it. Puparia were soon formed and the flies emerged on May 12th. Specimens were sent to Washington and have been determined as *Wagneria carbonaria* Panz.[1]

Again, the larva of *P. luctuosa* developed and formed a cocoon, emerging on the same day as the insect from the first nest. It, too, was a female of about the same size as the one from the other cell. Although each of these females were undersized, they were no smaller than some others found in the field capturing prey and provisioning nests and there is no reason to believe that these could not have done likewise had they developed in the soil or been released from the laboratory.

Newcomer, in the paper previously mentioned, gives the noctuid, *Euxoa testula Sm.*, as a possible prey of the wasp, the adults having been captured about his laboratory at a time when the cutworm should have reached maturity had similar ones been used earlier by the wasp. He lists three flies associated with the wasp. There are: *Hilarella hilarella* (Zett.), a species which deposits living young in the nest; *Taxigramma (Heteropterina) heteroneura* (Meig.), a species superficially resembling *Hilarella;* and *Metopia leucocephala* (Rossi).

Hilarella hilarella is a fly frequently met with at or near Los Angeles, depositing its larvae in the nest of this wasp and that of other nesting wasps. It was found quite common at Boulder, Colorado, in association with the wasp, *Sphex aberti* (Hald).[2]

[1] Determined by Dr. J. M. Aldrich.
[2] Determined by Dr. H. T. Fernald.

PSYCHE

INDEX TO VOL. XXXIX. 1932

INDEX TO AUTHORS.

INDEX TO SUBJECTS.

All new genera, new species and new names are printed in SMALL CAPITAL LETTERS.

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NEW PSAMMOCHARIDÆ FROM THE UNITED STATES

By Nathan Banks

Museum of Comparative Zoölogy.

The following new species are largely from the collections made by Dr. Bequaert and recently given by him to the Museum of Comparative Zoölogy.

Planiceps yavapai sp. nov.

♀ Black, scarcely at all purplish, wings black, on each side of second segment of abdomen is a distinct white spot.

Head and general structure similar to *P. luxus*, the front femora even more swollen than in *P. luxus;* the hairs on front coxae are very fine and short, much shorter than in *P. assimilis*, the rest of legs devoid of hairs. There are short erect hairs on face, and still shorter ones on pronotum; propodeum and pleura without hairs. The face is fully as narrow as in *P. luxus* (much more narrow than *P. niger*). The posterior ocelli are scarcely nearer to eyes than to each other; the antennae are noticeably more slender and longer than in other species, the third joint being more than three times as long as broad; inner spur of hind tibia about two-fifths of basitarsus. Venation similar to the mentioned species; the second submarginal rather long, receiving the first recurrent vein just beyond the middle, the second recurrent ends just a little beyond the cell; the second discoidal cell is quite long, once and a half as long as second recurrent vein, latter very oblique.

Length 14 mm., fore wing 10 mm.

From Post Creek Canon, Pinaleno Mts., Arizona, 15-18 July (J. Bequaert). Type M.C.Z. 17028.

Pedinaspis nigriceps sp. nov.

♀ Head black, scutellum, propodeum, pleura, legs, antennae, basal abdominal segment, and tip of abdomen, black. Pronotum, mesonotum (except scutellum) abdominal segments from second to fifth inclusive, red. Clypeus strongly rounded below; third joint of antennae no longer than fourth; ocelli up as high as in *P. mariae*, in a low triangle, posteriors scarcely nearer to eyes than to each other. Pronotum slightly arcuate behind; propodeum with a broad deep median groove on the basal part, the declivity transversely striate. Wings fumose, about as in *P. contiguus;* venation like that of *P. mariae;* inner spur of hind tibia scarcely two-fifths of basitarsus, shorter than *P. mariae,* legs spined similar to *mariae.*

Length 19 mm., fore wing 12 mm.

From Stein, Grant Co., New Mexico, 14 July (J. Bequaert). Type M.C.Z. 17029.

Separated from *P. contiguus* by black propodeum, and by fifth abdominal segment red, no white on tip, and striæ on propodeum. It is near to *P. portici* Rohwer in appearance, but that has a red head and is described in the subgenus *Psorthaspis;* this is a true *Pedinaspis.*

Allaporus gen. nov.

Type *Planiceps pulchellus* Bks., also going in the genus is *P. hesperus* Bks.

They differ from our other *Planiceps* in having the first recurrent vein interstitial with the base of the second submarginal cell, and the second recurrent vein ends in the second submarginal cell a short distance before tip. This second submarginal cell is fully as high as long. Both species are very small.

It differs from *Teleostegus* (of Europe) which has both recurrents ending in second submarginal, in having this cell very short, the first recurrent interstitial with the base of second submarginal, and in that the basal vein ends plainly before the transverse cubital.

Aporinellus bequaerti sp. nov.

♀ Black, basal joint of antennæ, the mandibles, all coxæ, femora and tibiæ ferrugineous. Head, pronotum (except black before tip), most of propodeum, the pleura, apical bands on first four segments of abdomen sericeous, the first segment also sericeous in middle above, not on sides, tarsi yellow brown; wings slightly fumose, much darker toward tip.

Clypeus very broad, truncate in front; third joint of antennæ scarcely if any longer than first, a faint median line from anterior ocelli down to antennæ; face about as broad as in *ferrugineipes;* ocelli a little closer to eyes than to each other; front basitarsus with but two comb-spines; mid and hind tibia with a few spines above, inner spur of hind tibia about one-half of basitarsus; in fore wing the second submarginal cell is no longer than the marginal.

Length 5.5 mm., fore wing 4.5 mm.

From El Paso, Texas, 11 July (J. Bequaert). Type M.C.Z. 17030.

Separated from *A. ferrugineipes* not only by the front and mid legs and basal joint of antennæ yellowish, but by the sericeous basal abdominal segment; in *ferrugineipes* it is across both base and tip.

Aporinellus basalis sp. nov.

♀ Deep black, face, clypeus and basal joint of antennae densely sericeous, vertex bare, front half of pronotum sericeous and a narrow white band on mesonotum connecting the bases of the wings; the metanotum outside of the scutellem sericeous, propodeum sericeous, pleura sericeous, but usually part of sides black; legs (except tarsi) also sericeous; abdomen with rather narrow sericeous bands on apex of first, second, third, and fourth segments, the first segment also shows a median area sericeous, but the sides are deep black; venter with three narrow sericeous bands. Head very narrow, face (including clypeus) much more narrow than in *A. fasciatus;* no evident median line on face; posterior ocelli closer to eyes than to each other, ocellar triangle not as low as in *A. fasciatus;* antennæ, spines on legs, and venation as in *A. fasciatus;* three of the four females have three submarginal cells, the other lacks (as usual) the dividing nervure, when present the third is much smaller than the second, and narrowed above.

Length 6 mm., fore wings 5.5 mm.

From Tempe, Arizona, 2 August (J. Bequaert). Type M.C.Z. 17031.

Readily separated from others by the narrow face.

Male taken at same time is very similar, more slender, the propodeum is sericeous all over, four segments banded at tip, and much resembles *A. apicatus*, but lacks the white spot at tip of abdomen, and has a narrower face.

Episyron laevis sp. nov.

♀ Black, no yellow on orbits nor on abdomen. Resembles *biguttatus*, but with much less and shorter hair, and with the third joint of antennae not nearly as long as in *E. biguttatus*, not nearly equal to width of vertex; there are three comb-spines on front basitarsus as in *biguttatus*, but all are longer, the apical one reaching much beyond the tip of the second tarsal joint, and more than one-half the length of the basitarsus, other comb-spines also extra long. The hair on head is short, as also that on pronotum, the pleura are not hairy, except very minute ones; the propodeum with a few erect hairs, and a few on basal abdominal segment above; venter with hairs only toward tip; the femora show no hair below; long spur of hind tibia two thirds of basitarsus. Wings and venation similar to *biguttatus*.

Length 7.5 mm., fore wing 7 mm.

From Fedor, Lee Co., Texas, 27 March (G. Birkmann). Type M.C.Z. 17032.

Episyron arizonica sp. nov.

♀ Bluish black throughout, no pale on orbits nor on abdomen; wings nearly uniform black, only little darker towards tips. Head and thorax and basal abdominal segment hairy as in *E. biguttatus*. The femora with very fine short hairs beneath as in *biguttatus* (not long as in *californica*). Front tarsi with three comb-spines on front basitarsus, but all, as well as others, longer than in *biguttatus*, the one at tip extending over tip of second tarsal joint, otherwise legs spined as in *biguttatus*; third joint of antennae long as in *biguttatus*, no median line on lower face as shows in *biguttatus*. Abdomen more slender than in *biguttatus*, scarcely any hairs on basal part of venter, many near tip; venation as in *biguttatus*.

Length 11 mm., fore wing 10 mm.

From Apache Camp, Santa Catalina Mts., Arizona, 25 July, 5,500 ft. (J. Bequaert). Type M.C.Z. 17033.

Sericopompilus fumosus sp. nov.

♂ Body and antennae black, the hind border of the pronotum with a yellowish band; fore wings black except the base; hind wings fumose, base clearer; legs black, hind tarsi with the upper half of the second, third, and fourth joints and on mid tarsi, the upper half of first, second, third, and fourth joints white, hind tibia with a white streak on basal half above.

Body very slender as in *S. cinctipes*, and the structure generally similar. Clypeus rounded below; ocelli in a low triangle, the posteriors a little nearer to eyes than to each other; hind border of pronotum broadly arcuate; propodeum scarcely arched, with a silvery sheen in certain lights; abdomen black, beneath with a few fine hairs, most numerous near the tip; long spur of the hind tibia two-thirds of basitarsus. Wings with venation very similar to *S. cinctipes*, but the third submarginal cell is less narrowed above, and the second recurrent ends at middle of third submarginal.

Length 7 to 8 mm., fore wing 7 to 8 mm.

Type M.C.Z. 17050. From Colorado Springs, Colo., 12 to 19 July (Klots), and Hot Springs, So. Dak., 9 to 19 July (Severin).

Sophropompilus mohave sp. nov.

♀ Differs from *bradleyi* and *tumiformis* in less hairy head and body. From *subangulatus* in shape of pronotum and in shorter propodeum, from *parvus* in having ocelli about as near eyes as to each other.

Deep bluish black, antennae and tarsi dull black, fore-wings violaceous black, hind wings hyaline, tips clouded; clypeus and lower part of face silvery. Clypeus broad, truncate in front; face with very short hairs; vertex nearly straight across, with some long hairs; ocelli subequal, in low triangle, posteriors about as near to eyes as to each other; occiput strongly silvery; antennae short as usual, third joint not longer than fourth; pronotum arcuate behind, with few extremely short hairs above; propodeum fully as short as in *parvus,* with few, short erect hairs above; pleura without hair; abdomen with only a very few short hairs near tip above, below more hairy, but also short. Legs smooth on femora and tibiæ, front coxæ with a few long hairs in front, mid and hind tibiæ with short scattered spines; inner spur of hind tibia a little more than one-half of basitarsus; front tarsus with three long comb spines on basitarsus. Venation very similar to eastern *S. hyacinthinus,* but the marginal cell longer, in this respect like the western *S. tumifrons.*

Length 9 mm., fore wing 6.5 mm.

From Tempe, Arizona, 1 August, and southern Arizona (J. Bequaert). Type M.C.Z. 17034.

Psammochares fabricii, nom. nov.

Dr. J. Bequaert has shown that the *Sphex tropica* of Fabricius (which is a Psammocharid) is not the same as the older *Sphex tropica* of Linnæus (which is a *Vespa*). It is therefore necessary to rename the species which Cresson (Trans. Amer. Ent. Soc. I, 98, 1867) treated as *Pompilus tropicus*; I presume, but do not know, that the species called *Sphex tropica* by Fabricius is the same.

Psammochares catalinæ sp. nov.

♀ Black throughout, head and thorax, pleura, propodeum with front coxæ hairy; not quite as much so as in *P. scelestus*, the femora not hairy, or with a few fine hairs, the mid and hind femora on apical part with distinct short spines rising from pits (these not in *scelestus*.) Face narrower than in *P. scelestus*, plainly narrowed above; the ocelli in a more nearly equilateral triangle, the posteriors only a little nearer to each other than to eyes; third joint of antennæ one and a third as long as the fourth; pronotum strongly angulate behind as in *P. scelestus;* propodeum sloping as in *P. scelestus*, not quite as much arched, a distinct median line on basal part; abdomen with a few hairs on base of first segment, and on tip and along venter. Legs of moderate length, with only a few extremely fine short hairs; front basitarsus with but three comb-spines, no shorter spine before them; inner spur of the hind tibia a little more than one-half of basitarsus. Wings with venation about same as in *P. scelestus*, second and third submarginal usually a little shorter in proportion and subequal in length. The male is very similar, but much more slender; the ventral plate has a very prominent median carina on the basal part, no hair-tufts; tip of abdomen is somewhat silvery in certain lights.

Length 9-10 mm., fore wing 8 mm., male 8 mm.

From Mt. Lemon, Santa Catalina Mts., Ariz., 6000 to 9150 ft. (mostly at 7800 ft.), 27 to 29 July (J. Bequaert).

Readily separated from *P. scelestus* by the narrower face, only three comb-spines on front basitarsus, less hairy body, and by the minute spines above on mid and hind femora. Type M.C.Z. 17039.

Cryptocheilus arizonicus sp. nov.

♀ Body, antennæ, and legs black; wings yellowish, tips black. Clypeus broad, broadly concave in front, more so than in *C. terminatus;* vertex rounded; ocelli subequal, in a low triangle, posteriors almost twice as close to each other as to eyes; antennæ not very long, slender, third joint long, one-half longer than the fourth; occiput without long hair;

pronotum moderately long, angulate behind, not hairy; pleura and propodeum also without hair, propodeum rather short, at first nearly horizontal, then suddenly bending down, basal part smooth, but apical part very plainly finely striate, the striæ strongest near tip. Abdomen with a few hairs near tip and on apical half of the venter. Legs of moderate length, spined about as in *C. terminatus,* inner spur of hind tibia short as in that species, some long hairs on front of front coxæ. Wings also similar to *C. terminatus,* the marginal cell a little more pointed at tip, first recurrent ends beyond middle of second submarginal, second recurrent at middle of third submarginal.

A male is similar, with very long, slender antennæ, the clypeus not excavate in front, the propodeum distinctly finely striate, and more toward base than in the female. The ventral plate is broad, with a median carina which on the basal part widens to a triangular area, not margined by carinæ, very similar to the plate of *C. birkmanni.*

Length ♀ 13 mm., fore wing 10 mm.; ♂ 10 mm.

From Tempe, Arizona, 1 August (J. Bequaert).

Readily separated from *C. terminatus* by the striate posterior part of propodeum. Type M.C.Z. 17035.

Cryptocheilus attenuatus sp. nov.

♂ Body and legs black, clothed with fine appressed pubescence, antennæ beyond the second joint yellow, wings yellowish, tips broadly black. Face rather narrow, clypeus broad, truncate in front, vertex rounded from eye to eye, ocelli subequal, posteriors much nearer to each other than to eyes, vertex with a few erect hairs, thorax without long hairs; pronotum rather long, arcuate behind; propodeum rather long, evenly arched, sides parallel; abdomen elongate, slender, hairs only on the last segment, pygidium margined on each side by a row of curved upturned hairs, and a median row of smaller hairs; ventral plate much longer than broad, tapering toward tip, with a faint median carina. Wings rather slender, marginal cell broadly rounded at tip, where it scarcely surpasses end of the third submarginal, being much more than its length from the tip of wing;

second submarginal a little longer than high, third but little longer than second, but wider, upper side fully two thirds of lower; first recurrent ends at middle of second submarginal, second recurrent, which is evenly curved, ends beyond the middle of the third submarginal.

Legs not very long, but tarsi long; front tibia with only a trace of spines beneath, front basitarsus not spined above, mid tibia with two rows of a few weak spines, or bristles above, hind tibia with two rows of about eight short bristles above, inner spur of hind tibia scarcely two fifths of basitarsus, last joint of hind tarsus with only two or three small spines beneath.

Length 9 mm., fore wing 5.5 mm.

From New Braunfels, Texas, 27 June (J. Bequaert). Type M.C.Z. 17036.

The last joint of hind tarsus would almost place this in *Priocnemis,* but the shape of the marginal cell and the palpi is that common in *Cryptocheilus.* Its slender body separates it from all other species that I have seen.

Onochares gen. nov.

In general similar to *Cryptocheilus;* last joints af all tarsi with spines beneath; claws with tooth near middle; marginal cell pointed at tip; entire body, coxæ, femora, and tibia with long hair; even on the abdomen above; the hind tibia beneath with long hairs (no spines), above the hind tibia is densely hairy, there is an inner row of teeth without spines, and among the hairs an outer row of very short spines, hind basitarsus without spines.

Separated from *Cryptocheilus* by the armature of hind tibia, the more pointed marginal cell, and hairy body and legs.

Includes *C. rugosus* Bks. Type *O. brazoria* n. sp.

Onochares brazoria sp. nov.

♀ Body, legs, and antennæ black; the tips of several joints of the antennæ narrowly reddish; wings ferruginous, extreme tips black. Body and legs hairy all over, those on head, pronotum, and upper side of abdomen rather short.

Clypeus broad, slightly concave on margin below; a line above base of the antennæ about one-half way up; ocelli large, posteriors very much nearer each other than to eyes; third joint of antennæ scarcely longer than the fourth, second and third about one-half of vertex-width; pronotum arcuate behind; propodeum short, high, rounded, steeply sloping behind, on basal part a median line very faint, no transverse wrinkles. Abdomen rather long, flattened above, last segment very densely hairy, basal parts of ventral segments without hair, surface punctulate; pleura very hairy, above the mid coxæ the mesopleura projects almost cone-like; legs rather short, front tibia with short spines below almost to base, mid and hind tibiæ without spines beneath, only long hairs, above armed as mentioned in generic description, the teeth about ten in number on hind tibia; long spur of hind tibia slightly incurved at tip, not one-third of the basitarsus. Wings similar to most *Cryptocheilus;* in hind wing the anal is nearly interstitial with the cubital fork; in fore wing the basal is much before the transverse; the marginal cell long, but with a pointed tip; second submarginal about one-half longer than high, third much longer below, scarcely longer above than second; first recurrent ends near middle of the second submarginal cell, second recurrent ends much before the middle of the third submarginal, this vein is only a trifle bowed outward.

Length 18 to 20 mm., fore wing 15 mm.

From Fedor, Lee Co., Texas (Birkman).

Type M.C.Z. 17037.

Priocnemis alienatus borealis var. nov.

Structurally similar to *P. alienatus;* differs in having the hind, as well as other, legs black, and in having but the first two segments of abdomen reddish. It represents a northern form with less red than usual, in contrast to Texas and Mexico specimens (*P. rupex* Cress.) which have the abdomen entirely red.

Specimens from Mt. Whiteface, N. Y., 22-24 August; Stony Brook Reservation, Mass., 21 June; and Alton, N. H., 11 August (Banks). Type M.C.Z. 17038.

Priocnemis oregona n. nov.

Priocnemis comparatus Walker was described in *Pompilus;* there was a previous *Pompilus comparatus* by Smith in 1855, therefore a new name is necessary for our species.

Priocnemis apache sp. nov.

♀ Body, legs, and antennæ ferrugineous throughout, tips of antennæ and last joints of legs a little more brown. Fore wings yellowish hyaline and with three brown bands, one over basal nervure, one behind the stigma, and one at apex; hind wings yellowish hyaline, with a broad dark band over tip. Clypeus large, truncate in front, with mostly golden appressed hair; vertex with some long erect hairs; ocelli equal, posteriors nearer to each other than to eyes, vertex straight across eye to eye; antennæ long and slender, third joint one-fourth longer than fourth, latter not longer than next; occiput, pronotum, and front coxæ with long yellowish hair, also rather long hair on scutellum and propodeum, latter with appressed yellowish pubescence behind, especially on sides; pronotum angulate behind. Abdomen moderately flattened and rather broad in middle, with yellowish hairs towards apex and on venter. Pleura with fine long, yellowish hair. Legs almost devoid of hairs, front tibia with a few minute spines, mid tibia with two rows of spines above, hind tibia with two rows of about twelve teeth above, last joint of hind tarsi without spines beneath, inner spur of hind tibia not quite one-half of basitarsus. Fore wings with marginal cell not its length from tip, second submarginal longer than high, both ends oblique, third submarginal one-half longer and wider behind, upper side one-third shorter than lower, first recurrent ends beyond middle of second submarginal, second recurrent ends a little before middle of the third submarginal cell. Veins yellowish, except in dark areas where they are brown.

Length 18 mm., fore wing 15 mm.

From Apache Canon, Santa Catalina Mts., 5500 ft., 25 July (J. Bequaert) and southern Arizona. Structurally similar to *P. nuperus*, and like that belonging to the subgenus *Priocnessus*. Type M.C.Z. 17040.

Priocnemis kiowa sp. nov.

♀ Body dull black, or very dark brown; femora and tibiæ the same, tarsi more brown, first and second joints of antennæ brown, beyond yellow, last two joints more brown. Wings black, tips scarcely paler. Clypeus large, front margin truncate, with appressed yellowish hair, and longer more erect bristles; ocelli equal, posteriors much closer to each other than to eyes; vertex straight across, with some erect black hairs; antennæ moderately long, third joint about one-third longer than the fourth, which is scarcely longer than each of the four following. Occiput, front coxæ and prosternum with much long black hair; pronotum with short black hair above, angulate behind, scutellum and propodeum with long black hair, as also on the pleura. Abdomen somewhat depressed, about as broad as *P. nuperus,* with much black or brown hair toward tip and on venter. Legs scarcely hairy, a few minute spines on front tibia, mid tibia with two rows of yellowish spines above, hind tibia with two rows of about 10 teeth above, inner spur of hind tibia almost one-half of the basitarsus, last joint of hind tarsus without spines beneath. Marginal cell of fore wings of the same shape as in *P. nuperus* and *apache,* the second submarginal longer than high, the third submarginal one-half longer and wider behind than the second, upper side about one-half of lower, first recurrent ends beyond middle of the second submarginal, second recurrent ends at middle of the third submarginal.

Length 15 mm., fore wing 13 mm.

From Walthena, Kansas, 23 July (W. M. Mann).

Like *P. apache,* it belongs in the subgenus *Priocnessus,* and like that species is structurally close to *P. nuperus.*

Type M.C.Z. 17041.

Priocnemis reynoldsi sp. nov.

♀ Head, thorax, legs, and antennæ dull black, abdomen yellowish above and below, wings pale yellowish hyaline, tips infuscated, veins yellowish. Clypeus very broad and low, in front faintly rounded, with appressed gray hair, and some longer yellowish ones; vertex plainly rounded from eye to eye; anterior ocellus rather larger than the posteriors, latter plainly a little nearer to each other than to the eyes; all front of head and vertex with appressed pale hair, no longer hairs; occiput and base of front coxæ with a few long hairs; antennæ very slender, third joint only about one-fourth longer than the fourth, which is no longer than any of the four following. Pronotum rather long, arcuate behind, clothed with appressed hair, as likewise the rest of the notum and the propodeum, latter rather low and evenly rounded, pleura without hair. Legs very long and slender especially the tarsi, coxæ and femora with only fine pubescence, front tibia with a few minute bristles beneath, front basitarsus with a few minute spines above, mid tibia with two or more rows of bristles above, hind tibia with two rows of about ten low teeth, each tipped with a minute bristle or spine, inner spur of hind tibia scarcely two-fifths of the basitarsus, hind tarsi especially long, claws with a minute tooth toward base. Abdomen convex, not very broad in middle, with appressed fine pubescence, only a few pale hairs near tip, none on venter except near tip.

Fore wings with marginal cell rather long, its outer side scarcely curved, and the end is out almost as far as the end of the third submarginal cell; second submarginal much longer than high, base more oblique than tip, third submarginal but little longer than the second, but wider behind, upper side about two-thirds of the lower; first recurrent ends at middle of the second submarginal, second recurrent a little before middle of the third submarginal, basal a little disjointed from transverse.

Length 14 mm., fore wing 10 mm.

From Ft. Reynolds, Colo. (Mills coll., Peabody Acad.). Type M.C.Z. 17042.

By the rounded vertex, long legs, and appressed hair, and venation it is similar to *P. incitus;* that species has a black abdomen.

Priocnemis pretiosa sp. nov.

♂ Black, tarsi more brown, wings yellowish on basal two-thirds, beyond infuscated. Body with minute appressed pubescence, practically no long hairs, two or three each side on vertex, and a few at tip of the abdomen. Face rather broad, vertex arcuate from eye to eye, clypeus moderately broad, slightly rounded below, eye extending a little below corner of clypeus; antennae situate close to clypeal margin, moderately long and slender, third joint hardly as long as first and second combined, and barely if any longer than the fourth; anterior ocellus larger than the posteriors, latter plainly nearer each other than to the eyes; pronotum moderately long, angulate behind; propodeum low, finely punctate, a faint median line; abdomen rather slender, almost polished, ventral plate a little longer than broad, slightly produced in middle behind, surface hairy, with some stout bristles on margin, a row of longer ones across tip; legs moderately long, front tibia without bristles, none above on front basitarsus, mid tibia with two rows of minute bristles above, hind tibia with scarcely more distinct bristles above, about eight in each row, inner spur of the hind tibia more than one-half of the basitarsus. Wings rather slender, out to the stigma yellow, and with yellow veins, a brown cloud in the basal half of marginal cell, in most of second submarginal, and most of second discoidal cells; a similar, broad, brown cloud over the apex; hind wings yellow on basal part, tip infuscated; in forewing the marginal is pointed at tip which is less than length of marginal from tip of wing, and beyond the end of third submarginal; second submarginal scarcely longer than high, third submarginal a little longer, but narrowed above, first recurrent ends at middle of second submarginal, second recurrent ends before middle of third submarginal, basal and transverse widely disjointed.

Length 5 mm., fore wing 5 mm.

One from Mt. Lemon, Santa Catalina Mts., Arizona, 6000 ft., 27 July (J. Bequaert). Type M.C.Z. 17043.

A female taken at same time is wholly black with blackish wings; its structure is closely similar to the male; it may be the female of the species.

Priocnemis arizonica sp. nov.

♀. Very similar to *P. facetus* except that the abdomen is wholly black, and no band over the basal and transverse nervure of the forewing. Head, thorax, legs, and antennæ yellowish, tips of hind tibiæ, and tips of hind tarsal joints darker, forewings with a dark cloud behind the marginal cell and another over the tip of wing, veins brown, elsewhere and the hind wing hyaline.

Clypeus broad, rounded below, clothed with yellowish hair; antennæ a little longer than in *P. facetus*, third joint a trifle longer than the fourth; ocelli subequal, posteriors nearer to each other than to the eyes; vertex nearly straight across, with two or three erect hairs each side; occiput with scattered pale hairs, similar ones on prosternum and front coxæ; pronotum rounded behind as in *facetus;* propodeum with some white pubescence each side behind near tip, also silvery pubescence on most of the pleura, and on middle and hind coxæ. Front tibia with a few bristles beneath, mid tibia with two rows of a few bristles above, hind tibia with two rows or eight or nine small, but distinct, teeth above, each tipped with a bristle; inner spur of hind tibia about two-thirds of the basitarsus. Marginal cell of fore wings pointed at tip, not its length from tip of wing, and extending as far out as the tip of the third submarginal cell; second submarginal a little longer than high, third much longer, but upper side only about two-thirds of lower side, first and second recurrent veins end at middle of second and third submarginal cells, second recurrent only faintly sinuate, basal and transverse slightly disjointed.

Length 7.5 mm., fore wing 5.5 mm.

From Tempe, Arizona, 2 Aug. (J. Bequaert).

Type M.C.Z. 17044.

Priocnemis navajo sp. nov.

♀ Black throughout, abdomen polished, thorax and head finely punctate; wings dark, but darkest on tip, and in second and third submarginal cells and in the second discoidal, similar to *P. conicus*. Clypeus broad, truncate below; ocelli subequal, posteriors a little nearer each other than to eyes; vertex nearly straight across, with a few erect hairs, a few hairs on face; third joint of antennæ not as long as first and second combined; hind margin of pronotum scarcely angulate in middle; propodeum at first nearly flat, then down-curved, without noticeable long hairs above; pleura also devoid of hairs. Abdomen without hairs except near tip and on venter; front coxæ with some long hairs, other coxæ without hairs, mid tibia spinulate above, hind tibia with the teeth and bristles like *P. conicus,* but not so large, inner spur of hind tibia about two-thirds of the basitarsus. Fore wings with marginal cell more rounded at tip, not near as pointed as *P. conicus,* about length of cell from tip of wing, stigma much shorter than in *P. conicus,* third submarginal shorter than in *P. conicus,* more like *P. pompilus,* first recurrent ends beyond middle of second submarginal, second recurrent ends a little before middle of third submarginal.

Length 7 mm., fore wing 5.5 mm.

From Apache Camp, Santa Catalina Mts., Arizona, 5500 ft., 25 July (J. Bequaert).

Differs from *P. conicus* in being less hairy, especially noticeable on mid and hind coxæ and thoracic notum; from *P. pompilus* in being more hairy, especially the front coxæ, from both species it differs by the shorter, more rounded tip of marginal cell and the shorter third joint of the antennæ.

Type M.C.Z. 17945.

Deuteragenia pilosa sp. nov.

♀ Body black, with much pale hair, even on the middle of abdomen above with erect hairs; antennæ pale yellowish on base, brown beyond; mandibles pale; front legs (including coxæ) yellowish, other legs brown, the tarsi and mid tibia at tip paler, spurs brown; wings hyaline, marked with dark bands as in *D. caliptera.* Face with appressed gray pubescence, and also erect hairs, hair-basket brown; clypeus broad, truncate in front, with some long hairs; ocelli subequal, in a moderately low triangle, posteriors scarcely closer to each other than to eyes; pronotum rather long, longer than in *D. caliptera,* scarcely angulate behind; antennæ slender, third joint one-fourth longer than the fourth, equal to first and second together; propodeum silvery each side behind, and with some short erect hairs, scarcely a trace of transverse striæ on the propodeum, and no sign of a median furrow; pleura also with fine erect hairs; front coxæ with rather short hairs in front, mid and hind tibiæ not as strongly spinulate above as in *D. caliptera*, inner spur of hind tibia less than two-fifths of the basitarsus; abdomen moderately elongate, with some erect hairs on nearly all segments above as well as below. Wings closely resemble those of *D. caliptera* and the venation is practically the same.

Length 7 mm., fore wing 6.5 mm.

From Lafayette, Indiana, 10 July (J. Bequaert). Type M.C.Z. 17046.

Deuteragenia papago sp. nov.

♀ Black, with some whitish pubescence, but most of the abdomen is shining; wings wholly evenly dark; hair-basket of brown hairs. Clypeus broad, truncate in front; vertex nearly straight across; ocelli subequal, in a low triangle, posteriors plainly farther apart than from the eyes; third joint of the antennæ not as long as first and second combined; pronotum arcuate behind, mesonotum with two fine parallel lines each side, propodeum plainly striate (more so than in *D. caliptera*), with erect white hairs; all coxæ and femora with some white hairs, tibia spinulate above as in *D. caliptera*. Abdomen with erect white hairs on basal segment above, and longer, more numerous hairs near tip, venter also with hairs.

Wings, uniformly fuscous, veins dark brown; marginal cell long and pointed, second and third submarginals short as in *D. caliptera;* first recurrent ends at middle of second submarginal, second recurrent ends much before middle of third submarginal, second discoidal thereby shorter than in *D. caliptera,* basal nervure interstitial with the transverse.

Length 8.5 mm., fore wing 7 mm.

From Southern Arizona (J. Bequaert). Readily separated by the uniform dark wings. Type M.C.Z. 17047.

Our four species of this genus can be separated as follows:

1—Wings wholly dark; hair-basket brown, body and legs and antennæ wholly black ....*papago*
Wings hyaline with two dark bands, or clouds 2

2—Hair-basket white; face and thorax with yellowish pubescence, pronotum arcuate behind; third and fourth section of marginal vein straight and oblique; spots in wing rather faint ....*brevis*
Hair-basket brown; face with gray or whitish pubescence; pronotum slightly angulate behind; third and fourth section of marginal vein somewhat curved, spots in wing very dark and distinct 3

3—Front legs and basal part of antennæ yellowish; abdomen hairy above; propodeum without median groove and no transverse striæ ....*pilosa*
Front legs and antennæ black; abdomen hairy only at tip, propodeum with median groove and transverse striæ ....*caliptera*

Phanagenia gen. nov.

Intermediate between Ageniella and Cryptocheilus. Discoidal cell without pocket; second ventral segment with strong transverse furrow; hind tibiæ with rows of small but distinct bristles above, but no teeth; last joint of hind tarsus with spines beneath in middle as other joints, marginal cell rather long and tip pointed and less than its length from tip of wing, basal disjointed from transverse nervule, claws with a tooth near middle.

Type *P. osceola* n. sp.

The last joint of the hind tarsus allies it to Cryptocheilus, but the very weak spines on the hind tibia with Ageniella. The genus includes also *Ageniella coronata* Fox, from California, and the Eastern *Ageniella bombycina* Cress.

Phanagenia osceola sp. nov.

♀ Black, in some parts with purplish reflections, tips of antennæ paler. Clypeus broadly rounded below, with appressed hair and long erect hairs in front; vertex faintly arcuate, with a few erect hairs each side, and four in the middle; anterior ocellus rather larger than the others, posteriors a little nearer to each other than to the eyes; third joint of antennæ very long, fully one-half longer than the fourth; occiput without long hair; pronotum angulate behind, with a very few fine erect hairs above; pleura with very fine short hairs; propodeum low, evenly curved, without hairs except very fine short ones each side near tip. Legs moderately long, front coxæ with some fine long hairs in front, front tibia with minute spines below almost to the base, mid tibia with short stiff bristles above in two rows and others on sides and below, hind tibia spined in the same manner, inner spur of hind tibia not two-fifths of the very long basitarsus. Abdomen fusiform, with fine hair near tip and on apical part of venter.

Fore wings with a long marginal cell, its tip nearly as far out as the tip of third submarginal cell; stigma wholly dark, very long, nearly four times as long as broad (longer than in *P. bombycina*); second submarginal over once and a half as long as high, third submarginal longer below but not above; first recurrent ends in the second submarginal beyond middle, second recurrent ends before middle of the third submarginal; basal less disjointed from the transverse than in *P. bombycina,* and the transverse is more oblique than in that species, lower part of the basal much bowed, more than in *P. bombycina.*

Length 13 mm., fore wing 11 mm.

From Miami, Florida (A. E. Wight). Type M.C.Z. 17048.

MERMIS PARASITISM IN SOME AUSTRALIAN AND MEXICAN ANTS

By William Morton Wheeler

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Since reviewing in several former papers[1] the modifications induced in ants by Nematode worms of the genus Mermis, I have obtained mermithized specimens of four additional species. Three of these are from Australia, a continent from which no cases of this form of parasitism had been previously recorded. The fourth case, from Mexico, partially bridges a gap in the known distribution of ant-mermithization extending from New England and Colorado to Argentina. In the Old World no cases are known from Asia, Indonesia and Papua, but their occurrence in these regions will be revealed in all probability by examination of sufficient material.

Myrmecia forficata Fabr. var. **rubra** Forel

While I was visiting Mr. John Clark in Melbourne, Victoria, during December, 1931, he presented me with a dried mermithogyne of this large Ponerine ant and informed me that he had seen others. The specimen was taken at Belgrave, Victoria, Jan. 29. It has the appearance of a normal deälated female, but the gaster is unusually voluminous and the postpetiole is very broad, being nearly twice as wide as long. Although the thorax is of the normal female struc-

[1]W. M. Wheeler, Mermis Parasitism and Intercastes among Ants, Journ. Exper. Zoölogy 50, 1928, pp. 165-237, 17 figs.; A Camponotus Mermithergate from Argentina, Psyche 36, 1929, pp. 102-106, 1 fig., and Two Mermithergates of Ectatomma, *ibid.* 37, 1930, pp. 48-54, 1 fig.

ture, I can find no evidence that the specimen has ever borne developed wings. The tegulæ are normal, but each fore wing is represented by a small, hard, jet-black tubercle. There is no trace of a hind wing on the left side, but the right hind wing appears to be represented by a minute rounded tubercle near the lateral border of the metanotum. If my interpretation is correct, we may suppose that the reducing effect of the Mermis on the wings is very much greater in Myrmecia than it is in the mermithogynes of Lasius, which have these appendages merely reduced to about half or one-third their normal size.

I have not seen the normal female of *rubra*, which is described by Clark as very slightly larger than the worker (19-23 mm.) as contrasted with the female of the typical *M. forficata* Fabr., which is considerably larger than its worker. I therefore compare the dimensions of the mermithogyne with those of the females of the very closely related *forficata, lucida* Forel and *regularis* Crawley. A *lucida* female from Hobart, Tasmania (G. H. Hardy) measures nearly 20 mm., its gaster 6 mm. in length and nearly 4 mm. in dorsoventral diameter, the head including the mandibles 6.5 mm., in diameter through the eyes 4 mm. Normal females of *forficata* from New South Wales and Victoria measure about 22 mm., the gaster nearly 7 mm., dorsoventrally nearly 4 mm., the head including the mandibles 6 mm., through the eyes 3.8 mm. The average female of *regularis* from Southwestern Australia measures 18-19 mm. in length; gaster 6 mm., dorsoventrally 3.5 mm.; head with mandibles 6 mm., through the eyes nearly 4 mm. The *rubra* mermithogyne measures nearly 24 mm.; its gaster 9 mm., dorsoventrally 5.5 mm.; the head with mandibles 6 mm., through the eyes 3.6 mm. This specimen therefore shows little modification as the result of parasitism compared with normal females of the closely allied species, except in the greater size of the postpetiole and gaster and its almost complete aptery. Probably, however, the head and thorax are distinctly narrower than in the unparasitized *rubra* female. The extreme, red bases of the gastric segments are exposed and through them portions of a coiled Mermis are distinctly discernible.

Camponotus (*Tanæmyrmex*) consobrinus Erichson

(Fig. 1)

The synonymy of this common and widely distributed Australian Camponotus, which comprises several subspecies and varieties and constitutes a well-defined group in the subgenus Tanæmyrmex, has been confused through failure to recognize the type. This was supposed to be *C. nigriceps* F. Smith (1858), but recently Mr. John Clark has been able

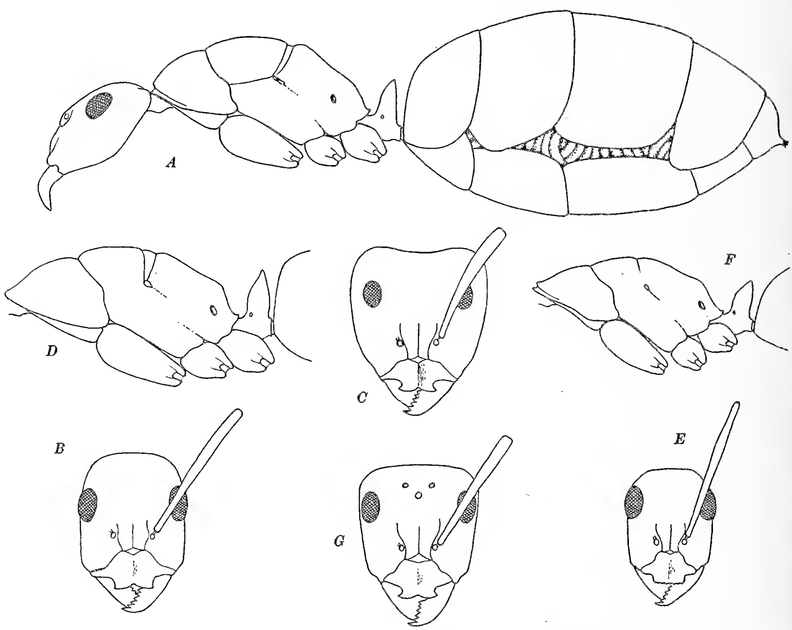


Fig. 1. *Camponotus (Tanæmyrmex) consobrinus* Erichson. *A,* mermithergate (specimen g), in profile; *B,* head of same, dorsal view; *C,* head of worker maxima, dorsal view; *D,* thorax and petiole of same, in profile; *E,* head of worker minima, dorsal view; *F,* thorax and petiole of same, in profile; *G,* head of female, dorsal view.

to identify Erichson's *consobrinus,* which was described as early as 1841. He has therefore suggested the following arrangement of the various subspecies and varieties to replace Emery's arrangement in the "Genera Insectorum."

C. (*T.*) *consobrinus* Erichson (1841). Type locality: Tasmania (= *dimidiatus* Roger, 1858). Common in New South Wales and Queensland.
 var. *obniger* Forel (1902). New South Wales.
 var. *perthianus* Forel (1915). Western Australia.

Subsp. *lividipes* Emery (1887). New South Wales.
 (= *prostans* Forel, 1907).

Subsp. *nigriceps* F. Smith (1858). Southeastern, South and Western Australia.
 var. *pallidiceps* Emery (1887). New South Wales.
 (= var. *clarior* Forel, 1902). Western Australia.

I have taken all of the six valid forms of *consobrinus* in various localities. They nest in open places in the soil under large flat stones, often in rather populous colonies. The largest workers are not very aggressive. Like many of the other Australian Camponoti they are often common in restricted areas and, like many other species of Tanæmyrmex, seem all to be nocturnal foragers.

In four colonies of the typical *C. consobrinus* (*dimidiatus*) among about 20 which I examined on December 14 and 15, 1931 at the Creel, (alt. 3000 ft.) at the base of Mt. Kosciusko, N. S. W., eight mermithergates were taken. Each of two colonies contained only one, one colony contained two and another four of the parasitized individuals. Owing to their large size and swollen gasters they were conspicuous among their normal sisters in the superficial galleries of the nests and were quite as alert in escaping when the stones were overturned. The colonies also contained considerable brood, a few males and immature winged females. Dr. P. J. Darlington has recently brought me a ninth mermithergate of *consobrinus*, which he took March 16, 1932, with a portion of the colony in the McPherson Range, below the National Park in Queensland.

The following are the average measurements (total length and length of gaster) of alcoholic material of the three normal worker forms of *consobrinus*:

Maxima: Length 13-14 mm.; gaster 4-5 mm.
Media: Length 10-11 mm.; gaster 3-3.5 mm.
Minima: Length 8-9 mm.; gaster 2.5-3 mm.

The nine mermithergates (in alcohol), which I designate by letters (*i* being the specimen from Queensland), had the following dimensions:

(a) Length 12 mm.; gaster 6.5 mm.
(b) Length 14 mm.; gaster 7 mm.
(c) Length 15 mm.; gaster 6 mm.
(d) Length 15 mm.; gaster 7 mm.
(e) Length 15 mm.; gaster 7 mm.
(f) Length 15.8 mm.; gaster 7.5 mm.
(g) Length 16 mm.; gaster 6.5 mm.
(h) Length 16.7 mm.; gaster 8 mm.
(i) Length 18 mm.; gaster 9 mm.

With the exception of (c) and (d), all the specimens have the gaster so greatly distended with Mermis that the white intersegmental membranes are more or less exposed; the two exceptions seem to have lost their Nematodes, though their gasters are decidedly enlarged. It will be seen that, with the exception of (a) and (b), all the specimens are longer than the largest normal maxima workers. Yet all have the aspect of large minima workers with abnormal gastric distension. Closer examination, however, shows that they represent a distinct intercaste, in the sense in which I used that term in my paper of 1928, because, while the head is much like that of the minima, the thorax and petiole are clearly of the media and maxima type. The head is somewhat broader than in the smallest minimæ and in several of the specimens less smooth and more sharply shagreened, and all have a faint pit in the place of the anterior ocellus. These are characters of the normal maxima. Specimen (i), however, has three very distinct ocellar pits. The clypeal carina, well-developed in all the normal worker castes, is undeveloped in the mermithergates and reduced to a blunt, elongate, median boss as in the normal female. The sides of the head are also distinctly less convex than in the minima and therefore more like the conditions in the female. The thorax is like that of the maxima, being stouter through the pronotum, higher and more convex in profile, with the epinotum proportionally shorter and more rounded, with less distinct base and declivity than in the minima. The lateral suture of the mesonotum, which is absent in the maxima but well-developed in the female, is distinct in specimens (b), (e), (g) and (i) and faintly indicated in some of the others. There is a distinct though small metanotal sclerite like that of the maxima (absent in the minima), and the foveolæ on the pronotum are also stronger and more numerous as in that caste. In two of the

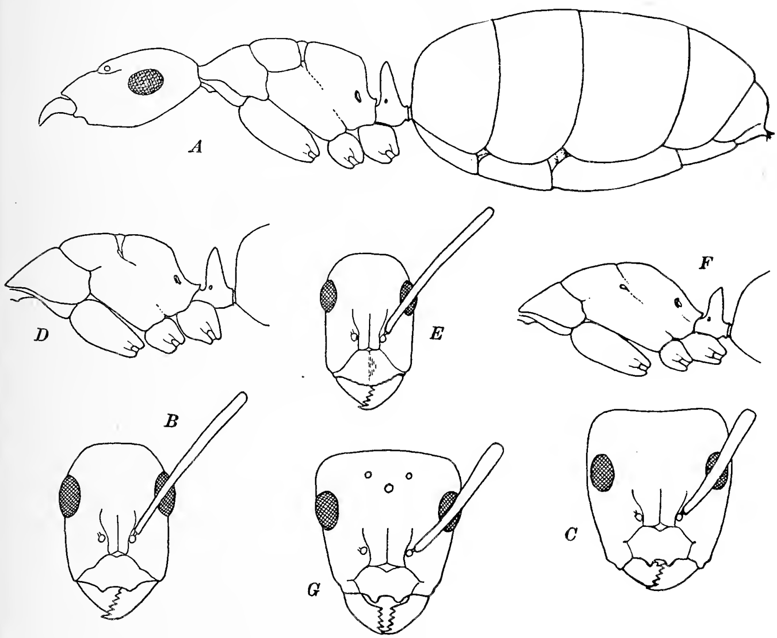


Fig. 2. *Camponotus (Myrmophyma) claripes* Mayr subsp. *piperatus* subsp. nov. *A*, mermithergate, in profile; *B*, head of same, dorsal view; *C*, head of worker maxima, dorsal view; *D*, Thorax and petiole of same, in profile; *E*, head of worker minima, dorsal view; *F*, thorax and petiole of same, in profile; *G*, head of female, dorsal view.

mermithergates, (b) and (g), the metanotum is decidedly larger and broader than in the normal maxima and therefore more as in the female. In (g) even the scutellum of the latter seems to be indicated by faint lateral impressions but not by a suture marking it off from the mesonotal scutum. The petiole of all the mermithergates is like that of the normal media and maxima in being stouter, broader and with more broadly rounded apical border than in the minima. In (h) this border is even very feebly emarginate in the middle as in some maximæ. The coloration and pilosity of all the mermithergates is that of the normal maxima, media and minima, except (d) and (h), which have the posterior corners of the head red.

Camponotus (*Myrmophyma*) **claripes** Mayr. (Fig. 2)

C. claripes is one of the most variable and widely distributed of the Australian Camponoti. It is an inoffensive ant which lives in the soil under stones and logs in rather small colonies. According to my observations, the worker media is either extremely rare or nonexistent, as in many species of the subgenus Colobopsis, so that the worker caste is sharply divided into minimæ and maximæ. Since the typical *claripes* was described by Mayr in 1876 from Peak Downs, Queensland, seven subspecies and varieties have been added by Forel, Viehmeyer and Crawley, but the material in my collection shows that these by no means exhaust the existing variants. Although the species needs revision, I here describe only one of the hitherto unrecorded forms, because it yielded a mermithized specimen.

Camponotus (*Myrmophyma*) **claripes** Mayr
subsp. **piperatus** subsp. nov.

Worker maxima. Length 8-10 mm.

Head shaped as in the typical *claripes*, but with slightly more convex sides; thorax shorter and higher, especially at the epinotum, which has a much steeper concave declivity, distinctly longer than the convex base. Punctures on the subopaque clypeus and cheeks smaller, more superficial and not elongated. Pilosity as in the type, but somewhat less abundant on the cheeks. Color brownish ivory yellow, legs paler; tip of gaster, a band across each of its more anterior segments, apex of the petiolar node, epinotum, sides of the mesonotum and more or less of the dorsal surface of the head brown or dark brown, the pronotum and paler portions of the gaster spotted with brown; tips of mandibles, antennal funiculi, tarsi, knees and tips of tibiæ, clypeus, gula, corners of the head, and a broad transverse band on each cheek yellowish or brownish red.

Worker minima. Length 4-6 mm.

Smaller than the minima of the typical *claripes*, with distinctly broader head and shorter and more convex thorax, the base of the epinotum more rounded and less distinctly marked off from the declivity. Ivory yellow, legs somewhat paler and more whitish; mandibles, funiculi, tarsi, knees and tips of tibiæ reddish; posterior third or fourth of the head, dorsal border of petiole and two last segments of the gaster dark brown; each of the gastric segments with a narrow posterior brown fascia, the remainder of its dorsal surface and that of the thorax spotted with brown.

Female. Length 11-12 mm.

Closely resembling the female *claripes* in form, but the sculpture of the clypeus and cheeks as in the maxima. Head similarly colored, but the thorax dark brown, except the pronotum and mesosterna, which are dull ivory yellow, spotted with brown; gaster dark brown with only the anterior and posterior borders of the segments and the anterior surface of the first segment ivory yellow, the latter with brown spots. Wings long (12 mm.), distinctly infuscated, and as in the typical *claripes*, with resin-brown veins and pterostigma.

South Australia: Mt. Lofty, type locality (Wheeler) ♃ ☿ ♀; Adelaide (F. R. Zietz, A. M. Lea) ♃ ☿ ♀; Belair (J. W. Haacke) ♀.

Victoria: Sea Lake and Ultima (J. C. Goudie) ♃ ☿.

New South Wales: The Creel, Mt. Kosciusko, 3000 ft. (Wheeler) ♃ ☿ ♀; Jenolan Caves (J. C. Wiburd) ♃ ☿; Katoomba (Wheeler) ♃ ☿.

Some of these series show departures in coloration, but they are not sufficiently constant to justify distinct varietal names. Thus the maximæ from the two localities in Victoria have the gaster almost entirely dark brown, and those from Katoomba not only show considerable variation in the amount of dark brown in the gaster, but often have the entire head reddish yellow, with the exception of a median spot on the vertex.

The single mermithergate of *C. piperatus* was taken December 14, 1931, from a small colony at the Creel on Mt. Kosciusko on the same hillside as the eight *consobrinus* mermithergates described above. It measures 10.3 mm. and is therefore somewhat longer than the normal maxima. The head measures 1.6 mm., the gaster, containing a well-developed Mermis, 5.3 mm. The general aspect of the specimen is that of a huge minima, but the head is distinctly broader in proportion to its length and the thorax and petiole are those of a maxima. The thorax has a distinct metathoracic sclerite and the epinotum is high, with a perceptible angle between the base and declivity. The petiolar node is robust, with a feebly notched superior border. The anterior portion of the head approaches that of the maxima in having a more uneven and more coarsely punctate surface than the minima. The color, too, is like that of the maxima, since the mesonotum and posterior portion of the epinotum are dark brown. The gaster is very pale even at the tip; the brown spots are pronounced on the pronotum, but pale and scattered on the gaster. Except for the smaller and narrower head, the specimen might be said to resemble a media, but this subcaste, as previously stated, does not seem to exist in *claripes*.

Camponotus (*Myrmothrix*) **abdominalis** Fabr. subsp. **stercorarius** Forel (Fig. 3)

C. abdominalis is a common and very aggressive, neotropical ant, quite as variable and widely distributed as the two Australian species above noticed. It ranges from southern Florida and Texas to southern Brazil as a "Formenkreis" embracing no less than 13 subspecies and 5 varieties. Most of these forms nest in moderately large colonies in dead branches or rotten wood, but some of them live, at least temporarily, in the ground under stones. This is true of the subspecies *floridensis* Buckley of Florida and the Central American and Mexican *stercorarius*. Forel (1884) long ago described the nesting habits of the latter from observations made by Stoll in Guatemala as follows: "This race is abundant in Central America. Mr. Stoll found it and varieties transitional to *esuriens* very common in the environs of Guatemala City and Antigua (cities at an altitude, with cool climate), making its nest in dry cowdung and often also under stones. Mr. Stoll has also found small

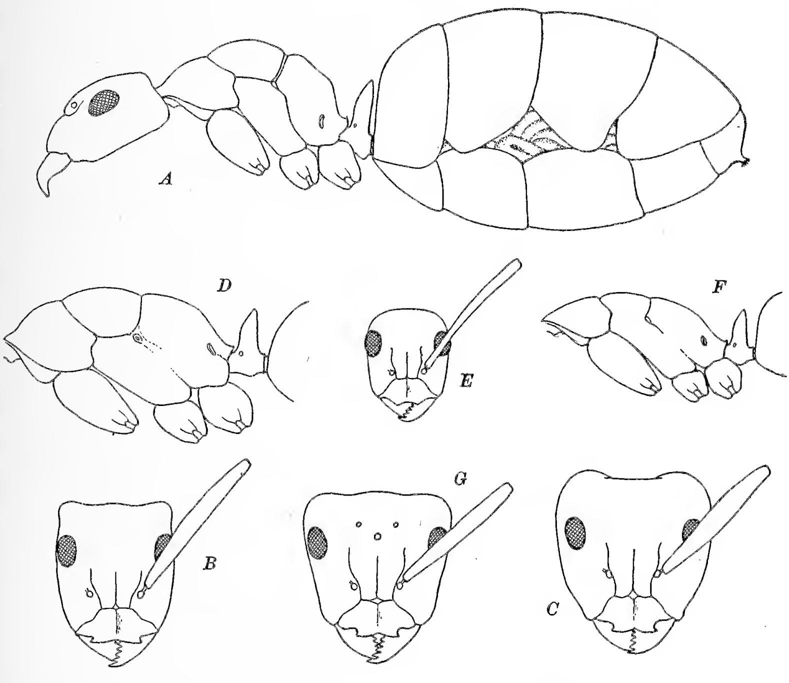


Fig. 3. *Camponotus (Myrmothrix) abdominalis* Fabr. subsp. *stercorarius* Forel. *A*, mermithergate, in profile; *B*, head of same, dorsal view; *C*, head of worker maxima, dorsal view; *D*, thorax and petiole of same, in profile; *E*, head of worker minima, dorsal view; *F*, thorax and petiole of same, in profile; *G*, head of female, dorsal view.

formicaries of *C. stercorarius* established in the large dried fruits of *Lucuma mammosum* that had fallen to the ground. These fruits have a hard rind 15 cm. long enclosing a soft pulp and a hard pit 7 to 8 cm. in length. The ants with their larvæ and cocoons simply occupied the cavity of the fruit from which they had probably removed the pulp."

An interesting mermithergate of *stercorarius* was sent me, with a portion of the colony in which it was living, by Dr. Wolfgang von Hagen, who took it during September, 1932, in the state of Guerrero, Mexico. It differs from the mermithergates of *consobrinus* and *piperatus* in being more clearly a modified maxima with some of the characters of the female. Though smaller and narrower, the head combines the characters of these two castes as shown by its sculpture, the shape of the antennæ, mandibles, clypeus, frontal carinæ, etc. The normal maxima measures 12-13 mm., its petiole and gaster 4-4.5 mm., its head, including the mandibles 4.6 x 3.5 mm. The normal female is 14-15 mm. long, the gaster and petiole 6.5 mm., the head 3.5 x 3 mm. The corresponding measurements of the mermithergate are: total length (in alcohol) 15 mm.; gaster and petiole 7 mm.; head 3.5 x 2.5 mm. Its head is decidely longer than broad, nearly as broad in front as behind, with rather straight subparallel sides, the posterior border less concave than in the maxima, the posterior corners rectangular as in the female, but with a distinct transverse impression on each side just behind the eye. This impression is absent in all the normal female castes. Eyes larger, more convex and situated more laterally when the head is viewed from above than in the maxima and therefore more like those of the female. There are no traces of ocelli. Mandibles convex like those of the maxima, with coarse teeth, but the terminal tooth is longer, as in the female. Antennal scapes stout and distinctly flattened distally as in the large media, maxima and female, extending half their length beyond the posterior border of the head (in the maxima less than 1/3, in the female about 2/5). Clypeus shaped as in the maxima, carinate, but with the anterior lobe shorter though angularly excised in the middle and strongly toothed at each lateral corner. Thorax also like that of the maxima, but smaller, shorter and somewhat more convex in the mesonotal region, with more sloping base to the epinotum. Metanotal sclerite very short as in the maxima but more distinct owing to the more pronounced mesoëpinotal impression. Petiole decidedly larger and broader than in the maxima, its superior border distinctly notched in the middle, so that it is very similar to the petiole of the female. Gaster very large and swollen, even larger than in the virgin female, with the dorsal sclerites more or less separated, revealing the coils of one or more Nematodes through the tense intersegmental membrane. Legs longer than in the maxima, median and hind femora more slender. Sculpture, pilosity and color as in the maxima but the sides of the pro- and mesonotum with some coarse elongate grooves which are found neither in any of the normal worker forms nor in the female. Similar but finer, parallel grooves occur on the dorsal sclerites of the three first gastric segments. Traces of these grooves occur, however, on the first gastric segment of some maximæ and on the first and second segments of the female.

The thirteen known mermithergates, representing five species of Camponotus, namely the three above described, *C.* (*Tanæmyrmex*) *punctulatus* Mayr subsp. *minutior* Forel of the Argentine and *C.* (*T.*) *pompeius* Emery subsp. *cassius* Wheeler of the Congo, are all very similar, if we omit the last, which is merely a parasitized worker minima. Each of them exhibits a combination of worker maxima, worker minima and queen characters in the structure of the head, thorax, petiole and appendages, and may be said, therefore, to represent a pathological "intercaste" produced by Mermis infestation. The queen characters are less pronounced in the mermithergates of Camponotus than in those of Pheidole, which may even possess small ocelli. The late Dr. N. A. Cobb showed that the young Nematodes enter the body-cavity of the ant-larva. They probably undergo little growth or development till the larva is well advanced, but the disturbance they set up in the prepupal and pupal development of the host suffices to bring about a considerable diminution in the size of the head and thorax and a simultaneous greater differentiation of the latter region in the imaginal ant. The series of nine mermithergates of *C. consobrinus* probably arose from a series of larvæ that were, when attacked by the Mermis, at various points on the road to development as normal media and maxima workers or had even begun to develop as queens.

TRICHOPTERA FROM THE MOUNTAINS OF NORTH CAROLINA AND TENNESSEE

By F. M. Carpenter

Museum of Comparative Zoology

The caddis-flies listed in this paper were collected by Professor Nathan Banks, Dr. P. J. Darlington, Jr., and the writer in the Black Mountains of North Carolina and the Smoky Mountains of North Carolina and Tennessee during August and September of 1930. Several specimens collected by Dr. and Mrs. W. S. Creighton in the Black Mountains at about the same time are also included. For the opportunity of studying this material and for many helpful suggestions, I am indebted to Professor Banks. The types of all new species are deposited in the Museum of Comparative Zoology.

The summer of 1930 was very dry in the southern Appalachian region and as a consequence caddis-flies were not very abundant. But about two hundred and fifty specimens were collected, belonging to twenty-three species, including five new ones, as well as three new genera. Several species previously known only from the types were taken in considerable numbers, and both sexes of other species formerly known only by one sex were also secured.

Limnephilidæ

Neophylax mitchelli n. sp.

Text-figure 1

♂ Length of fore wing, 7 mm. Vertex and frons yellow; antennæ light yellow; hairs on head and antennæ golden-yellow; maxillary palpi yellow; basal segments of maxillary palpi not much thicker than the other segments; thorax light reddish brown; abdomen dark reddish brown above, light brown laterally and ventrally; legs light brown. Fore wing: yellowish, with areas of gray or shading; one large light yellow spot on the posterior border; outer margin bordered with gray, the center of the wing more or less maculate; venation as in other members of this genus, Rs forking close to its origin. Hind wing: M reduced as in all other males of Neophylax; M3+4 is in actual contact with

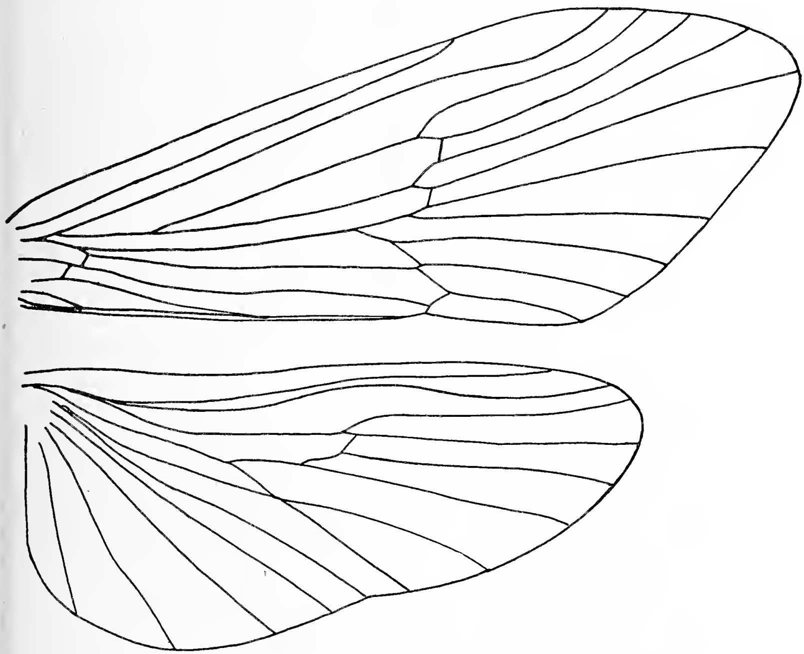


Fig. 1. Venation of *Neophylax mitchelli*, n. sp.

Cu1 for a short distance; M is free from Rs for its entire length, arising independently from the base of the wing. The hind wing is uniformly light yellow.

Holotype (♂): Mt. Mitchell, Black Mountains, N. Carolina, at 5000-6711 ft., Sept. 1, 1930; N. Banks, collector.

This species differs from the previously described members of Neophylax by its color markings and particularly by the free basal part of M in the hind wing. In all other

American species of Neophylax the stem of M fuses with Rs just a little basad of the fork of M. The condition in *mitchelli* is quite unique and probably should rank as a subgeneric division. The spur formula of the type is 1, 2, 3 instead of 1, 2, 4 as usual in the genus. This in all probability is also a subgeneric characteristic, but additional specimens may show that it is only an individual feature and subject to variation.

Allegophylax subfasciatus Say

This common eastern species was taken at three localities: Deep Creek, Bryson City, N. Carolina, 2000 ft., Aug. 20, 27; Newfound Gap, Smoky Mts., Tennessee, 5000-5200 ft., Sept. 1; and on the state road to Newfound Gap, Tennessee, at 3500 ft., Sept. 3.

SERICOSTOMATIDÆ

Notiopsyche Banks

Banks, 1905, Bull. Amer. Mus. Nat. Hist., 21:216.
Banks, 1905, Trans. Amer. Ent. Soc., 32:11.

♂ Spurs 2, 4, 4; ocelli absent; maxillary palpi short and flattened, covered with scales; labial palpi long and slender; basal segment of antennæ longer than head and covered with scales and stout hairs. Fore wing: costal area of wing rather broad, the margin slightly recurved and bearing a series of long hairs, some of which extend backwards to about the middle of the wing; all four branches of Rs present; M with three branches, M1, M2, and M3+4; Cu1 unbranched. Hind wing; costal margin slightly recurved and bearing short recurved hairs; Rs with four branches, M with only two; Cu1 forked.

♀ Similar to the male, except for the following: the maxillary palpi are 5-segmented and normal in shape; basal segment of antennæ long, bearing long hairs, but no scales; the anterior margin of the fore wing is normal and lacks the long, recurved hairs.

Genotype: *Notiopsyche latipennis* Banks.

Banks originally established this genus for *latipennis*, and later (1911) placed another species here (*carolina*). *Latipennis* has previously been known only by the male type, but in the new material obtained in 1930, there are fifteen more specimens belonging to both sexes, which have enabled me to prepare a more complete description of the male and to describe the female for the first time. *Carolina* is known only by the three male types, all from Southern Pines, North Carolina, there being no additional specimens from the mountainous regions of that state. From my examination of these types, which are in the Museum of Comparative Zoology, I am convinced that *carolina* does not belong to Notiopsyche, but to an undescribed, aberrant genus, which I propose to call *Oligopsyche*. The characteristics of that genus will be considered below.

Notiopsyche latipennis Banks

Figure 14.

1905, Bull. Amer. Mus. Nat. Hist. 21; 216.

1905, Trans. Amer. Ent. Soc. 32: 11; pl. 2, fig. 20 (forewing), fig. 27 (♂ genitalia).

♂ Length of fore wing, 8 mm. Face grayish brown; antennæ mostly yellow-brown, the distal edge of each segment dark brown; basal segment dark brown and covered with brown scales and hairs; maxillary palpi movable, bearing yellow scales in the upper surface and dark brown hair and slender scales below; legs and thorax yellowish brown; wings uniformly gray; the anterior margin bearing long yellow hairs, some of which extend backward as far as the middle of the wing; veins and some membraneous areas of the wings bear flat, scale-like hairs. Forewing[1]: fork R4+5 deeper than R2+3; M1+2 divide below the separation of R4+5. The male genitalia have been figured by Banks.

♀ Similar to the male in size, coloration and venation, ex-

[1]The figure of the wing of this insect given by Banks (1905) is not quite correct, and the figure of both fore and hind wing published by Ulmer in the Genera Insectorum (pl. 13, fig. 114) is likewise incorrect. Ulmer accidently labels this wing *Notiopsyche mexicana*.

clusive of the secondary sexual characters mentioned in the generic description.

Holotype (♂): Black Mt., North Carolina, June; in the Museum of Comparative Zoology.

Allotype, by present designation: Bryson City, Deep Creek, North Carolina, 2000 ft., Aug. 25, 1930; N. Banks, collector.

In addition to the allotype, 11 specimens were collected in 1930: 9 at Bryson City, North Carolina, from Aug. 25-27; 1 at Smokemont, North Carolina, 2000 ft., Aug. 24; and 1 at Newfound Gap, Smoky Mts., Tennessee, 5000-5200 ft., Sept. 1.

Oligopsyche, new genus

♂ Spurs, 2, 4, 4; ocelli absent; mouth-parts vestigial, the maxillary palpi reduced to a pair of small papillæ bearing a few short hairs; mandibles and labrum completely absent; labial palpi short, with 3 segments; basal segment of antennæ slender, long, and very hairy; fore wings broad, and bearing a prominent fringe of light yellow hairs; Rs arising close to base of wing; M fused with Rs at the base; Rs and M with two branches each; Cu unbranched. Female unknown.

Genotype: *Notiopsyche carolina* Banks. The genitalia have been figured by Banks (1911).

The species for which this genus is established is one of the most unusual in the family Sericostomatidæ. One of the outstanding features of the members of the family is the elaboration of the maxillary palpi of the male, which are usually enlarged. In *carolina,* the opposite condition has been developed; the palpi are almost entirely lost. This reduction of the palpi is probably a part of the much greater modification, the atrophy of all the mouth-parts. The venation is also much more reduced than is usual in the Sericostomatids.

Phanopsyche grisea Banks

Trans. Amer. Ent. Soc., 1911, 37: 357; fig. 17 (wing), fig. 22 (genitalia).

Four specimens of this species were collected at Newfound Gap, 5000-5200 ft., Smoky Mts., Tennessee; Aug. 30, 31; one at Bryson City, Deep Creek, 2000 ft., North Carolina, Aug. 26; and 1 at Nantahala Gorge, North Carolina, August 25. This series of specimens greatly extends the range of *grisea*, which has previously been recorded only from New York and New Jersey.

Goera calcarata Banks

Figures 8, 13.

Trans. Amer. Ent. Soc. 25: 211, 1899.

One female of this species was collected at Andrews, North Carolina, 1800 ft., Aug. 25. *Calcarata* was originally described from a single female from Sea Cliff, New York, and is represented in the collections at the Museum of Comparative Zoology by several additional specimens from New Jersey, Massachusetts, and New York. Since the male has not previously been described, I take this opportunity to do so.

♂ Spurs 2, 4, 4. Head dark reddish brown; basal segment of antennæ thickened and a little longer than the head hairy, and slightly scaly; palpi light brown, cylindrical, fleshy, almost hairless, except at top, where there is a cluster of long, light yellow hairs; thorax reddish brown; legs yellow. The venation, which is shown in figure 13, is the same as in the female. The male genitalia are illustrated in figure 8.

Allotype, by present designation: Ramsey, New Jersey, July 27, 1917; in Museum of Comparative Zoology.

Pseudogoera, new genus (*Goerinæ*)

♂ Spurs 2, 4, 4; ocelli absent, maxillary palpi slender, cylindrical, covered with long hairs; basal segment of antennæ thickened, but not so long as the head. Fore wing: R1 connected to R2 by an oblique cross-vein below the pterostigmal region; Rs with two branches, M with four; Cu1 unbranched.

Genotype: *Pseudogoera singularis,* n. sp.

Pseudogoera singularis, n. sp.

Figures 2, 12.

♂ Length of fore wing, 6-7 mm.; vertex and frons dark brown; antennæ light brown, the basal segment covered with long, dark brown hairs; maxillary palpi grayish, with long dark gray hairs, those at the base being the longest; labial palpi long, gray; thorax light brown, abdomen dark reddish brown; legs light brown, with darker hairs. Fore wing: broadest beyond middle of wing; Rs arising close to the base; M dividing into M1+2 and M3+4 below the division of Rs; R4+5 separating before R2+3; Cu2 and anal veins apparently absent, although there is a short vein leading from the hind margin and terminating on Cu1 near its distal end; this is probably a remnant of an anal vein which was originally more or less marginal. Hind wing: cross-vein between R1 and R2+3 missing. All four branches of Rs present; M with two branches; Cu1 forked. Genitalia as in figure 2.

Female unknown.

Holotype (♂), Bryson City, Deep Creek, 2000 ft., North Carolina, Aug. 26, 1932, N. Banks, collector; in Museum of Comparative Zoology.

Paratype: 1 ♂, same locality and date as holotype; in Museum of Comparative Zoology.

So far as the tibial spurs are concerned, this species belongs to the subfamily Goerinæ; but it is separated from all other genera of that group by the possession of the vein between R1 and R2 below the pterostigma. In fact, the only other North American genus of the Sericostomatidæ in which this vein is present is Agarodes, which has only two spurs on the middle tibiæ and which is therefore a member of the Sericostomatinæ.

Neuropsyche, new genus (*Lepidostominæ*)

♂ Spurs, 1, 4, 4; ocelli absent; maxillary palpi short, slightly flattened, covered with long gray hairs and scales, basal segment of antennæ thickened, but not so long on the head. Fore wing: Rs arising close to the base, with three branches (R2, R3, R4+5); M with two branches; Cu1 unbranched.

♀ Spurs 1, 4, 4; basal segment of antennæ longer than that of male and less thickened; venation similar to that of male, except that R4+5 is forked in both fore and hind wings.

Genotype: *Neuropsyche tibialis*, n. sp.

Neuropsyche tibialis, n. sp.

Figures 3, 15, 16.

♂ Length of fore wing, 6-7 mm; vertex and frons light yellow; antennæ light yellow; the basal segment covered with light yellow hairs; maxillary palpi yellow, the ventral surface covered with long, brown hairs, and the dorsal surface, with whitish scales; labial palpi short, gray; thorax, legs, and abdomen light yellow. Fore wing: rather slender, nearly oval; R4+5 arising before the middle of wing; M dividing just beyond mid-wing. Hind wing: Rs branched as in fore wing; M with two branches, arising before origin of R4+5; Cu1 unbranched. The wings are covered with flattened yellow hairs.

♀ Color and size as in male.

Holotype (♂) and allotype: Bryson City, Deep Creek, North Carolina, Aug. 27, 1930; P. J. Darlington, collector.

Paratypes: 1 ♂ Bryson City, North Carolina, Aug. 23; 7 ♂ ♂, Bryson City, Aug. 26; 3 ♂ ♂, Bryson City, Aug. 27; 2 ♀ ♀, Bryson City, Aug. 23; 3 ♀ ♀, Bryson City, Aug. 26; 1 ♀, Nantahala Gorge, North Carolina, Aug. 25, 1930. All types in Museum of Comparative Zoology.

Neuropsyche is readily distinguished from the other North American genera of Sericostomatidæ by the possession of one tibial spur on the front legs, and four on the middle ones. This condition is not present in any other genera of our fauna, except the very aberrant Nosopus. I have placed the genus tentatively in the Lepidostominæ, but its position is not at all certain.

Micrasema falcata Banks

Nine specimens were taken at Deep Creek, Bryson City, Smoky Mts., Aug. 26 and 27; Smokemont, Smoky Mts., N. Carolina, Aug. 24; and Andrews, N. Carolina, Aug. 23.

RHYACOPHILIDÆ

Rhyacophila fuscula Walker

Figure 5.

Ten specimens of this species were collected at the following localities: Newfound Gap, Smoky Mts., 5000-5200 ft., Tennessee, Sept. 1; Smokemont, N. Carolina, Aug. 24; Bryson City, N. Carolina, Aug. 23-27; Nantahala Gorge, 2000 ft., N. Carolina, Aug. 25. This is the first record of the species south of New Jersey known to me.

Rhyacophila torva Hagen

Figure 7.

Rhyacophila torva Hagen, 1861, Syn. Neur. N. A., 296.
Rhyacophila terminata Banks, Proc. Ent. Soc. Wash., 8: 132; fig. 7.

Over forty specimens of this species were collected at Nantahala Gorge, Bryson City and Smokemont, N. Carolina; and other specimens were taken between Blowing Rock and Linville, N. Carolina; Willets, N. Carolina; Andrews, N. Carolina; and Newfound Gap, Smoky Mts., Tennessee. This is perhaps the commonest of our eastern species of Rhyacophila. As I have indicated above, Banks' *terminata* is synonymous with *torva;* the types of both of these species, now in the Museum of Comparative Zoology, are identical. Betten has suggested[2] that the species which Banks identified and figured as torva is the same as *nigrita* Banks; but I am not sure that this is so, since I cannot locate the specimen on which Banks based his figure. For purposes

[2]List of the Insects of New York, p. 522, 1926.

of comparison I have included here a drawing of the genitalia of *nigrita*, which was originally described from the Black Mountains, N. Carolina (figure 11.)

Rhyacophila glaberrima Ulmer

Ulmer, 1907, Coll. Selys, 6, Trichoptera: 85; fig. 131, 132.

This species has previously been known only by the male type, collected many years ago in Georgia[3]. I therefore take this opportunity to describe the female, several specimens of which were collected in 1930:

♀ Color of body similar to that of ♂, the head except frons dark brown; frons yellowish; hairs on vertex, at least those between the ocelli, yellowish brown; the warts between the ocelli are very prominent and elongate-oval in shape; the posterior warts are also long and oval. The female herewith designated as allotype was collected by the writer between Blowing Rock and Linville, N. Carolina, at an altitude of 3-4000 feet, September 8, 1930.

Forty additional specimens, of both sexes, were collected at the following localities: Bryson City, N. Carolina, Aug. 26-27; Nantahala Gorge, Aug. 25; Andrews, Aug. 25; Mt. Mitchell, about 4000 ft., Sept. 4; Little Switzerland, Black Mountains, N. Carolina, Sept.; and Newfound Gap, Smoky Mt., 5000-5200 ft., Tenn., Sept. 1-3. The insects resemble *torva* superficially, but the males are easily separated by the genital structure, as can be seen by comparing Ulmer's figure of *glaberrima* with that of *torva* given here (figure 7). The females can be distinguished by the hairs on the vertex, which are a very dark brown in *torva* but light brown or even yellow in *glaberrima;* and by the interocellar and posterior warts, which are rounded and flattened in *torva,* but oval and prominent in *glaberrima.*

Rhyacophila carolina Banks

Two males found at Bryson City, N. Carolina, Aug. 26, and another on the road between Blowing Rock and Linville, N. Carolina, Sept. 8.

[3]In the Genera Insectorum (1907) Ulmer erroneously gives the type locality as Massachusetts.

Rhyacophila montana, n. sp.

Figure 10.

Male: Length of fore wing, 5 mm. Body uniformly dark brown, nearly black; ocelli white; wings uniformly smoky brown, probably with golden spots in fresh specimens. Fore wing: R2+3 and R4+5 forked to the same depth; M dividing just basal of the origin of Rs; forks of M shallow, fork M1+2 not so deep as fork M3+4; Cu forked directly below origin of Rs. Hind wing: fork M3+4 deeper than fork R2+3; M3+4 not forked; M dividing first directly below origin of Rs. Genitalia as in figure 10.

Female: Length of fore wing, 7 mm.; similar to the male in coloration and venation. The wings have more hair than those of any of the males, and show several golden spots.

Holotype (♂), Newfound Gap, Smoky Mts., 5000-5200 ft., Tennessee, Aug. 30, 1930; N. Banks, collector. Allotype: same locality, Sept. 3; F. Carpenter, collector.

Paratypes: 3 males, same data as holotype, N. Banks, collector; 1 male, same locality, Aug. 31, F. Carpenter; 1 male, Bryson City, Deep Creek, 2000 ft., Aug. 23, N. Banks.

Paragapetus moestus Banks

Three males were taken at Deep Creek, Bryson City, North Carolina, Aug. 23, and two males at Newfound Gap, Smoky Mountains, Tennessee, Aug. 30. The types of the species were collected at Black Mt., North Carolina.

Glossosoma nigrior Banks

Previously known only by the type specimens from Black Mountains, N. Carolina, this species was well represented in the 1930 collection by thirteen males and females, taken at Deep Creek, Bryson City, N. Carolina, Aug. 26, 28; and Nantahala Gorge, N. Carolina, Aug. 25.

Chimarrha aterrima Hagen

One male was collected at Andrews, N. Carolina, 1800 ft., Aug. 25, and another at Nantahala Gorge, N. Carolina, 2000 ft., Aug. 27.

HYDROPSYCHIDÆ

Hydropsyche alternans Walker

Figure 1.

Seven specimens of this common eastern species were taken at Bryson City, N. Carolina, and also at Smokemont, Andrews, and Willets, Aug. 24 and 25.

Hydropsychodes minuscula Banks

Although originally described from Plummer's Island, Maryland, this species was represented by thirteen species from Nantahala Gorge, Andrews, Ashland in N. Carolina, Aug. 22-25; and near the French Broad River, Tennessee, 6 miles west of the N. Carolina line, Aug. 28.

POLYCENTROPIDÆ

Phylocentropus carolinus, n. sp.

Figure 9.

♂ Length of fore wing, 6 mm.; vertex and frons gray-brown; antennæ yellow, except the basal segment, which is brown; thorax covered with bray-brown hairs; legs yellow; wings spotted with brown and yellow. Fore wing: Rs arising near the middle of the wing; forks R2+3 and R4+5 are the same depth; fork M3+4 deeper than M2+3; M dividing before the origin of Rs; Cu1 forked below Rs. Genitalia as in figure 9. Female unknown.

Holotype (♂): Nantahala Gorge, 2000 ft., N. Carolina, Aug. 25; N. Banks, collector. Paratypes: two males, Bryson City, Deep Creek, N. Carolina, Aug. 26; N. Banks, collector; one male, Bryson City, Aug. 25, F. Carpenter, collector; four males, Nantahala Gorge, N. Carolina, Aug. 25, N. Banks, collector.

This species is the fourth to be described in the genus; it is closest to *lucidus* Hagen, but the genital appendages are much larger in *carolinus* than in Hagen's species.

Neuroclipsis parvula Banks

This species, originally described from Maryland, has subsequently been found in northern New York. Two specimens were collected in 1930: one male at Andrews, N. Carolina, Aug. 23; and one near the French Broad River, Tennessee, 6 miles west of the N. Carolina state line, Aug. 28.

PSYCHOMIIDÆ

Psychomyia flavida Hagen

Figure 6.

This species has been taken commonly from the District of Columbia to eastern Canada, but not previously in the southern states; two specimens were collected in Nantahala Gorge, N. Carolina, Aug. 25.

PHILOPTAMIDÆ

Philopotamus distinctus Walker

Fifteen specimens were taken in the Smoky Mt. and Black Mt. region: Bryson City, Andrews, Linville, Marshall and Black Mt., all N. Carolina; and Newfound Gap, Smoky Mts., Tennessee, during late August and early September.

LEPTOCERIDÆ

Mystacides nigra Linn.

One male was taken at Andrews, N. Carolina, Aug. 25, at an altitude of about 1800. This conspicuous insect has been recorded from most of the northern states and Canada, but I have not seen any specimens previously collected south of the District of Columbia and vicinity. It is interesting that no specimens were secured in the Black Mts. or Smoky

Mts. proper, where one would expect to find such a northern species.

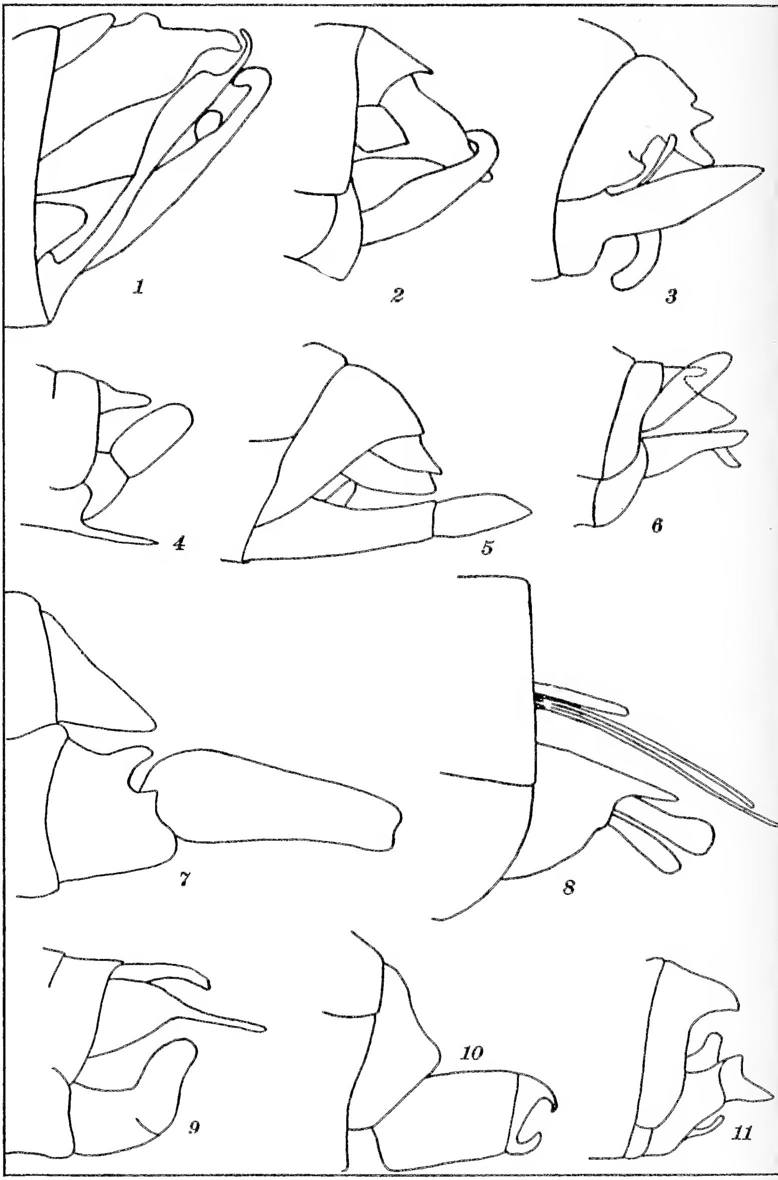
Plate I.

Male genitalia, lateral views.

Figure 1. *Hydropsyche alternans* Walker
Figure 2. *Pseudogoera singularis*, n. sp.
Figure 3. *Neuropsyche tibialis*, n. sp.
Figure 4. *Paragapetus moestus* Banks
Figure 5. *Rhyacophila fuscula* Walker
Figure 6. *Psychomyia flavida* Hagen
Figure 7. *Rhyacophila torva* Hagen
Figure 8. *Goera calcarata* Banks
Figure 9. *Phylocentropus carolinus*, n. sp.
Figure 10. *Rhyacophila montana*, n. sp.
Figure 11. *Rhyacophila nigrita* Banks

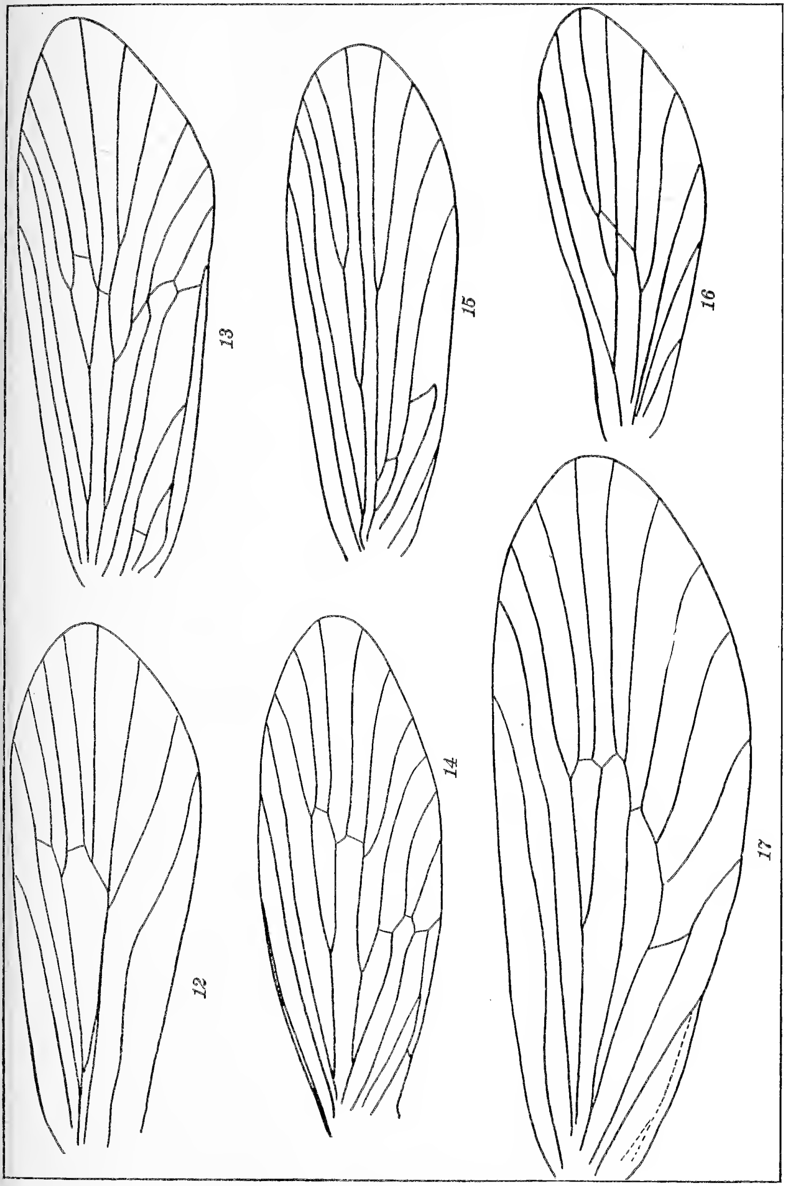
Plate II.

Figure 12. *Pseudogoera singularis*, n. sp., fore wing.
Figure 13. *Goera calcarata* Banks, fore wing.
Figure 14. *Notiopsyche latipennis* Banks, fore wing.
Figure 15. *Neuropsyche tibialis*, n. sp., fore wing.
Figure 16. *Neuropsyche tibialis*, n. sp., hind wing.
Figure 17. *Phanopsyche grisea* Banks, fore wing.



Carpenter-Trichoptera

Psyche, 1933 VOL. 40, PLATE 2



Carpenter-Trichoptera

NOTES ON AMERICAN TRYPETIDÆ *(Diptera)* II.

BY MARSTON BATES,

Museum of Comparative Zoology, Cambridge, Mass.

The species considered in this paper all belong to groups which have the "*Aciura*" wing pattern—black, with hyaline indentations. The various genera have little else in common, and belong to widely separated sections of the family, although they are sometimes placed together. The group of species placed in *Aciurina* by Curran (1932, p. 9) will be considered in a separate paper. I am indebted to Mr. E. T. Cresson, Jr., of the Philadelphia Academy of Sciences, and to Mr. C. H. Curran, of the American Museum of Natural History, for part of the material on which this work is based.

Genus BLEPHARONEURA Loew

Loew, 1873, p. 272 (type, *B. poecilogastra* Loew, sole species)

The front is about as broad as one eye, less than twice as high as broad. There are two pairs of upper, and two of lower orbital bristles; the verticals and ocellars are well developed. The third antennal segment is about as long as the second, rounded. The face is excavated, with the oral margin projecting. The dorsocentrals are behind the anterior supra-alars; there are three pairs of scutellars. The venation is shown in Fig. 2; the third and fifth veins are spinose above.

The above notes are based on the genotype, with which the following new species agrees closely in structure, despite the very different wing pattern.

Blepharoneura hirsuta, sp. nov.

Figs. 1, 2.

♀ The head is brown, lighter just above the antennæ, with the ocellar triangle black; the bristles are all dark brown. The thorax above is brown, shiny, covered with fine hairs, which appear yellowish or dark, depending on the light. The thoracic bristles are dark brown. The sides of the thorax and the legs are lighter, yellowish, the legs covered with yellow spines and hairs. The scutellum is yellow. The abdomen is marked above by two broad black subdorsal longitudinal bands, in sharp contrast to the yellow medio-dorsal area and under-surface. The ovipositor sheath is broad, flat, trapezoidal in outline, black; it is covered with fine hairs.

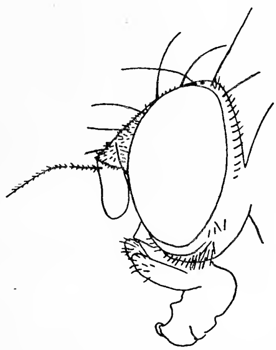


Fig. 1. *Blepharoneura hirsuta,* sp. nov., profile of head.

The wing is dark brown, lighter in the costal cell and toward the posterior margin, with the following hyaline indentations: a triangular area in the marginal cell at the tip of the first longitudinal vein, which reaches the third vein below; an elongate band which opens on the lower half of the first posterior cell, and extends above to the second vein; two similar bands opening in the second posterior cell, the first of which reaches the third vein above, while the second stops at the fourth; two other bands in the third posterior cell, the outer of which extends across the discal cell above to the fourth vein, the inner reaching beyond to the third vein. There is a small hyaline spot in the second basal cell, and another in the anal cell.

Total length, 6.1 mm.; length of wing, 6.3 mm.; length of ovipositor sheath, 0.8 mm.

Type, one female, from Aroa, Venezuela, in the American Museum of Natural History.

Genus HEXACHAETA Loew

Loew, 1873, p. 219 (type, *Trypeta eximia* Wied., by desig. of Coquillett, 1910)

The front is narrow, about half as wide as one eye; there are three lower and two upper pairs of orbitals; the ocellars are rather weak, the verticals well developed. The third antennal segment is moderate to long, rounded; the face is slightly excavated beneath the antennae. The dorsocentrals are behind the anterior supra-alars; there are pairs of scu-

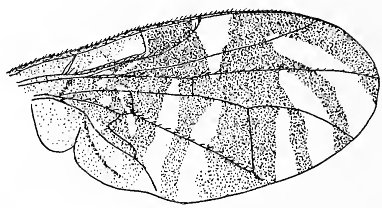


Fig. 2. *Blepharoneura hirsuta,* sp. nov.

tellars. The third vein is spinose for most of its length; the fifth vein is spinose at the base in the genotype.

Some of the species assigned to this genus have a rather "*Aciura*-like" wing pattern. The group is very likely heterogeneous as at present listed.

Genus EULEIA Walker

Euleia Walker, 1836, p. 81 (type *Musca caesio* Harris, as *onopordinis,* sole sp.)
Myoleja Rondani, 1856, p. 112 (type *Tephritis lucida* Fall.)
Philophylla Rondani, 1870, p. 9 (type *Musca caesio* Harris)
Eucosmoptera Phillips, 1923, p. 131 (in part; no type designated.)
Myiolia Hendel, 1927, p. 100.
Aciura and *Acidia* auctorum, in part.

The front is narrow, one and one half to two times as high as wide, sparsely hairy. There are three pairs of lower orbital bristles, two of upper; the ocellars are moderately developed or weak; the occipitals are black, fine. The third antennal joint is moderate to long, rounded; the face is almost flat, the lower edge projecting only slightly if at all. The dorsocentrals are behind the anterior supra-alars; there are two pairs of scutellars. The third vein is spinose above on the lower half at least.

I can find no basis for the oft repeated statement that *Euleia* Walker is preoccupied, except that Hübner had previously used the variant spelling *Eulia* in the Lepidoptera.

Euleia limata (Coquillett)

Aciura limata Coquillett, 1899, p. 263.

This species, from the Eastern United States, seems to be strictly congeneric with the European *cæsio*. It is a Ceratitine form, in no way related to either *Aciura* or *Xanthaciura*.

Euleia nigricornis (Doane)

Aciura nigricornis Doane, 1899, p. 183, pl. III, f. 7.

Despite the peculiar sex characters of the male, this species seems to fit here better than anywhere else.

Genus POLYMORPHOMYIA Snow

Snow, 1894, p. 165. (type, *P. basilica* Snow, sole species).

The front is higher than wide, hairy. There are three lower orbitals, one upper orbital; the ocellars are well developed. The third antennal joint is long; the face is retreating; the occipitals are white and stumpy. The dorsocentrals are in front of the anterior supra-alars; there are two pairs of scutellars. The third vein is spinose; the wings broad.

Two species have been described in this genus.

Genus PSEUDEUTRETA Hendel

Hendel, 1914, p. 86. (type, *Trypeta adspersa* Wiedemann)

The front is higher than wide, hairy. There are three lower orbitals, one upper orbital; the ocellars are well developed. The third antennal joint is short; the face projects slightly; the occipitals are white, stumpy. The dorsocentrals are in front of the anterior supra-alars; there is one pair of scutellars. The third vein is naked above; the wings are broad.

The above notes are based on the following new species; the only other species that I have seen is *P. anteapicalis* Hendel, in the National Museum collection. Six South American species have previously been placed in the genus.

Pseudeutreta ligularis, sp. nov.

Fig. 3.

♂ ♀ The front is a little broader than one eye, slightly higher than broad, brown, with a few scattered white,

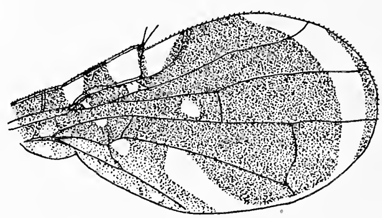


Fig. 3. *Pseudeutreta ligularis,* sp. nov.

stumpy, hairs. The thorax is dark reddish brown, almost black, finely pollinose, with a few scattered stumpy white hairs on the dorsum, lacking on the sides. The scutellum is concolorous with the thorax. The head and thoracic bristles are all black. The abdomen is black, thickly covered with fine hairs. The genitalia of the male are lighter, brown, as is the ovipositor sheath of the female which, however, is narrowly tipped with black. The legs of the female are a rather uniform light brown except the somewhat darker posterior tibia; in the male, however, the fore femur is darker also, and somewhat swollen.

The wing pattern is shown in figure 3. There are two hyaline indentations in the costal cell, both of which have narrow extensions across the first longitudinal vein. A similar indentation in the stigmal cell is yellowish rather than hyaline. A hyaline band borders the wing tip from about the middle of the marginal cell to the fifth vein, separated from the distal margin of the wing by a narrow brown area which begins just beyond the second vein, and extends to about a third of the distance between the fourth and fifth veins. A hyaline indentation in the third posterior cell opens on the lower half of the cell margin, and extends about two thirds of the way up the cell to end on the fifth vein. There is a round hyaline spot in the first basal cell, just before the small cross-vein, another in the very base of the third posterior cell, and some rather indefinite clear spots along the posterior margin of the wing.

Total length of female, 5.5 mm.; length of wing, 5.0 mm.; length of ovipositor sheath, 0.6 mm.

Described from one male (the holotype), and one female (allotype), in the Museum of Comparative Zoology, from Sara Prov., Bolivia (Steinbach); one male paratype from São Paulo, Brazil.

This species seems close to *Aciura falcigera* of Kieffer, described from Argentina. It differs from Kieffer's description and figure in several ways, most notably in the wing pattern. The apical narrow hyaline spot of *falcigera* is lacking in *ligularis;* the sickle-shaped hyaline band which parallels the wing tip does not reach the costa above in *falcigera,* and so forth.

Genus TETREUARESTA Hendel

Hendel, 1928, p. 368 (type, *Trypeta obscuriventris* Loew)

This genus is included here because of the wing pattern of the following new species; the described species of the group all have a typical "Euaresta" pattern. The genus is sufficiently well characterized by Hendel, *l.c.*

Tetreuaresta bartica, sp. nov.

Fig. 4.

♂ ♀ The front is yellowish, slightly elevated on its lower half, strongly narrowed toward the base, about two-thirds as wide at the vertex as high. There are three pairs of brown lower orbitals, two of upper orbitals; the vertical and ocellar bristles are well developed. The antennae do not quite reach the oral margin; the third joint is about twice as long as the second; the cheeks, face and mouthparts are proportioned much as in *T. obscuriventris*.

The thorax is probably black, overlaid with greyish pollen in all of my specimens. The bristles are well developed, yellow, arranged much as in the genotype, *T. obscuriventris*. The scutellum is yellowish, with both pairs of bristles well developed; the legs are yellow, with light colored hairs and spines.

The wing pattern is shown in figure 4. The ground color is a uniform dark brown, with various hyaline indentations

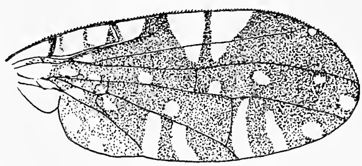


Fig. 4. *Tetreuaresta bartica*, sp. nov.

and spots. The costal cell is mostly hyaline, with some brown lines; the stigmal cell includes a yellowish spot which occupies about half of its area. There are two triangular hyaline indentations in the marginal cell, the tips of which extend over the second longitudinal vein, almost reaching the third vein. A small hyaline spot is sometimes present just below the tip of the second vein. The spots in the first hind marginal cell are variable in number and position, and may be different on the two wings of one specimen. Most commonly three are present, sometimes only the two basal spots are present; sometimes the apical spot splits into two, as in the figure, or even three smaller spots. The first basal cell includes a single round hyaline spot. In the second hind marginal cell there are three hyaline indentations: the distal one is small, round, and may be absent; the two proximal ones are elongate, always present. The third hind marginal cell includes two elongate hyaline areas which reach the fifth vein above; there is a small round spot in the discal cell, usually about midway between these two marginal indentations. There are various hyaline spots on the base of the wing. The cross-veins are approximated, parallel; the third vein is spinose for almost its entire length.

The abdomen is brown, sparsely covered with brownish hairs. The ovipositor sheath of the female is dark brown, trapezoidal in shape.

Total length, female, 4 mm.; length of wing, 3.4 mm.; length of ovipositor sheath, 0.6 mm.

Described from 10 ♂ ♂ and 7 ♀ ♀ from Bartica, British Guiana, March, April, May and September, from the Johnson Collection in the Museum of Comparative Zoology, and the collection of the Academy of Natural Sciences of Philadelphia. The types are distributed as follows: holotype ♂, and allotype ♀, and 5 paratypes in the M.C.Z.; 5 paratypes in the A.N.S.P.; 2 paratypes in the United States National Museum; 2 paratypes in the American Museum of Natural History; one paratype in the collection of H. K. Munro.

This very interesting species agrees closely in structure with *Tetreuaresta obscuriventris*, except that it has two well developed upper orbitals, while only one pair is present in Loew's species. The wing pattern is very like that of *Xanthaciura*, and there are some structural similarities.

Genus XANTHACIURA Hendel

Hendel, 1914, p. 86. (type, *Trypeta chrysura* Thomson).
Tetraciura Hendel, 1914, p. 90. (type, *T. quadrisetosa* Hendel).
Eucosmoptera Phillips, 1923, p. 131 (in part; no type designated).

The front is very narrow, naked; there are three pairs of lower orbital bristles, but only one fully developed pair of upper orbitals; the ocellars are well developed. The face is retreating; the occipitals are white, stumpy. The dorsocentrals are in front of the anterior supra-alars; there may be one or two pairs of scutellars. The wings are narrow, the third vein naked.

Eucosmoptera tetraspina Phillips may be taken as the type of her genus, as it was the species with which she was most familiar. There really seems to be no good reason for separating the species with two scutellars from those with four, in this case, as the species are all very close, and form a compact, well defined group when arranged together.

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PSYCHE

VOL. XL JUNE, 1933 No. 2

UNUSUAL PREY OF BEMBIX

By W. M. Wheeler and Richard Dow

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It is usually supposed that the solitary wasps of the genus Bembix always provision their burrows with Diptera. Only one observation to the contrary has ever been reported in detail.[1] One day while Dr. G. D. H. Carpenter was collecting Hesperiidæ on a muddy road in East Africa, he saw a Bembix hunting. First it seized a lycænid butterfly which it dropped, then it hovered over a skipper. Transferring its attention to another skipper, it pounced on its victim, and hung for a moment in the air. When Dr. Carpenter tried to catch it, the wasp flew off with its prey.

In addition to this observation, Mr. W. A. Lamborn[2] has reported that several African species of Bembix take various Muscidæ and Orthoptera, and according to Professor Flaminio Ruíz,[3] the wasps of the genus Bembix may feed their larvæ with "certain Lepidoptera of smooth texture." As the basis of the latter statement is unknown to the present authors, its accuracy must be questioned.

[1]Proc. Ent. Soc. London 1917: xli-xlii. 1918.
[2]Bull. Ent. Research 6: 63. 1915.
[3]Rev. Chilena Hist. Nat. 34: 156. 1930.

During 1931, while the senior author was on the Harvard Zoological Expedition to Australia, he made a few observations on a Bembix colony which was storing its burrows with very unusual prey. At 3.30 p. m. on September 27, he was resting on the sandy shore of Lake Violet, a beautiful body of brackish water about 6 miles south of Wiluna, in the dry interior of Western Australia. As he was sitting in the shade of some bushes, he noticed almost at his feet a flourishing colony of an undetermined species of Bembix. The sand containing their burrows was so hot that the insects were able to open them only by practicing the interesting tactics described by R. N. Chapman for bembicine wasps in Minnesota.[4] After locating the position of their nests, they would swoop down to the glowing surface of the sand, hastily scratch for a few seconds and then rise in the air to cool off. Frequent repetition of this behavior finally enabled them to penetrate the hot surface layer and enter their burrows. From time to time a Bembix would arrive with a slender object clasped to its thorax with the posterior legs, and projecting far beyond its abdomen. Closer inspection showed that the prey was a blue damsel fly which the junior author has identified as *Austrolestes annulosus* (Selys). After opening its burrow, the wasp very deftly slipped into it without releasing its prey. Three specimens of this insect, each netted with a wasp by Dr. P. J. Darlington, Jr., on October 2, proved to be males. Time did not permit an examination of the burrows, but there could be no doubt that all the wasps of the colony were storing only damsel flies as food for their larvæ. Indeed, these insects seemed to be the only available prey at the time. Diptera were extremely scarce on the shores of the lake, probably because they were being constantly devoured by the damsel and dragon flies, which were hawking about in great numbers. On the plants surrounding the lake in which they had passed their nymphal stages, the exuviæ were everywhere in evidence. It would seem, therefore, that in this locality the Bembix, being unable to secure their customary prey,

[4]Ecology 7: 425. 1926.

had shifted their predatism to the very insects which were responsible for the dearth of Diptera.

Another Australian Bembix is also known to provide its young with unusual prey. Mr. A. E. Burns, a young hymenopterist of Melbourne, Victoria, informed the senior author that in Queensland he had taken a *Bembix palmata* F. Smith in the act of provisioning its burrow with a female nymph of a locustid.

Lest the reader conclude that all the Australian Bembix are aberrant in their choice of prey, it should be mentioned that among the insects caught by the Harvard Expedition is a *Bembix furcata* Erichson with a fairly large tabanid. These specimens were collected by Dr. P. J. Darlington, Jr., at Blackheath in the Blue Mountains, in January 1932.

SOME WASP-LIKE BEES FROM GUATEMALA

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

The bees recorded below were, with one exception, collected by J. Bequaert in Guatemala. At first sight, the collection appears to consist of small wasps, and whatever any one may think about Müllerian mimicry, these resemblances must be admitted to be very remarkable, and to call for some explanation.

Epeolus fulvopilosus Cameron

Seventeen specimens, including both sexes. Finca Mocá near Guatalon, 1,000 m., at flowers of *Synedrella nodiflora* and *Melampodium divaricatum*. Finca Sa. Emilia near Pochuta, 1,000 m. This species was described in 1902, from a specimen caught on the west coast of Mexico by G. F. Matthew. This was a male. The female is similar, rather more robust, the fifth tergite with a short silvery-white lunule. The first tergite has a very broad pale fulvous band of tomentum. A related species is *E. xanthurus* Cockerell, from Ecuador. I said of this when describing (1917), "with the aspect of an Odynerid wasp."

Megachile aurantipennis Cockerell

Five specimens, both sexes. Mocá near Guatalon, 1,000 m.; Sa. Emilia near Pochuta, at flowers of *Melampodium divaricatum*. Described from Guatemala. Very closely allied to *M. pulchriventris* Ckll., from British Guiana.

Osiris fasciatus (Radoszkowsky)

One male; Mocá near Guatalon, 1000 m., April 26, 1931. Length about 11 mm. Radoszkowsky described the female, from Orizaba, Mexico. The male is a little smaller, but agrees with the description, except that the scape is black, not yellow, and there is a broad dark brown band across the occiput. Noteworthy features are the thick ferruginous flagellum, the canary yellow face (with a little black band down each side of supraclypeal area and extending a little way down sides of clypeus), the dark mesothorax with two yellow bands, the yellowish wings with large pale orange stigma, the basal nervure falling considerably short of nervulus, and the abdomen with alternate bands of black and yellow. The legs are yellow, the hind femora and trochanters black beneath. The nearest relative appears to be *O. mexicanus* Cresson.

I have a note that Radoszkowsky's figure (not now available to me) shows a very short marginal cell, but Friese examined the type in the Berlin Museum, and found it to be an *Osiris,* as indeed the description sufficiently indicates. It was considered to represent a new genus *Euthyglossa.*

Anthidiellum apicale (Cresson)

One female; Amapala, Rep. Honduras, March 29, 1931 (D. M. Bates). Described from Mexico, as *Anthidium apicale.*

Stelis (*Protostelis*) **costaricensis** Friese

One female; Mocá near Guatalon. It differs slightly from Friese's description, based on specimens from Costa Rica, in that the venter of abdomen is entirely black, the first tergite has a slender transverse yellow stripe on disc, while the second has no yellow on disc, but a yellow spot (cuneiform in shape) at each side. The second recurrent nervure goes nearly as far beyond second cubital cell as the first is from the base of that cell.

Halictus sericeus Friese

One female; Sa. Emilia near Pochuta. Friese described this from a female collected at San Carlos, Costa Rica. The description agrees so closely with the Guatemala specimen that I cannot doubt the identity, though the hair at end of abdomen is pale fulvous rather than brown, and the hind tibiæ have pure white anteriorly.

THE SUBSPECIES OF *SPHAERODERUS CANADENSIS* CHD.

By P. J. Darlington, Jr.

Museum of Comparative Zoölogy, Cambridge, Mass.

Chaudoir described *Sphaeroderus canadensis* (Bull. Soc. Imp. Nat. Moscou 34, (1), 1861, pp. 498-9) in considerable detail, giving the type locality as Canada, probably near the Ottawa River. *S. palpalis* Mots. (*ibid.* 38, (4), 1865, p. 312) from "Hudson Bay" is placed as a synonym of *canadensis* by Roeschke (Ann. Nat. Mus. Hungary 5, 1907, p. 263), probably correctly, although Motschulsky's description of the elytra as *"profunde crenato-st*[*r*]*iatis"* does not fit typical *canadensis* very well. *Sphæroderus blanchardi* Leng (Journ. New York Ent. Soc. 24, 1916, pp. 41-2), described as a subspecies of *canadensis,* is a pure synonym of the latter. Not only do paratypes of *blanchardi* in the Blanchard Collection in the Museum of Comparative Zoölogy answer the description of *canadensis* perfectly, but they are very closely matched by a specimen from Canada in the Leconte collection. This Canadian specimen lacks the setigerous punctures of the 4th and 8th elytral intervals just as New England *(blanchardi)* specimens usually do, and is not otherwise separable, although the elytral striæ are a little more distinctly punctured than in most New England specimens. The difference, however, is too trifling to be significant.

Although Leng was mistaken in describing a New England race, *Sphæroderus canadensis* does divide into two geographical subspecies on much the same characters which Leng *(loc. cit.)* points out. However, it was the southern, not the northern form which was undescribed, and which may now be separated under the following name:

Sphæroderus canadensis lengi, subsp. nov.

Closely similar to typical *canadensis* in size, form, and color. Differs chiefly in having the elytral striæ more heavily punctate, the intervals more interrupted posteriorly, and the sculpture heavier and more irregular throughout; in having the 11th interval more elevated apically, forming a distinct cariniform tubercle at the declivity, especially in the ♀; and in having the 4th and 8th elytral intervals each with several (usually 5 or 6 or more) setigerous punctures. In the last character it differs from northern specimens of true *canadensis* but not from some specimens I have seen from the Black Mts., especially Mt. Mitchell, N. C. Length 10-11.5 mm.

Holotype ♂, allotype ♀, and 4 (♂ ♂) paratypes from between Newfound Gap and Clingman's Dome, 5,000-6,600 ft., on the North Carolina-Tennessee state line. One ♀ paratype from Newfound Gap itself. One ♀ paratype from State Road to Newfound Gap, Tennessee side, 3,500 ft. All the preceding localities are in the Smoky Mts.; the specimens were collected by the writer August 31-Sept. 3, 1930. Also 6 paratypes (5 ♂ ♂, ♀) from Highlands, North Carolina, Blanchard Collection. All of the type series, except 3 paratypes in the writer's collection, are in the Museum of Comparative Zoölogy, type number 17,238.

S. canadensis differs from all other Sphæroderus in having the elytra only 12-striate. Of the characters given above to separate the two subspecies only the setigerous punctuation of the 4th and 8th elytral striæ needs special discussion. In typical *canadensis* from the North these intervals are usually impunctate, but there is one setigerous puncture on the 4th interval of the left elytron of each of two ♂ ♂ from Mt. Madison, N. H. There is one on the 4th interval of a ♀ from Isle-au-Haut, Me. A ♂ from St. Vincent, Penn., has 4 on the left, 3 on the right 4th interval, none on the 8th interval. A ♀ from Virginia has two on each 4th interval. A ♂ and ♀ from Boone, northern North Carolina, have the 4th and 8th intervals impunctate, as has a ♀ from near Linville, northern

North Carolina, but another ♀ and a ♂ from the latter locality have a single puncture apiece on one 4th interval. A ♂ from "Black Mts., N. C., VI. 1-15, 1912" has a *total* of 3 punctures on the 4th and 8th intervals; another ♂ with identical label has a total of 15. Specimens from near the top of Mt. Mitchell, N. C., usually have rather numerous punctures on the intervals in question, but seem to be otherwise hardly distinguishable from northern specimens, and the bristle character alone is so inconstant that I do not think a local race should be based on it. I therefore consider that there are only two reasonably distinct subspecies of *Sphæroderus canadensis:* (1) *S. canadensis canadensis* Chd. (*palpalis* Mots., *blanchardi* Leng) which ranges from eastern Canada to the Black Mts. of northern North Carolina, and (2) *S. canadensis lengi* Darl., occurring in the mountains of southwestern North Carolina and adjacent parts of Tennessee and probably also in parts of Georgia and Alabama.

NEW ANTS FROM CHINA AND JAPAN

By William Morton Wheeler

Formicinæ

Formica pratensis Retzius var. **superba** var. nov.

Worker. Length 5-6.5 mm.

Head, including the frontal area, thorax and abdomen opaque; mandibles and legs, including the coxæ, distinctly shining. Eyes not hairy. Erect hairs golden yellow, very few on the head, gula and promesonotum; border of petiole ciliate; gaster with sparse, blunt, apparently deciduous hairs; pubescence grey, very fine, dense on the coxæ and legs; more dilute and not concealing the opaque surface on the gaster. Thorax and petiole rather rich red; mandibles dark brown; entire head, center of pronotum and anteromedian portion of mesonotum and the gaster deep black, decidedly darker than the similar regions in the typical *pratensis* of Europe, which are really dark brown or brownish black. First gastric segment with a large, transverse red spot just above the petiolar articulation; antennæ nearly black; legs dark brown, coxæ and trochanters somewhat paler and more reddish; border of petiole not infuscated.

Six specimens from Eastern Tomb, near Peking, China (Chi Ho).

Formica truncorum Fabr. var. **approximans** var. nov.

Worker. Very similar to the typical *truncorum* of Europe. Pilosity on the body and legs as abundant but of a bright golden yellow color, and on the tibiæ somewhat coarser though not longer than in the type. Color of head, thorax and petiole darker red; vertex and often also the middle of the promesonotum dark brown, even in large specimens; base of first gastric segment not yellowish red but dark brown like the remainder of the gaster.

Six specimens from Eastern Tombs, near Peking, China (Chi Ho).

Formica truncorum var. **yessensis** Forel

Six workers from Nankataigan, Formosa, collected by J. Sonan are really intermediate between the preceding form and *sinensis* Wheeler from Western China, the dorsal surface of the head and thorax being less hairy than in *approximans* and the typical *truncorum* and the tibiæ without oblique hairs, as in *yessensis* and *sinensis*.

Formica yoshiokæ sp. nov.

Worker. Length 4-6 mm.

Closely related to *F. picea* Nylander. Jet black; palpi, mandibles, antennæ, tarsi and articulations of legs deep piceous brown. Surface of the body, and especially of the gaster, even smoother and more shining than in *picea;* mandibles subopaque, densely and rather coarsely punctate-striate; clypeus and cheeks with very sparse, elongate, piligerous punctures. Head broader than in *picea*, epinotum of the same shape, in profile with straight and nearly horizontal base, forming a distinct obtuse angle with the declivity, which is straight, sloping and of the same length. Petiole with the superior border more compressed, more acute and distinctly notched in the middle. Hairs white, rather short, very sparse on the upper surface of the head and thorax and on the petiolar border; more numerous on the gaster, absent on the legs, which have only the usual row of bristles on the flexor surface of the tibiæ. Pubescence pale, distinct, but short and very dilute on the head, denser on the mesosterna and legs, lacking on the gaster.

Described from ten specimens taken by Mr. H. Yoshioka at an altitude of 1400 meters on Mt. Okagi, near Kiryu, Japan, July 26, 1932.

This ant may have to be regarded as a subspecies of *picea*. It differs, however, from the typical form, the subspecies *orientalis* Ruzsky and the five varieties described by him and Forel, in details of coloration and sculpture and from most of them in the shape of the epinotum and petiole.

Dolichoderinæ

Dolichoderus *(Hypoclinea)* **quadripunctatus** L. subsp. **sibiricus** Emery

Several workers taken by Mr. H. Yoshioka at Gummaken, Japan, July 17, 1930, agree closely with typical specimens of *sibiricus* in my collection from Tashkent, Turkestan (N. Kusnetzov). Emery states that the mandibles of this subspecies, which is slightly larger (3.5-3.8 mm.) than the typical *quadripunctatus*, are not shining, but in this respect all of my specimens are like the European form, though somewhat more coarsely coriacious.

Heretofore no species of Dolichoderus has been taken in Japan. To Mr. Yoshioka belongs the credit of having added not only this but the following beautiful subspecies to the known ant-fauna of his native land.

Dolichoderus *(Hypoclinea)* **quadripunctatus** subsp. **yoshiokæ** subsp. nov.

Worker. Length 2.8-3 mm.

Smaller than *sibiricus* and of the same size as the typical *quadripunctatus*. The sculpture is like that of *sibiricus*, but the surface of the head and thorax is more shining, apparently because the cavities of the numerous pits, or foveolæ are smoother and not so distinctly reticulate as in that subspecies. The color is different: Head, coxæ and gaster black; the paired spots on the first and second gastric segments ivory white, very large and sharply defined; thorax and petiole deep red, with the extreme base of the epinotum and anterior portion of the metapleuræ black; summit of petiolar node infuscated; mandibles, antennæ and legs yellowish red; a spot on the distal enlargement of the scapes and the distal portion of the funiculi fuscous; femora and tibiæ dark brown, except at their bases.

Described from ten workers taken by Mr. H. Yoshioka at Kiryu, Japan, Nov. 26, 1932.

NOTES ON HIPPOBOSCIDAE

4. On the Larger Species of *LYNCHIA* Weyenbergh (*OLFERSIA* of Authors; *ICOSTA* Speiser; *ORNITHOPONUS* Aldrich)

By J. Bequaert

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On size alone, most of the species of *Lynchia* may be divided rather readily into two groups. Although this arrangement disregards true relationship, I shall use it for the purpose of this paper, which discusses only the larger forms of the genus. These are 10 mm. or more in length, as measured from the tip of the fronto-clypeus to the tips of the folded wings. The length of the wing, a much more reliable standard, varies from 6 to 8.5 mm. in the specimens I have seen. *L. pilosa* (Macquart) is the smallest member of the group known to me. *L. penelope* Weyenbergh, the unrecognized genotype, also belongs to this group.

I have seen specimens of the six species included in the subjoined key. Having studied much material, I am inclined to regard most of the other names proposed for large *Lynchiæ,* as synonyms and I have attempted to treat them accordingly. In many cases the identity of these names must remain open to question, until the original specimens can be examined. I have seen the types of *Hippobosca bubonis* Packard and *Hippobosca nigra* Perty only.

1. Mesonotum and scutellum covered fairly uniformly with soft, short hairs, directed backward; scutellum without median groove. Frons very wide, with the sides distinctly converging below; postvertex very short and wide, about one-fourth of the length of the medio-vertex; inner orbital bristles of frons very numerous, in several irregular rows; palpi short, slightly shorter

than the fronto-clypeus. Basal two-thirds of wing almost destitute of setulæ on the upper side; second basal cell (M) only about one-third the length of the first (R); subcosta (SC) complete, ending in costa. Wing 6 to 6.5 mm. long. African species..*L. pilosa* (Macquart).

Mesonotum almost bare, except for patches of hairs behind the humeri and before the scutellum; scutellum with a distinct median depression, groove or furrow, the disk bare except for a pair of lateral setæ and an apical fringe of soft hairs. Palpi as long as or longer than fronto-clypeus. Upper side of wing mostly covered with setulæ, except the axillary cell (2d An) or this cell and the posterior fourth to half of the anal cell (Cu + 1st An) .... 2.

2. Upper side of wing mostly covered with setulæ; only the axillary cell (2d An) bare. Inner orbital bristles of frons fairly numerous, mostly in one row, but a few forming an incomplete second row. Subcosta (SC) complete, ending in costa. Frons nearly twice as wide as an eye, with subparallel sides. Postvertex rather short, the anterior margin longer than each of the sides. Wing 7 to 8 mm. long...*L. palustris* (Lutz, Neiva and Costa Lima).
   Axillary cell and posterior fourth to half of anal cell bare .... 3.

3. Bristles on inner margin of orbital plates few in number, placed mostly in one, irregular row. Subcosta (or auxiliary vein; SC) incomplete, not ending in costa.. 4.
   Inner orbital bristles of frons numerous, placed in more than one row. Subcosta (SC) complete, ending in costa. Frons about one and a half times to twice as wide as an eye; inner orbits distinctly diverging toward vertex .... 5.

4. Inner orbits subparallel. Smooth postvertex rather long, semi-elliptical, with broadly rounded anterior angles, the anterior margin about as long as the sides; with a rudimentary ocellus in a median pit. Wing 6.5 to 7 mm. long ....*L. fusca* (Macquart).

Inner orbits very distinctly diverging toward the vertex. Smooth postvertex rather short, transversely elongate, the anterior angles abruptly rounded off, the anterior margin rather straight and longer than each of the sides; without median pit and rudimentary ocellus. Wing 7 to 8.5 mm. long............. *L. americana* (Leach).

5. American and Pacific species. Postvertex rather long; the anterior angles broadly rounded off, the anterior margin about as long as each of the sides. Wing 7.5 to 8.5 mm. long .... *L. nigra* (Perty).

African species. Postvertex rather short, more transverse; the anterior angles more abruptly rounded off, the anterior margin much longer than each of the sides. Wing 8 to 8.5 mm. long........ *L. dukei* (Austen).

In the foregoing key the terms "postvertex" and "fronto-clypeus" are used as defined by Jobling. The postvertex corresponds to the "vertical plate" or "vertex" of most authors, being the hard, smooth area in the upper part of the frons, limited behind by the occipital margin.

Lynchia pilosa (Macquart)

Olfersia pilosa Macquart, 1843, Mém. Soc. Sci. Lille, (1842), p. 434 (no sex; Africa, without more definite locality; but since the type was collected by Delalande, it must have come from South Africa); 1843, Dipt. Exot., II, pt. 3, p. 277. Neave, 1912, Bull. Ent. Res., III, pp. 317, 320 and 322. Morstatt, 1913, Der Pflanzer, IX, p. 509.

Lynchia pilosa Falcoz, 1930, Encyclop. Entom., Diptera, V, p. 48. Bedford, 1932, 18th Rept. Director Vet. Serv. Animal Ind. Union S. Africa, p. 424.

Specimens Examined.—Orange Free State: Hoopstad, one female (H. Brauns).—Abyssinia: Ouache (= Hawash River?), one male (Paris Museum).

This remarkable species is readily recognizable by the peculiar pilosity of the thorax and the hyaline, extensively bare wings.

The present location of the type is unknown. The hosts are species of bustards, according to G. A. H. Bedford (1932), who records *L. pilosa* off the Kori, *Choriotis kori*

(Burchell), in Zululand; the White-quilled Black Knorhaan, *Afrotis atra afraoïdes* (A. Smith), in Transvaal; and the Greater Bustard, either *Choriotis kori struthiunculus* (Neumann) or *Neotis cafra jacksoni* Bannerman, in Kenya Colony.

Lynchia palustris (Lutz, Neiva and da Costa Lima)

Olfersia palustris Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, VII, p. 183, Pl. XXVIII, fig. 4 (no sex; off *Herodias egretta, Tigrisoma brasiliense, Cancroma cochlearia* and *Harpiprion cayennensis,* State of Piauhy; off a white heron, Rio de São Francisco, Brazil: and off *Ardea socoi,* Lassance, State of Minas Geraes). Ad. Lutz, 1928, Est. Zool. Paras. Venezolanas, p. 9.

? *Olfersia americana* Massonnat, 1909, Ann. Univ. Lyon, N. S., CXXVIII, p. 304, Pl. V, figs. 40-42 (♀). Not of Leach.

? *Ornithoponus massonnati* Falcoz, 1926, Faune de France, XIV, Diptères Pupipares, p. 31, figs. 28-29 (♀; off *Platalea leucorodia;* region of the Dombes, Ain, France).

SPECIMEN EXAMINED.—Belgian Congo: Mongende, one male; off a Cormorant, *Phalacrocorax africanus* (Gmelin), April 14, 1921 (H. Schouteden).

I am unable to separate this African specimen from *L. palustris,* commonly found in South America on wading birds. The species appears to be most closely related to *L. hirsuta* Ferris, of North America; but that fly is much smaller (wing 5 mm. long), has the basal cell relatively shorter, three long setæ on each half of prescutum, and a long prescutellar on each side. I find no such setæ in my specimen of *L. palustris. L. botaurinorum* Swenk, which I have seen from Brazil, as well as from North America, likewise differs from *L. palustris* in the smaller size (wing 5 mm. long).

L. palustris is readily differentiated from *L. ardeæ* (Macquart) and related species, found more commonly on wading birds, by the larger size, the much wider fronto-clypeus, and the absence of setæ over an extensive median area on the dorsal face of the abdomen.

SYNONYMY.—The name *Ornithoponus massonnati* was introduced by Falcoz for the fly from France which Massonnat (1909) described and figured as *"Olfersia americana,"* (the type probably in the collections of the University at Lyons). Ferris and Cole (1932) were quite justified in concluding that Massonnat's insect was probably "an entirely distinct species" from *"americana."* Among the larger species of *Lynchia* (Massonnat gives the length of the wing as 8.2 mm.) known to me, Massonnat's description agrees best with *L. palustris*, although the hairs of the inner orbital plates and the peculiar setulose covering of the wing membrane are not mentioned by him nor by Falcoz. There are some features of Massonnat's drawings, such as the very wide frons, that do not fit *L. americana*, though some of them might be due to inaccuracies (there are striking differences between the drawings of the head in figures 40 and 42, particularly in the outline of the postvertex and the trend of the sides of the frons). In addition, Massonnat's fly was taken off a white spoonbill, *Platalea leucorodia*, and thus far I have never seen specimens of true *L. americana* taken from a wading bird. In view of the fact that *L. palustris* has now been found on a cormorant in Africa, it seems highly probable that *Ornithoponus massonnati* is the same species.

Lynchia americana (Leach)

Feronia americana Leach, 1817, Gen. Spec. Eprobosc. Ins., p. 11, Pl. XXVII, figs. 1-3 (no sex; no host; Georgia, North America). Austen, 1903, Ann. Mag. Nat. Hist., (7) XII, p. 264 (type at Brit. Mus.). Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, VII, p. 188.

Olfersia americana Wiedemann, 1830, Aussereurop. Zweifl. Ins., II, p. 606. Macquart, 1835, Hist. Nat. Ins. Dipt., II, p. 641. T. W. Harris, 1835, in Hitchcock, Rept. Geol. Miner. Zool. Bot. Massachusetts, 2d Ed., p. 600. Walker, 1849, List Dipt. Brit. Mus., IV, p. 1141. Osten Sacken, 1858, Cat. Dipt. North America, p. 86. v.d. Wulp, 1867, Tijdschr. v. Entom., X, p. 128. Osten Sacken, 1878, Cat. Dipt. North America, 2d Ed., p. 213. C. W. Johnson, 1900, 27th Rept. New Jersey Bd. Agric., (1899), Suppl.,

p. 699. Aldrich, 1905, Cat. North Amer. Dipt., p. 655. Speiser, 1907, Ent. News, XVIII, p. 104. Swenk, 1916, Jl. New York Ent. Soc., XXIV, p. 130. W. E. Britton, 1920, Conn. Geol. Nat. Hist. Surv., Bull. 31, p. 210. Cole and Lovett, 1921, Proc. California Ac. Sci., (4) XI, p. 344. W. T. Davis, 1922, Proc. Staten Island Inst. Arts Sci., I, p. 65. C. W. Johnson, 1922, Psyche, XXIX, p. 83.

Ornithoponus americanus Aldrich, 1923, Insecutor Insc. Menstr., XI, pp. 77 and 78. C. W. Johnson, 1925, Proc. Boston Soc. Nat. Hist., XXXVIII, p. 99; 1925, Bull. Northeast. Bird-Banding Assoc., I, p. 52; 1925, Occas. Pap. Boston Soc. Nat. Hist., VII, p. 293. Gross, 1925, The Auk, XLII, p. 431. C. W. Johnson, 1927, Bull. Boston Soc. Nat. Hist., No. 42, p. 15. O. A. Johannsen, 1928, in Leonard, List Insects New York, (1926), p. 868.

Lynchia americana Falcoz, 1930, Encyclop. Entom., Diptera, V, p. 48 (in part?). C. W. Johnson, 1929, Bull. Northeast. Bird-Banding Assoc., V, p. 52. Ferris, 1930, Canad. Entom., LXXII, p. 67, fig. 5A, D, and F.

Hippobosca bubonis Packard, 1869, Guide to the Study of Insects, 1st Ed., p. 417 (no sex; off Great Horned Owl; Massachusetts). Copied without change in all later editions.

? *Ornithomyia villadæ* Dugès, 1887, La Naturaleza, Mexico, (2) I, pt. 1, p. 20, Pl. III, fig. 3 (no sex; off *Buteo calurus* and *B. bairdii;* somewhere in Mexico; no definite locality given).

?*Olfersia villadæ* van der Wulp, 1903, Biol. Centr. Amer., Diptera, II, p. 430. Aldrich, 1905, Cat. North Amer. Dipt., p. 656.

The following references to "*Olfersia americana*" are doubtful or erroneous.

Olfersia americana Ferris and Cole, 1922, Parasitology, XIV, p. 194, figs. 11-12 (♀; off *Tyto alba pratincola;* San Bernardino, California). To judge from fig. 11, the frons is distinctly less than twice the width of an eye and has subparallel sides; while the postvertex is rather long in the middle, with broadly rounded angles. Most probably this specimen was what I call *L. fusca* (Macquart).

Lynchia americana Ferris, 1927, Canad. Entom., LIX, p. 248, figs. 2 and 3 (fig. 3 erroneously labelled "*L. hirsuta*"; corrected by Ferris, 1929, *Ibidem*, LXI, p. 285) (♀; off *Otus asio;* Monticito, California). The same remark applies to this as to the foregoing record.

Ornithoponus americanus C. W. Johnson, 1924, Zoologica, New York, V, No. 8, p. 91 (off *Buteo galapagoensis*; Seymour Bay, Indefatigable, Galapagos). I have seen this fly, which is *L. nigra* (Perty). Curran's *O. americanus*, from Santa Cruz, Indefatigable, (1932, Nyt Mag. Naturvid., LXXI, p. 366), probably also was *L. nigra*, but I have not seen the specimen.

Olfersia americana C. W. Johnson, 1895, Proc. Ac. Nat. Sci. Phila., p. 340 (off Screech Owl, *Otus asio floridanus*; St. Petersburg, Florida). I have seen this specimen, which is *L. fusca* (Macquart).

Olfersia americana C. W. Johnson, 1913, Bull. Amer. Mus. Nat. Hist., XXXII, p. 90 (St. Augustine and Miami, Florida). These specimens, seen by me, are *L. fusca* (Macquart).

Specimens Examined.—*L. americana* is perhaps the most common of the North American hippoboscids. I have seen over one hundred specimens from the following localities. Ontario: Point Pelee.—Nova Scotia: Annapolis.—Maine: Kittery Point.—New Hampshire: Candia; Hampton.—Vermont: Dunmore Lake.—Massachusetts: Boston; Wenham; Middleboro; West Tisbury; Framingham; Monterey; Dover; Sherborn; Princeton; Chicopee.—Connecticut: Liberty Hill.—New York: Long Island; Staten Island; Freeport; Yankee Lake, Wurtsboro, Sullivan Co.; Austerlitz; Ithaca; West Point; Albany; Sparta; Clarksville; Albany Co.; Baldwinsville; Carmel.—New Jersey: Ramsey; Haddanfield; Stag Lake, Sussex Co.; Kittatinny Mts.—Pennsylvania: Eschol; Penfield; Dauphin Co.; Philadelphia; Shirleysburg; Pike Co.; Harrisburg.—Virginia: Urbana.—North Carolina: Raleigh.—South Carolina: Charleston; Dewees Island; Society Hill.—Florida: St. Augustine.—Ohio: Licking Co.; Crestline; Wauseon.—Indiana: Indianapolis.—Illinois: Warsaw.—Wisconsin: W. Spring Green; Ripon.—Iowa: Iowa City.—Kansas: Clay Co.; Douglas Co.

—Texas: Dallas.—Nevada: without more definite locality. —Mexico: Grito (in which State?).—In addition there are reliable published records from Washington, D. C., Georgia, Nebraska and Kentucky.

The host list is a very large one, including owls, hawks and other birds of prey, as well as grouse: Great Horned Owl, *Bubo virginianus* (Gmelin), (very common on several subspecies); Barred Owl, *Strix varia* Barton; Long-eared Owl, *Asio wilsonianus* (Lesson); Barn Owl, *Tyto alba pratincola* (Bonaparte); Screech Owl, *Otus asio* (Linnæus); Pigeon Hawk, *Falco columbarius* Linnæus; Sharp-shinned Hawk, *Accipiter velox* (Wilson); Red-tailed Hawk, *Buteo borealis* (Gmelin); Broad-winged Hawk, *Buteo platypterus* (Vieillot); Rough-legged Hawk, *Buteo lagopus sancti-johannis* (Gmelin); Red-shouldered Hawk, *Buteo lineatus* (Gmelin); Western red-tailed Hawk, *Buteo borealis calurus* (Cassin); Marsh Hawk, *Circus hudsonius* (Linnæus); Cooper's Hawk, *Accipiter cooperi* (Bonaparte); Golden Eagle, *Aquila chrysaëtos* (Linnæus); Goshawk, *Astur atricapillus* (Wilson); and Ruffed Grouse, *Bonasa umbellus* (Linnæus). At the Mus. Comp. Zoöl. there is also an old specimen, without locality, labelled "off wild turkey." Sometimes the parasite is very abundant. C. W. Johnson records a Great Horned Owl that yielded 32 flies and some pupæ, the latter hidden in the ears.

Owing to frequent confusion with related species (particularly with *L. fusca*), some previously published records of hosts and localities are unreliable. Two old specimens labelled "Nevada" at the Mus. Comp. Zoöl., and one specimen from St. Augustine, Florida, in the C. W. Johnson Collection, are true *L. americana*. But all other specimens I have seen from west of the Rockies and from Florida were *L. fusca*. Published records from Oregon (Cole and Lovett, 1921, Proc. California Ac. Sci., (4) XI, p. 344; Falcoz, 1930, Encyclop. Entom., Diptera, V, p. 48), and California (C. W. Johnson, 1922, Psyche, XXIX, p. 83; in addition to those mentioned before), are all open to question. There is one definite record of *L. americana* from Mexico, but how widely it is distributed there is unknown. Falcoz' indication "Columbia" refers to Washington, D. C., not to British

Columbia nor to Colombia. There is as yet no conclusive evidence that *L. americana* occurs in Europe, as shown in the discussion of *L. palustris.*

SYNONYMY.—The type of *Feronia americana* (Leach) is at present at the British Museum and it is reasonably certain that it agrees with the characters here given for the species.

That *Hippobosca bubonis* (Packard) is identical with *L. americana* (Leach), was recognized by Osten Sacken as early as 1878. The type, which I have seen at the Museum of Comparative Zoölogy, shows the correctness of this synonymy.

From the description alone it is difficult to recognize *Ornithomyia villadæ* Dugès, (the type of which is probably lost), although there can be no doubt about its being a *Lynchia.* For a time I believed that it might be *L. nigra* (Perty), and I have named specimens of *L. nigra,* in some collections, *"villadæ."* Recently, however, I received, from the Department of Entomology of Kansas University, a fly taken off *Buteo borealis calurus* at Grito, Mexico, and bearing a manuscript label "resemble à *Ornithomyia villadæ* A. Dug." This specimen agrees in every respect with the North American *L. americana.* I am, therefore, listing *villadæ,* provisionally at any rate, in the synonymy of *americana,* pending the examination of further Mexican material.

Lynchia fusca (Macquart)

Olfersia fusca Macquart, 1845, Mém. Soc. Sci. Lille, (1844), p. 346 (no sex; Nouvelle Grenade = Colombia); 1846, Dipt. Exot., Suppl. I, p. 218. Speiser, 1902, Zeitschr. Syst. Hym. Dipt., II, p. 177 (description of type). Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, VII, pp. 182, 189 and 194 (doubtful records). Bau, 1929, Zoolog. Anzeiger, LXXXV, p. 10.

Lynchia fusca Falcoz, 1930, Encyclop. Entom., Diptera, V, p. 47.

? *Olfersia macquartii* Rondani, 1878, Ann. Mus. Civ. Genova, XII, p. 160 (no sex; New Grenada = Colombia; based upon a specimen received as *"fusca"* from Macquart, but claimed to be of a different species). Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, VII, p. 190.

? *Olfersia wolcotti* Swenk, 1916, Jl. New York Ent. Soc., XXIV, p. 132 (no sex; off *Buteo platypterus;* Ann Arbor, Michigan).

Specimens Examined.—Florida: St. Augustine, off a Screech Owl, *Otus asio floridanus* (Ridgway) (C. W. Johnson); Miami (P. Laurent).—Colorado: one female without more definite locality (Ks. Univ. Ent. Mus.).—California: several specimens off Burrowing Owl, *Speotyto cunicularia hypogea* Bonaparte, and off Californian Screech Owl, *Otus asio mccalli* (Cassin), without more definite locality (H. Edwards.—M. C. Z.); San José, Santa Clara Co., off Great Horned Owl, *Bubo virginianus pacificus* Cassin, and off Barn Owl, *Tyto alba tuidara* J. E. Gray, three specimens (G. A. Allen).—Also several specimens, without localities, in the old Osten Sacken Collection at the M. C. Z.

The specimens from Florida, here listed as *L. fusca,* were recorded by C. W. Johnson (in 1895, 1913, and 1922) as *L. americana.* As suggested above, most previous records of *L. americana* from California and Oregon were probably based on *L. fusca.*

The differences between *L. fusca* and *L. americana,* mentioned in my key, may seem trifling. Yet they appear to be constant and in the large series of both species studied I have seen no specimen of doubtful identity. A repeated and careful study of my material has failed to disclose other reliable characters. The following peculiarities may, however, be of some value. (1) The frons is usually narrower in *L. fusca* than in *L. americana,* although the width seems to be variable in both species; in most *fusca* it is less than one and a half times as wide as the eye; in most *americana* it is one and a half times to twice as wide as the eye. (2) The apical, flaring arms of the fronto-clypeus appear to be less spreading in *fusca* than in *americana.* (3) The color of body and legs is as a rule more uniform and darker mahogany brown in *fusca,* lighter and blotched in *americana,* while the wings of *fusca* lack the slight yellowish tinge of *americana.*

SYNONYMY.—That the flies here called *L. fusca* are specifically distinct from *L. americana* can hardly be doubted. A specimen without locality, received from the Zoölogical Institute of Halle a.S. (through Dr. Vult Ziehen), had been named "*fusca* Macquart" by the late A. Baù and this identification appears to be correct. Macquart's species could not possibly be recognized from the original description. Fortunately, Speiser has fully redescribed the type (from the Bigot Collection, now in the possession of Mr. J. E. Collin), and his account tallies well with the specimens listed above.

I am inclined to regard *Olfersia wolcotti* (type in the Dept. of Zoölogy, University of Nebraska at Lincoln, Nebraska), as a synonym of *L. fusca.* Swenk's brief description agrees with my specimens, except for his statement that the frons is "not wider than the breadth of an eye." In all my specimens of *L. fusca,* the frons is distinctly, though often only very slightly, wider than an eye.

Falcoz (1930) lists as synonyms of *L. fusca* both *Olfersia macquartii* Rondani and (with doubt) *O. angustifrons* v.d. Wulp. With regard to *angustifrons,* I follow Swenk, who places it among the smaller species and I have seen several specimens from Central America that agree in every respect with the original description. It appears to be a perfectly valid species. It is more difficult to decide what to do with *O. macquartii* (location of type unknown). Rondani received it from Macquart under the name "*fusca*" (but it was not Macquart's type, although it came from the same locality), and claimed that it did not agree with the original description of that species. Speiser (1902), in his discussion of the type of *O. fusca,* regards *macquartii* as distinct, but he points out only one difference: "Scheitel . . . in der Mitte des Vorderrandes mit einem seichten grubenförmig tiefen Einschnitt (Abweichung gegenüber *O. macquartii* Rond.)." This, however, is erroneous, since Rondani states in his description: "area verticale antice in medio incisa." Rondani's type does not appear to have been studied again.

As indicated below, *Olfersia raptatorum* Lutz, Neiva and da Costa Lima is probably also a synonym of *L. fusca.*

Ornithomya fusca "Macquart" Percheron, 1838, in

Guérin and Percheron, Genera des Insectes, 6e Livr., No. 9, Diptères, Pl. VI (no sex; with description, without locality), has evidently nothing in common with *Olfersia fusca* Macquart. The very large size (length 5 lines = 11 mm.), and the statement that ocelli were present, would seem to point to a species of *Ornithoctona.* The figures, it is true, do not show the closed anal cell, but this may be due to an oversight. It should, moreover, be noted that some at least of the detail drawings were made from *Ornithomyia avicularia.*

Lynchia nigra (Perty)

Hippobosca nigra Perty, 1833, Delectus Anim. Artic. Brasil., III, p. 190, Pl. XXXVII, fig. 15 (no sex; no host; State of Piauhy, Brazil).

Pseudolfersia nigra Austen, 1903, Ann. Mag. Nat. Hist., (7) XII, p. 266.

Olfersia nigra Speiser, 1905, Zeitschr. Syst. Hym. Dipt., V, p. 356. Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, VII, p. 181 (doubtful records).

Ornithomyia intertropica Walker, 1849, List. Dipt. Brit. Mus., IV, p. 1144 (no sex; Galapagos). Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, VII, p. 189.

Olfersia intertropica Austen, 1903, Ann. Mag. Nat. Hist., (7) XII, p. 264. Aldrich, 1905, Cat. North Amer. Dipt., p. 655. Speiser, 1907, Ent. News, XVIII, p. 104. Austen, 1911, Bull. Ent. Res., II, p. 172, footnote.

Lynchia intertropica Ferris, 1930, Canad. Entom., LXXII, p. 69, fig. 5 *B, C,* and *H.*

Olfersia acarta Speiser, 1902, Zeitschr. Syst. Hym. Dipt., II, p. 149 (no sex; type from Molokai; also from "short-eared owl" in Kona, and from Lanai; all Hawaiian Islands); 1902, Fauna Hawaiiensis, III, p. 87 (same localities; it is claimed here that the type, from Molokai, was found on a Frigate bird, *Fregata aquila,* a statement not made in the other paper). Alfken, 1904, Zool. Jahrb., Abt. Syst., XIX, p. 572.

The following references do not refer to true *O. nigra,* as here recognized:

Olfersia intertropica Swenk, 1916, Jl. New York Ent.

Soc., XXIV, pp. 129 and 133 (specimen from Orizaba, Mexico). Since Prof. Swenk places his *intertropica* in the group of small species, the specimen could not have been Walker's *intertropica.* It was probably either *Lynchia albipennis* (Say) or a closely allied species.

Ornithoponus intertropicus C. W. Johnson, 1924, Zoölogica, New York, V, No. 8, p. 91 (off *Butorides sundevalli*; Seymour Bay, Indefatigable, Galapagos); quoted by Curran, 1932, Nyt Mag. Naturvid., LXXI, p. 366. I have seen this specimen; it belongs to one of the smaller species, related to *Lynchia albipennis* (Say).

Specimens Examined.—Prov. Quebec: Kamouraska (au Moulin), Kamouraska Co., off Duck Hawk, *Falco peregrinus anatum* Bonaparte (W. LaBrie.—Dept. Agr. Canada, Ent. Br.).—Colorado: Denver, off Red-tailed Hawk, *Buteo borealis calurus* (Cassin) (W. H. Bergtold).— Montana: Truman Siding, Ravalli Co., off Red-tailed Hawk, *Buteo borealis calurus* (Cassin) (C. B. Philip).—New Mexico: (U. S. N. M.).—Texas: Elkhart, off a hawk (U. S. N. M.). —Mexico: one female without definite locality (A. Dugès.—Paris Mus.; specimen doubtfully referred to *Olfersia raptatorum* by Falcoz, 1930); Mexico City (U. S. N. M.).—Panama: Pacora, off Mexican Black Hawk, *Buteogallus* (or *Urubitinga*) *anthracina anthracina* (Lichtenstein) (L. H. Dunn).—Brazil: holotype, without more definite locality (Zoöl. Mus. Munich); Rio São Francisco, State of Bahia, off a hawk No. 1004 (J. A. Allen, Thayer Exped.—M. C. Z.).—Bolivia: Province Sara, one female (Steinbach.—M. C. Z.).—Galapagos Islands: Indefatigable Island, several specimens, off *Buteo galapagoensis* (Gould) (J. P. Chapin, Astor Exped.—Am. M. N. H.).—Hawaiian Islands: Kanai, off an owl (E. Knudsen).

Synonymy.—Through the kindness of Dr. E. O. Engel, I have been able to study Perty's type of *Hippobosca nigra*, now preserved at the Bavarian Zoölogical Museum, Munich. I find that it is specifically identical with Walker's *Ornithomyia intertropica* and Speiser's *Olfersia acarta.*

Lynchia dukei (Austen)

Olfersia dukei Austen, 1911, Bull. Ent. Res., II, p. 171 (♀;

off *Haliætus vocifer* (Daudin); Nsadzi Island, Lake Victoria, Uganda). Neave, 1912, *Ibidem*, III, p. 322.

Lynchia dukei Falcoz, 1930, Encyclop. Entom., Diptera, V, p. 48.

Ornithomyia nigricans C. W. Johnson, 1898, Proc. Ac. Nat. Sc. Philadelphia, p. 164. Not of Leach.

SPECIMENS EXAMINED.—Belgian Congo: Kwamouth (J. Maes); Ganda Sundi, two specimens off a bird of prey (H. Schouteden); M'Bamu Island in the Stanley Pool, one male (E. Roubaud.—Paris Museum); Elisabethville, three females off Bateleur Eagle, *Terathopius ecaudatus* (Daudin) (J. De Riemaecker).—Abyssinia: Dada, near the Daroli River, one male and one female (A. D. Smith.—Ac. Nat. Sc. Phila.; specimens recorded by Johnson, 1898, as *O. nigricans*).

This species, the type of which is at the British Museum, is exceedingly close to *L. nigra* (Perty) and I am by no means satisfied that it is distinct. Austen writes that it is distinguishable from *Olfersia intertropica* (Walker) (a synonym, in my opinion, of *L. nigra*) "by its more elongate and darker palpi, by the hairs and punctures on the inner borders of the sides of the front being fewer in number and coarser, and especially by the different shape of the shining plate on the vertex, which is more transversely elongate, and the anterior angles of which are more abruptly rounded off." Of these differences, only the shape of the postvertex (as indicated in my key) seems reliable in the series of *dukei* and *nigra* studied. The length of the palpi in dried specimens varies with the retraction of the proboscis; and I can detect no difference in the number and coarseness of the hairs on the inner orbits of perfectly preserved specimens (the punctures being the insertions of the hairs). Austen gives the length of the wing as 9.4 mm., but this must be unusual, since the wing in my specimens reaches at most 8.5 mm. in length.

Lynchia penelopes Weyenbergh

Lynchia penelopes Weyenbergh, 1881, Anales Soc. Cientif. Argentina, XI, p. 199 (♀ ♂; off *Penelope canicollis* Wagler; Province of Tucuman, Argentina). Brèthes, 1907, An. Mus. Nac. Buenos Aires, XVI, p. 302. Speiser, 1908, Zeitschr. Wiss. Insektenbiol., IV, p. 304. J. Bequaert, 1926, Psyche, XXXII, (1925), p. 270.

This species has not been recognized thus far, but, from the description and the host, it is evidently quite distinct from any of the foregoing. If Weyenbergh's measurements are correct (spread of wings, 2.5 cm., corresponding to a wing length of 10 to 11 mm.), the large size alone should enable one to recognize it.

Lynchia raptatorum (Lutz, Neiva and da Costa Lima)

Olfersia raptatorum Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, VII, p. 181, Pl. XXVIII, fig. 3 (no sex; off *Polyborus tharus*, *Milvago chimachima* and *Leucopternis palliata* in several States of Brazil; and off *Cathartes aura*, State of Piauhy, Brazil). Ad. Lutz, 1928, Est. Zool. Paras. Venezolanas, p. 9.

The length of the wing (7.5 to 8 mm.) places *L. raptatorum* in the group here under discussion. It is probably either *L. fusca* (Macquart) or *L. nigra* (Perty), both of which are found on birds of prey. The original description is insufficient to decide the point, but the probabilities are rather for *L. fusca*.

A SECOND PARASITIC CREMATOGASTER

By William Morton Wheeler

Harvard University

In 1930 I described in this journal a diminutive, presumably parasitic, female ant, *Crematogaster* (*Acrocœlia*) *kennedyi,* taken by Professor C. H. Kennedy in Indiana from a colony of our common acrobat ant, *C. lineolata* Say. Now Dr. W. S. Creighton has sent me winged females of another closely related form which he collected recently at Roanoke, Virginia, in a colony of *C. pilosa* Pergande. Since the colony also contained many females of the host, the alternatives discussed in my previous paper, seem to be applicable to this case. We may suppose that we are dealing either with a workerless parasite or with a remarkable dimorphism and dichromatism of the females of *lineolata* and *pilosa.* The latter supposition seems to be improbable because the occurrence of two forms of females cannot be a normal peculiarity of *lineolata,* since in hundreds of colonies of this ant examined by myself and others during the past 40 years only females of the large type have been encountered. And though smaller females occasionally occur in colonies of certain tropical species of Crematogaster, they are always few in number, wingless and ergatomorphic, and therefore quite unlike the perfect, winged microgynes taken by Prof. Kennedy and Dr. Creighton. Nevertheless, a rather serious objection to the interpretation of these insects is the presence of virgin females of the host species in the same nest. This has never been observed in any of the numerous recorded cases of ant parasitism. In the European *Strongylognathus testaceus,* however, the mother queen of the host colony (*Tetramorium cæspitum*) is not eliminated after the intrusion of the parasitic female, and Wasmann described a flourishing mixed colony of these ants in which a few male pupæ of the host species were present. Perhaps, therefore, *C. kennedyi* and *creightoni* represent a hitherto unknown type of social parasitism, in which the males and females of the parasite are permitted to develop to maturity in a host colony which not only retains its mother queen but also succeeds in rearing females and males of its own species. That the two parasitic species of Crematogaster have been brought to light only very recently is not surprising, because all the workerless parasitic ants are extremely rare. One of these, *Epœcus pergandei* Emery, described in 1894, from specimens taken by Pergande near Washington, D. C., is still known only from the types, notwithstanding long and diligent search for additional specimens by Dr. W. M. Mann, Dr. Creighton and myself. Moreover, the presence of workerless parasites in a colony is very apt to be overlooked unless the nest happens to be examined during the few days that intervene between the emergence of the parasites and their nuptial or dissemination flight. Since there is every reason to believe that both *kennedyi* and *creightoni* are derived phylogenetically from their respective host species, either by mutation or, more probably, by a gradual reduction in size and fecundity of certain females (compare, for example, the series of temporary social parasites of the genus Formica, beginning with such forms as *F. rufa* and *truncorum* and ending in the North American species of the *microgyna* group), the parasitism of the two species of Crematogaster may be in a primitive phylogenetic stage, that is one in which the reduction in size and fecundity of the female is already accomplished but in which the host species has not yet acquired the habit of substituting the parasitic queen for that of its own species, as in certain other workerless species (Anergates, Bruchomyrma, etc.).

Crematogaster (*Acrocœlia*) *pilosa*, the host of *C. creightoni* is not as well known as many of the other members of the *lineolata* "Formenkreis," which has a wide distribution, embracing Nova Scotia, Southern Ontario and the whole United States. Emery (1849) described only the worker *pilosa* as a subspecies of *lineolata* from specimens furnished by Pergande, who discovered it in the District of Columbia. It has since been recorded from Southern New Jersey and Florida. The specimens collected by Dr.

Creighton comprise three workers, three females and a male.

The worker closely resembles the typical *lineolata* in form and sculpture, but the head is smoother and more shining posteriorly and the epinotal spines, though fully as long as in *lineolata,* are distinctly more slender and tapering and even more acute at their tips. The pilosity is conspicuously longer and more abundant on all parts of the body, and, on the antennal scapes and legs, long and suberect, whereas in *lineolata* and its varieties these parts have only a dilute and appressed pubescence, though of somewhat variable length in specimens from different localities. Color brown or brownish red, with the head somewhat darker and the gaster piceous or blackish; mandibles sometimes yellowish and paler than the head; funiculi, except their tips, usually paler than the scapes.

The female (undescribed) measures 8.5 - 9 mm. and is of the same size and deep piceous or blackish coloration as the typical *lineolata,* but the wings have their basal two-thirds distinctly tinged with brown and the veins and pterostigma are dark brown, instead of white as in *lineolata.* Pilosity like that of the worker, much more abundant and conspicuous on all parts of the body, long and suberect on the antennal scapes and tibiæ. Even the wing-membranes are distinctly more pubescent than in the female *lineolata.* Anterior two-thirds of head more shining, more sharply and more coarsely rugulose, with less distinct punctulation or reticulation between the rugæ.

In the absence of authentic males of *pilosa* I am unable to decide whether the single male sent me by Dr. Creighton belongs to the host or to the parasitic species. Its very small size (only 3 mm.) might indicate that it belongs to the latter. Though the head and thorax are almost hairless, the pilosity of the legs is like that of the *pilosa* worker. The mandibles are narrower than in the male of the typical *lineolata* and have only 2 instead of 3 or 4 teeth. The color of the body is deep black, with brown legs and antennal funiculi and more reddish scapes and mandibles. The wings are distinctly yellowish at the base, with brown veins and pterostigma, and therefore resemble the wings of the female *pilosa.*

Crematogaster (Acrocœlia) creightoni sp. nov.

Female. Length 5 - 5.2 mm.; fore wing 4 mm.

Closely resembling *kennedyi* Wheeler in form but averaging smaller; the head narrower in proportion to its length, with somewhat more rounded sides; antennal scapes slightly longer. Thorax shorter; mesonotum decidely shorter, scarcely longer than broad; epinotal spines longer, more slender, less swollen at their bases. Petiole more concave above, with more sharply marginate sides; postpetiole distinctly shorter in proportion to its width and with less pronounced posterior emargination. Gaster of the same shape as in *kennedyi.*

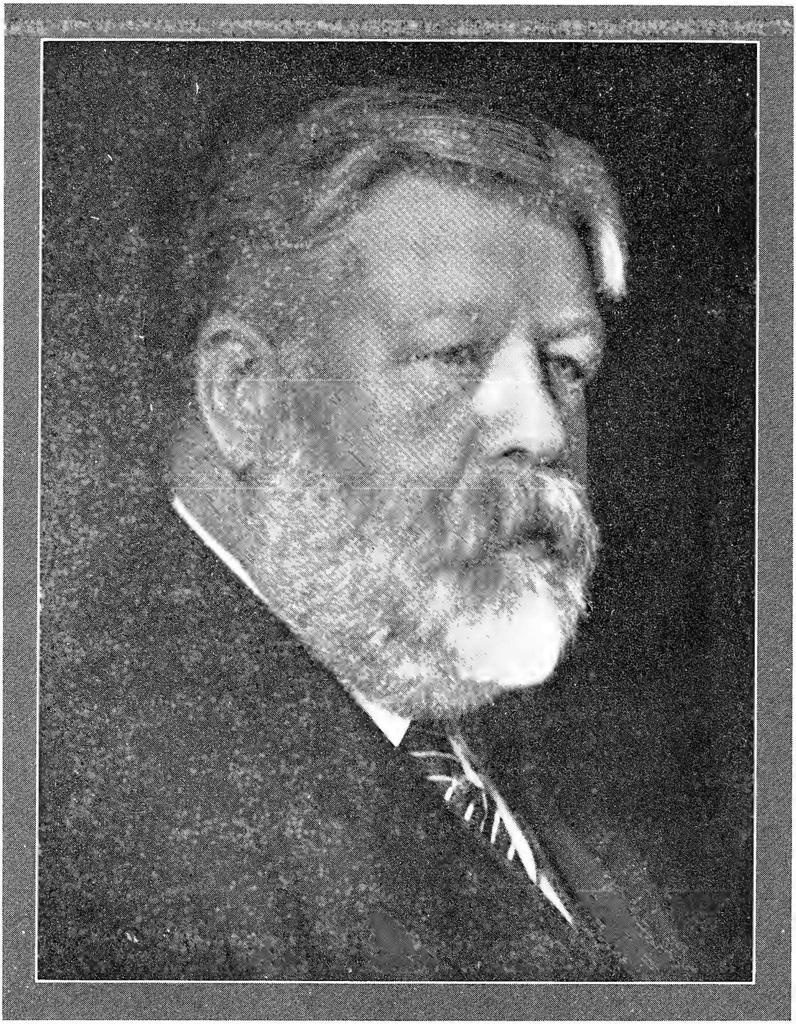
Head more shining, especially behind; fine piligerous punctures of mesonotum and scutellum more numerous.

Pilosity on all parts of the body, including the wing-membranes, longer, much more abundant and of more uneven length.

Brownish red; front and middle of occiput, mesonotum, scutellum and gaster black; scapes, upper surface of postpetiole and middle portions of femora and tibiæ dark brown; pleuræ spotted with brown. Wings, as in *kennedyi,* white with white veins and white, or in some specimens, slightly brownish pterostigma.

Described from six specimens from Roanoke, Virginia, Sept. 10, 1932 (W. S. Creighton).

C. creightoni might, perhaps, be regarded as a subspecies of *kennedyi.* In color and pilosity the female of the former is certainly more closely related to its host, but the color of the wings is quite different, being like that of *kennedyi* and the typical *lineolata.* Dr. Creighton has sent me the following note: "Unfortunately, I cannot give you any startling facts about the colony since it appeared to be perfectly normal in every respect. As I recall, it was under a limestone slab not far from a small stream. There were many sexual forms in the nest, and of these I should say that the normal ones exceeded the parasitic males and females by perhaps two to one. Certainly there was no excessive proportion of the latter."



Percy Gardner Bolster, 1865-1932

PERCY GARDNER BOLSTER

August 20, 1865-May 22, 1932

Percy Gardner Bolster, son of the late Judge S. A. Bolster and Sarah Gardner Bolster, died in Boston, May 22, 1932, at 66 years of age. He was educated at the Roxbury Latin School and Harvard College, where he received the degree of A. B., *summa cum laude,* in 1886. He was a member of Phi Beta Kappa. Following the wishes of his father, he entered the Harvard Medical School, and while there he received the degree of A. M. Following his inclination for law he later left the Medical School and entered the Harvard Law School. He passed the Bar examinations at the end of his second year, and started practicing immediately.

He was a member of numerous clubs, including the Cambridge Entomological Club, to which he was elected (from the Harris Club) in 1903, and of which he was a member until his death. He was president for 1909 and 1913, and on the executive committee six times. As retiring president, in January 1910, he read a paper on the history of the Club. The manuscript of the paper, which contains much valuable information, has been presented to the club. As an entomologist Mr. Bolster was first interested in Lepidoptera, later in Hymenoptera, and finally and most deeply in Coleoptera. He collected extensively, especially in New England, Nova Scotia, and Newfoundland. His manuscript list of the beetles he had collected in Newfoundland was used by Sherman in compiling a list of Labrador Coleoptera in 1910. Two insects collected by Mr. Bolster bear his name: *Bombus bolsteri* Franklin and *Dolichopus bolsteri* Van Duzee, Cole & Aldrich. In 1917, after fire had destroyed the Wellesley College insect collection, he presented a series of Coleoptera to help replace it. His collection at the time of his death contained about 60,000 specimens of Hymenoptera and beetles, in excellent condition and labeled not only with collecting data but with authoritative identifications and the sources from which they had been received. The collection might serve as a model for orderliness and for care and accuracy of annotation. Together with part of Mr. Bolster's entomological library it has been presented to the Museum of Comparative Zoology, at Harvard College, by his widow and son, Charles S. Bolster, Harvard '15. It adds materially to the museum collection, and the specimens, which have been individually labeled "Percy Gardner Bolster Coll'n," will remain as a monument to Mr. Bolster's skill and patience as an entomologist.

It is with the deepest sorrow that the Cambridge Entomological Club records the loss of Mr. Bolster, one of its least assuming but most helpful members.

P. J. Darlington, Jr.

PSYCHE

VOL. XL SEPTEMBER, 1933 No. 3

TWO WASP-GUESTS FROM PUERTO RICO (MICROLEPIDOPTERA).

By Wm. T. M. Forbes,

Cornell University, Ithaca, N. Y.

The two following species were reared by Mr. Francisco Seín, Jr., from nests of Polistes, along with the well-known *Setomorpha insectella*, and two Pyralids, which are to be included in Dr. Schaus's revision of that family. One of these new species which is accompanied by the pupa has also been found in Cuba, making a description perhaps more advisable.

Tæniodictys, new genus

Head with smooth flat occiput, heavily tufted vertex, and smooth, strongly retreating front. Ocelli invisible, apparently absent; eyes large, labial palpi moderate, obliquely upturned or drooping (loosely held), clothed with irregular bristly scales, but without true bristles; maxillary palpi of folded type, the visible part short, drooping on each side of tongue, which is naked. Antennae with scape broad, concave and bristly-scaled, covering over half of eye but hardly a true eyecap, without pecten; shaft 5/6, smoothly scaled with one whorl to a segment. Body nearly cylindrical, the coxæ not flattened against the body; mid-tibiæ smooth-scaled, normal, hind tibiæ with spurs at 2/5, clothed above with bristly hairs, which are long except before the upper spurs; hind metatarsus also clothed above with some bristly hairs. Fore wing (fig. 1) linear, rather caudate; smooth and glossy; Sc short, R_1 absent, R_2 and R_3 free, arising from the upper side of the cell, which is represented by a ridge on the under side, there being no trace of a true vein; R_4 stalked with M_2, M_1 lost; M_3 normal, from same point of origin as stalks of R_4-M_2; Cu simple, a true vein all the way, exceedingly closely parallel to the ridge that represents R, so that the cell is linear; A short, sinuous, simple; 1st A represented by a slight fold only; hind wing under 1/2; fringe over 6; costa with sinuousity and specialized scales quite close to base, the vein Sc fading out only a little beyond it; Cu simple and short; the remaining veins represented only by ridges on the under side, which appear to represent Rs and three medians, the two upper connate; no cell.

This genus would belong to the Oinophilidæ, considering the well developed palpi (labial and maxillary) and semi-scavenger habits. By Meyrick's grouping it would be included in the Lyonetiidæ, whose typical members have lost the mouth-parts, and have smooth heads, and have larvæ feeding on living plants. The genus appears distinct, but in the complete absence of any attempt at a classification of the group it is difficult to be sure. I have not come across any genus in the group which shows the exceedingly narrow cell, and most of the few genera which have lost R_1 are Old World forms of quite different appearance.

Tæniodictys sericella, new species

Glossy ash gray, nearly immaculate. Top of head and thorax rather paler, with luteous tint, gradually shading into luteous on lower part of tuft and under side of head, antennæ pale pearl gray above, the scape more luteous; fore wing shading gradually into deeper gray toward apex and luteous white toward inner margin, the basal half of dorsal fringe markedly shaded with luteous. Hind wing clay color, the dorsal fringe also heavily shaded with brighter luteous. Legs dirty white, shaded on outer sides with light gray. Abdomen pale gray, the under side toward apex and anal tuft paler and yellower. 6-7 mm.

Lares, Puerto Rico, Dec. 1931, holotype and several paratypes reared from nests of *Polistes crinitus* by Fr. Seín, Jr., with a much larger number of the following species. Holotype in Cornell University collection, type No. 1240.

Antipolistes, new genus

Similar to Tinea. Head densely hairy all over, the hair above the antennæ tending to form two tufts, as usual; eyes very small, separated by more than 3 times their width; ocelli invisible; antennæ over 2/3, simple, scape simple, somewhat roughly scaled, without pecten or eyecap, shaft with one whorl of long scales to a segment, smooth toward base, somewhat rough outwardly; labial palpi moderate, drooping, second segment bristled, third rather shorter, fusiform; maxillary palpi invisible, and tongue absent; hind tibia with upper spurs between 1/3 and 1/4, the outer upper spur very long, reaching nearly to tip of tibia; loosely hairy above and with some loose hair below; tarsus not modified. Wings lanceolate (figs. 2 ♂, 3 ♀); fore wing with R_1 and Cu_1 lost, and one other vein (apparently M_1); the three apical veins stalked, but not always the same way; no accessory cell; R_5 running to costa, R_2 arising at 5/6, Cu_2 a little further out but hardly at angle. 1st A absent, 2nd A simple. Hind wing broad lanceolate, 2/3 fore wing, the costa a little sinuate beyond middle; subcosta ending beyond the sinuation but far before apex, R simple, free, M_1 lost, M_2 very weak and free, M_3 longer and free; Cu a much stronger vein, plainly forked at apex. No cell or anal veins. Fringe 3.

There are a few weak aculeæ at the base of the cell of the fore wing, besides the usual patch on the inner margin.

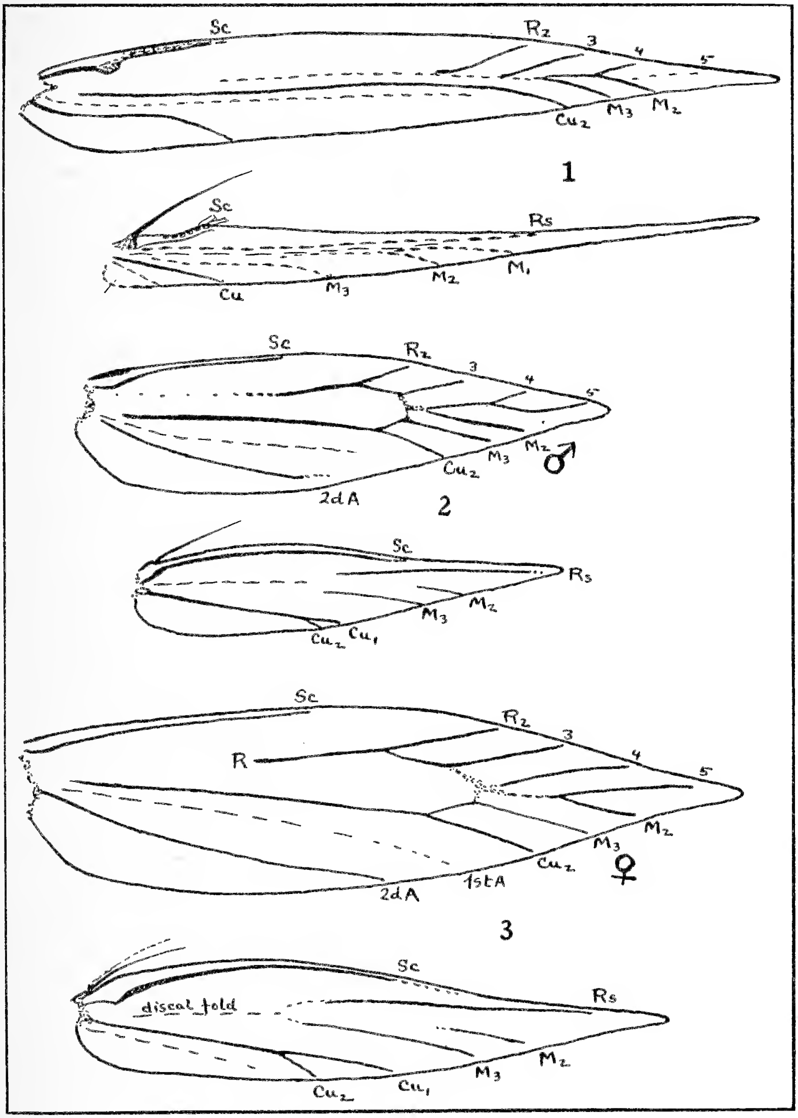
This genus is the most reduced of the Tineidæ known to me, the vein formula being 9-5; I judge it is a reduction of Achanodes, but the only genera that seem to have reached a similar stage of reduction in venation are the Indian Brachydoxa and Asyndetaula, which show by their short antennæ and smooth hind tibiæ that they do not belong to the true Tinea group. Meyrick's *Clepticodes hexaleuca* (Exot. Micr., iv, 324) must be similar, but if correctly placed by Meyrick has a much more complete structure:—with maxillary palpi folded, R_3 apparently free, and all three medials of hind wing preserved, but Cu_1 lost.

Antipolistes anthracella, new species

Coal black. Head lighter, wood brown to umber brown according to the light, becoming darker on under side of tuft and about mouth. Antennæ and palpi fuscous gray; legs pearl gray, the segments barred with dark gray, leaving pale bands at the joints, all very difficult to see clearly on account of the gloss of the scaling. Fore wing coal black, with four whitish spots, on the costa near middle and at 5/6, and in the fold at 1/3 and rather below the fold at 2/3; the spots variable in size, and tending to be relatively smaller in the female. Under side mouse gray. Female much like male, but noticeably larger, and apparently darker. ♂ 4 1/2 mm. ♀ nearly 6 mm.

Lares, Puerto Rico, holotype male and numerous specimens of both sexes reared by Fr. Seín, Jr., from nests of *Polistes crinitus,* in Dec. 1931; also several paratypes from Guabairo, Central Soledad, Cienfuegos, Cuba, reared from two nests of *Polistes cubensis* Lep. by Richard Dow. Holotype in Cornell University collection, type no. 1241, paratypes in Cornell University collection, Museum of Comparative Zoölogy and National Museum.

The larva appears to be unknown. Pupa (from Seín) similar to *Tinea pellionella* as figured by Miss Mosher (Bull. Ill. State Lab. Nat. Hist., xii, pl. 20, figs. 30, 31), sutures not clearly seen, prothorax depressed dorsally, maxillæ shorter, nearly obsolete, but maxillary palpi large and transverse; antennæ barely longer than fore wings; angulations of terminal segment ventral rather than lateral. The small round eyes are also more completely visible below the antennæ. Abdomen dorsally with first three segments unarmed; fifth and sixth with anterior rows of fine spinules; 7th and 8th also with coarser rows near the mid-segments, the latter rather sparse; ninth segment with two subdorsal clusters of about three spinules each and last with small pointed subdorsal cones.



Forbes—Microlepidopterous Wasp-Guests

FOUR NEW SPECIES OF CHIRONOMIDÆ FROM THE GREATER ANTILLES

By Bertram I. Gerry,

Department of Agriculture, Boston, Mass.

The material, from which the new Cuban species were isolated, was collected by Professor Nathan Banks of the Museum of Comparative Zoology of Harvard University. That from which the new Jamaica species were taken, was collected by Mr. W. S. Brooks of the same institution. The types may be found in the collection at the Museum mentioned above.

Bezzia banksi sp. nov.

Female.—Dull brown. Head brown, vertex grayish, eyes narrowly separated dorsally, antennæ pale brown. Thorax dull brown, pronotal lobes silvered dorsally, mesonotum dull brown, sparsely clothed with short golden hairs, a grayish pollinosity extending over the lateral portions of the disc and the upper portions of the pleurae, scutellum yellowish, halters whitish. Abdomen blackish brown, sparsely clothed with short golden hairs, the ground color somewhat obscured by the conspicuous grayish pollinosity, venter fulvous. Legs blackish brown, fore femora with six apical spines grouped five and one, mid and hind femora each possessing three apical spines; tarsi yellowish, first, second, third and fourth segments narrowly blackened at apices, the fifth entirely black; metatarsi of fore and mid legs equal to the combined length of second, third, and fourth tarsal segments, those of the hind legs equal to the combined length of the four remaining segments, fifth tarsal segments with two ventral rows of blunt tipped spines; tarsal claws long and equal, each possessing a large basal tooth. Wings hyaline, anterior veins light yellow, vein (R_1) terminating at costa before (R_3), vein (R_{4+5})

joining costa at a point six sevenths of the distance from wing base to apex, cubitus forking just beyond the crossvein; anal vein forked, the anterior branch joining the tip of vein (Cu_2) at the wing margin, posterior branch short and sinuous.

Male.—Undescribed.

Length.—3.00 mm.

Coll. by Nathan Banks, Soledad, Cienfuegos, Cuba. June.

This species will run to *B. setipes* Coquillett in Malloch's key for the genus Bezzia. Since, however, *B. setipes* possesses yellow fore and mid tibiæ and the number and arrangement of the femoral spines differ in the two species, they may be readily separated.

Tanypus brooksi, sp. nov.

Male.—Brownish yellow. Head yellow; antennæ light brown, longer than head and thorax combined, scape dark brown with greenish pruinescence, palpi yellow. Thorax light brown, pronotum with silvery sheen, mesonotum with dark ground color nearly obscured by heavy greenish pruinescence, pleurae pale brown with slight pruinescence, scutellum yellowish, postnotum blackish brown with greenish pruinescence, halters yellow with blackish knob. Abdomen yellow, segments three to seven yellow with brown basal bands, segments seven and eight black with conspicuous whorls of long coarse blackish hairs, venter yellow. Legs pale brown, clothed with short brownish hairs; femora pale brown, tibiae yellowish, the apices narrowly brown; tarsi pale yellow, the apices of segments one, two and three narrowly brown; fourth and fifth segments entirely brown, ratio between fore tibiae and fore metatarsi (14-9). Wings whitish, unspotted, sparsely clothed with short brownish hairs, veins nearly colorless, costa terminating in front of apex, vein (R_1) at a point two-fifths the distance from crossvein to end of costa, vein (R_{4+5}) terminating at a point three-fifths the distance from crossvein to tip of costa, crossvein not infuscated. Hypopygium yellow, coxites long and blunt; styli narrow, resembling those of *T. illinoensis* but possessing a simple tip as in *T. hirtipennis.*

Female.—Undescribed.

Length.—2.50 to 3.00 mm.

Coll. by W. S. Brooks, Moneague, Jamaica. January.

The outstanding characteristics of this species are as follows:—heavy greenish pruinescence of mesonotum and silvery pruinescence of pronotum; brown basal bands of abdominal segments three, four, five and six; the blackish seventh and eighth abdominal segments with whorls of long, black, spine-like hairs; conspicuous yellow coxites of the hypopygium.

Chironomus jamaicensis sp. nov.

Male.—Yellowish green. Head yellow, antennæ brown, scape brown, palpi yellowish brown. Thorax yellow, mesonotum yellow with wide reddish vittae, pleurae yellowish, scutellum pale greenish yellow, postnotum brown; halters pale yellow to white, the apex slightly greenish. Abdomen yellow, the first three basal segments often greenish, remaining segments including the hypopygium pale brown, venter greenish yellow. Legs yellow, mid and hind legs sparsely clothed with long brownish hairs, coxae yellowish, fore femora dark brown, mid and hind femora greenish yellow; fore tibiae brownish, the apices narrowly blackened, apical comb absent; mid and hind tibiae yellowish with conspicuous black apical combs; fore tarsi entirely brown, metatarsi nearly twice as long as fore tibiae, ratio between fore tibia and tarsal segments as follows 40—70, 40, 30, 25, 15; mid and hind tarsi brownish yellow, the distal half of second and the entire third, fourth and fifth segments blackened. Wings hyaline, veins pale yellow, crossvein not infuscated, vein (R_1) joining the costa at a point slightly more than half the distance from crossvein to tip of vein (R_{4+5}), media and (R_{4+5}) equidistant from wing apex, cubitus forking distinctly beyond crossvein. Hypopygium similar to that of *C. decorus.*

Female.—Agrees with male regarding color.

Length.—3.50 to 4.00 mm.

Coll. by W. S. Brooks, Moneague, Jamaica. February.

This species appears to be closely related to *C. decorus* and *C. serus* from the standpoint of male hypopygium, but differs from these in regard to abdominal markings, the absence of any discernible infuscation of the crossvein, and also in the fork of the cubitus which is located beyond the crossvein.

Chironomus bulbosa sp. nov.

Male.—Yellow, marked with green. Head greenish yellow, antennæ brown, plume whitish at base, scape pale brown. Thorax greenish with reddish vittæ, scutellum green, postnotum yellow, halters white with greenish apices. Abdomen greenish yellow, sparsely clothed with short yellow hairs. Legs pale green; fore femora and fore tibiæ light brown, narrowly blackened at apices; fore metatarsus less than one and one-half times length of fore tibia (10-13); mid and hind femora and tibiæ greenish yellow, densely clothed with long yellowish hairs; tarsi pale brown, the fourth and fifth segments blackened. Wings hyaline, greenish at base, veins pale brown, vein (R_{4+5}) and media equidistant from wing apex; cubitus forking beyond the crossvein. Hypopygium brownish yellow; the coxites and inner processes large, curved and leaf-like, forming a conspicuous bulb at tip of abdomen.

Female.—Differs slightly in coloration, i.e., the head, greater portion of thorax, and the abdomen are a deeper green.

Length.—3.00 to 3.50 mm.

Coll. by Nathan Banks, Soledad, Cienfuegos, Cuba. August.

The male of this species may be easily identified by the bulbose form of the hypopygium.

CYATHOMYRMEX, A NEW NAME FOR THE SUBGENUS CYATHOCEPHALUS EMERY.

By William Steel Creighton,

Dept. of Biology, College of the City of New York.

The purpose of this note is to call attention to the existence of a synonym in the case of the generic name *Cyathocephalus*. This name was first used by the helminthologist Kessler in 1868 and repeated as the name of a subgenus of ants by Emery in 1915. With several excellent compilations of generic names at the disposal of the taxonomists it is surprising that the repetition has escaped detection for a period of almost eighteen years. The history of this synonym is instructive since it is a perfect example of the evils arising from what may be called a buried subgenus. It is obvious that the task imposed upon the compilers of generic and subgeneric lists is yearly growing more onerous. In justice to the men who have undertaken this herculean labor as well as for the sake of their own subject taxonomists should bend every effort to make the names of new subgenera as prominent as position and typography will permit. The present case demonstrates how easily confusion can arise when this practice is not followed.

In 1868 Kessler erected the genus *Cyathocephalus* to include a single species of a Cestode worm previously described by Pallas (1781) under the specific name *truncatus*. Kessler's work appeared in Russian in the Proceedings of the Russian Naturalists Society of St. Petersburg. Because of linguistic difficulties or, as seems more probable, because of the great rarity of the early issues of this periodical Kessler's description did not come to the attention of the compilators for a number of years. The first standard compilation to list the genus *Cyathocephalus* seems to have been Bronn's Klassen und Ordnungen des Tier Reichs. In 1894 this publication carried a reference to a paper by Brauns in which the genus was mentioned. Four years later the genus *Cyathocephalus* appeared in the Zoological Record, this time having been brought to light by Riggenbach when he described a second species in the genus. It is natural to suppose that the name *Cyathocephalus* would have been listed in the Record's Index of Genera covering the period from 1891 to 1900. Actually it occurs in the Index for 1901 to 1910. The genus does not, of course, appear in Sherborn's Index Animalium since at present this colossal publication deals only with descriptions made prior to 1850. Heider includes Kessler's *Cyathocephalus* in his Nomenclator Animalium citing Braun's paper as his source. I am at a loss to account for the absence of Emery's synonymic subgenus in this publication for, as will be subsequently shown, there is no reason for the omission of the subgenus *Cyathocephalus* in any list made after 1921.

So much for the taxonomic history of the original *Cyathocephalus*. Let us now consider the case of Emery's synonym. In 1915 Emery published a brief paper in the Bulletin of the Entomological Society of France entitled "Names of Subgenera and Genera proposed for the Subfamily Myrmicinae." In an explanatory preface Emery states that the paper presents a summary of work prepared for inclusion in Wytsman's Genera Insectorum. At that time this publication had been suspended on account of the World War and it is easy to appreciate Emery's anxiety to get his work into print. It may be questioned, however, that any circumstances justify the means which he took to insure the priority of his classification. In his paper, three pages in length Emery established eleven new subgenera. Five of these were delimited at least by a line or two of description but the remaining six were set up by simply designating a type. Emery's position was, nevertheless, technically secure since all of his subgenotypes were previously described species. Regardless of what attitude we take as to the propriety of this procedure there can be no question that Emery made a serious mistake by incorporating the names of six of his new subgenera in the text of the article in such a manner that it is virtually impossible to discover their existence. Nor does Emery's culpability end here since, through oversight, he used the name *Cyathocephalus* for one of his new subgenera. As has already been shown this name was present in two standard compilations prior to the year 1915. There is, consequently, no way in which Emery could have justified his repetition of the name.

Emery's paper was duly entered in the Zoological Record for 1915 and it is interesting to see what they made of it. Three of the subgenera were prominently placed in a key and noted as new in bold face type. Immediately following this key were two line descriptions of two more new subgenera which were also noted in bold face. All five of these are listed in the index of the Zoological Record for the year 1915. The remaining six subgenera were incorporated in several short paragraphs which together total slightly more than three hundred words. Of these seventy-nine are italicized. To make matters worse the italics may be specific, generic or tribal names and in one case they refer to a publication. Is it any wonder, since Argus could not be called to the aid of the compilators, that the names of the six new subgenera escaped notice? It may be said in Emery's defense that his masterly treatment of the Myrmicinae in the Genera Insectorum, when that section was published in 1921, does much to condone this rare lapse from taxonomic grace. At the same time it cannot be too strongly stressed that the practice of embodying the names and description of new subgenera as a part of the text is pernicious in the extreme. The very facility with which this can be done, especially if the subgenotype is one of previous description, makes it especially dangerous.

There remains the duty of assigning a new subgeneric name to replace Emery's synonym. With a view to minimizing the change and retaining a term which is very aptly applied to the curious, cup-headed workers of this group I propose the following alteration:

Subgenus **Cyathomyrmex** nomen novum, to replace the synonymic subgenus *Cyathocephalus* Emery. The subgenotype *Cryptocerus pallens* Klug, the subgeneric characteristics as delimited by Emery in the Myrmicine section of the Genera Insectorum.

NOTES ON HIPPOBOSCIDAE

7. A TENTATIVE KEY TO THE SPECIES OF *OLFERSIA* WIEDEMANN (*FERONIA* LEACH; *PSEUDOLFERSIA* COQUILLETT).

By J. Bequaert

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A prolonged study of extensive material has led me to recognize more species of *Olfersia* than is customary at present. Pending the more detailed publication of my results, I offer herewith a key to the species which I regard as valid. Full acknowledgments will be given later; but I wish to thank now Prof. G. F. Ferris for entrusting me with his entire collection of the genus, as well as Mr. J. E. Collin for the detailed study of Bigot's types which he made at my request.

Key to Species

1. First basal cell (R) short and wide, distinctly bulging before the apex; fourth longitudinal vein (M_{1+2}) partly setulose. First tergal plate of abdomen triangularly excised at apex in male, divided into two median lobes in female..*O. sordida* Bigot.
   First basal cell (R) long and narrow, its apical half parallel-sided or nearly so; fourth longitudinal vein (M_{1+2}) bare throughout. Apical margin of first tergal plate straight or slightly curved inward........................2.

2. Posterior orbits (above eyes) about as long as or barely shorter than the greatest width of the inner orbits; occipital margins of posterior orbits and of postvertex (or vertical plate) strongly produced behind and separated from one another by deep curved notches. Lower, frontal area of postvertex alutaceous, separated from the upper, smoother area by a slight transverse depression ....3.

Posterior orbits much shorter than the greatest width of the inner orbits; occipital margins of posterior orbits and of postvertex scarcely produced and separated by shallow curves ....4.

3. Occipital margin of postvertex somewhat more produced behind than the posterior orbits. Third longitudinal vein (R_{4+5}) setulose throughout. Cross-vein closing second basal cell very oblique, the upper outer angle of the cell acute .... *O. spinifera* (Leach).
Occipital margins of postvertex and of posterior orbits about equally produced behind. Third longitudinal vein either bare or at most with a few setæ toward apex. Cross-vein closing second basal cell nearly vertical, the upper outer angle of the cell almost square.
.... *A. erythropsis* Bigot.

4. Second basal cell (M) very short; second section of fourth longitudinal vein (M_{1+2}) about twice as long as first section of fifth ($M_{3+}Cu_1$). Frons not or hardly wider than an eye. Postvertex not divided by a transverse depression from the lower, frontal area. Third longitudinal vein (R_{4+5}) with minute setæ, as a rule on apical portion only .... *O. bisulcata* Macquart.
Second basal cell long; second section of fourth longitudinal vein at most one and one-third times the length of the first section of the fifth (often about the same length) 5

5. Third longitudinal vein (R_{4+5}) distinctly setulose throughout. Postvertex not divided by a transverse depression from the lower, frontal area. Frons narrow, not or hardly wider than an eye
.... *O. fumipennis* (Sahlberg).
Third longitudinal vein bare or at most with a few minute setæ on apical portion ....6.

6. Postvertex not divided by a transverse depression from the lower, frontal area, extending as one smooth and shiny plate from the occiput to the fronto-clypeus. Frons at least one and one-third times as wide as an eye. Wing 7 to 9 mm. long .... *O. fossulata* Macquart.

Postvertex divided by a slight transverse depression into an upper, smooth and shiny area and a lower (frontal) portion which is more or less dull. Frons about one and one-fifth times as wide as an eye, rarely slightly more. Wing 6 to 8 mm. long........................*O. coriacea* v.d. Wulp.

The synonymy, characters, distribution and hosts of the several species will be fully discussed later. The following remarks are preliminary:

Olfersia sordida Bigot

According to Mr. J. E. Collin, Bigot's type is a male and shows the characters here given for the species. Originally described from Guatemala, *O. sordida* is widely distributed in North America. I have seen it from Oregon, Louisiana, Florida, the Bahamas, St. Thomas (W. I.), Jamaica, Trinidad, Mexico and Panama. The usual host is the Brown Pelican, *Pelecanus occidentalis* Linnaeus; but I have also seen it from the Florida Cormorant, *Phalacrocorax auritus floridanus* (Audubon).

Olfersia spinifera (Leach)

I regard *Ornithomyia unicolor* Walker, *Olfersia courtilleri* "Fairmaire" Courtiller, and *Olfersia sulcifrons* C. G. Thomson as synonyms of *O. spinifera*. I have seen specimens of true *spinifera* from Florida, Louisiana, the Bahamas, the Galapagos, the coast of Brazil, Nihoa Island (near Hawaii), and the Solomon Islands. Most specimens came from Frigate or Man-o-War birds (species of *Fregata*); but I have seen a few taken off Pelicans and Cormorants.

Olfersia erythropsis Bigot

This species has been generally confused with *O. spinifera*. It is identical with *Pseudolfersia diomedeæ* Coquillett, the types of which I have seen at the U. S. National Museum. The type of *O. erythropsis*, studied by Mr. J. E. Collin, has all the characters of *diomedeæ*. I have seen the species from the Bahamas, Desecheo Island (near Porto Rico), the Galapagos, Moorea (one of the Tahiti Group), and Ponape (one of the Caroline Islands). The hosts known to me are the Albatross, *Diomedea irrorata* Salvin; the Red-tailed Tropic-bird, *Phaëthon rubricauda* Boddaert; the White-bellied Booby, *Sula leucogaster* (Boddaert), and the Small Noddy, *Anous minutus* Boie.

Olfersia bisulcata Macquart

The type of this species passed into the Bigot Collection and is now the property of Mr. J. E. Collin. According to his detailed account, it has all the characters of the well-known *Olfersia vulturis* van der Wulp, a name which will pass in the synonymy. *O. bisulcata*, originally described from Chile, is a common species throughout Central and South America. I have seen it from Mexico, Yucatan, Guatemala, Panama, Venezuela, Brazil, Bolivia, Peru, and British Guiana. *O. vulturis* was described from Costa Rica. The usual hosts are the South American Vultures, *Catharista urubu* (Vieillot) [=*Coragyps atratus* (Meyer)], *Gypagus* (or *Sarcoramphus*) *papa* (Linnaeus), and *Cathartes aura* (Linnaeus); but there are also records from Turkey Buzzard, smaller Hawks and Condor.

Olfersia fumipennis (Sahlberg)

Pseudolfersia maculata Coquillett, of which I saw the holotype at the U. S. National Museum, is in my opinion identical with *O. fumipennis*, originally described from Finland. The species appears to be very rare in Europe, since I have been unable to find another record from that part of the world. In North America, however, it is one of the common hippoboscids. I have seen specimens from Vermont, Massachusetts, New Hampshire, Wisconsin, Michigan, Minnesota, New York, New Jersey, Pennsylvania, Virginia, North Carolina, Florida, Louisiana, Texas, Kansas, and Cuba. In most cases the host is the Osprey or Fish-hawk, *Pandion haliaetus* (Linnaeus) [typical form in Finland; race *carolinensis* (Gmelin) in North America]; but a few specimens have been taken off Loon, *Gavia immer* (Brünnich), Bald Eagle, *Haliaeetus leucocephalus* (Linnaeus), and Hawks.

Olfersia fossulata Macquart

Originally described from Brazil, this species is widely distributed in South America. I have seen it from Desecheo Island (near Porto Rico), Peru (near Lima, as well as on the Guano Islands), and Chile. Seven specimens from the Philippine Islands undoubtedly belong to this species. The chief hosts are certain tropical marine birds, such as the Peruvian Cormorant or Guanay, *Phalacrocorax bougainvillei* (Lesson); Belcher's Gull, *Larus belcheri* Vigors; the White Gannet, *Sula variegata* (Tschudi); and the Pelican, *Pelecanus thagus* Molina. These four birds nest in enormous numbers on the Guano Islands off the coast of Peru, where *O. fossulata* often swarms in the rookeries, even over bare rocks.

Olfersia coriacea van der Wulp

Pseudolfersia meleagridis Lutz, Neiva and da Costa Lima I regard as a synonym. Thus far I have seen *O. coriacea* from southern Mexico, Guatemala, Panama, British Guiana, Bolivia and Brazil. Its hosts are various wild gallinaceous birds, notably the Crested Curassow, *Crax globicera* (Linnaeus). The species has been discussed in an earlier paper [1932, Psyche, XXXVIII, (1931), p. 186]. It was then suggested that *Olfersia mexicana* Macquart might be the same; but, according to information recently received from Mr. E. Séguy, Macquart's type in the Paris Museum is apparently a specimen of *Ornithoctona erythrocephala* (Leach). On the other hand, Mr. J. E. Collin writes me that the specimen called "*Olfersia mexicana*" in Bigot's collection is a true *Olfersia* and not separable from *O. bisulcata* Macquart.

The following names and descriptions evidently were based upon species of *Olfersia*. Most probably they are synonyms of one or another of the forms studied above.

Olfersia aenescens C. G. Thomson, from Keeling Island, off an unknown host. The type is at the Stockholm Museum. According to Speiser, who saw the specimen, the postvertex is not divided by a transverse depression. I suggest that it was *O. fossulata* Macquart.

Olfersia mycetifera (Speiser), from Senafir, on the African shore of the Red Sea, off an Eagle. Most probably this was *O. fumipennis* (Sahlberg).

A NEW GENUS OF PHORIDÆ FROM PERU[1]

BY CHARLES T. BRUES.

On a recent visit to the United States National Museum in Washington, Dr. J. M. Aldrich showed me a very extraordinary phorid fly which had been received in a collection of Diptera obtained by R. C. Shannon at Iquitos, Peru. The individual in question bears near the base of the wing a conspicuous, button-like, heavily chitinized swelling which projects strongly above both the upper and lower surfaces of the wing membrane between the base of the third and fifth wing veins. As the specimen evidently represents an undescribed form Dr. Aldrich very kindly loaned it to me for more detailed examination. On account of certain other structural characters it must, I think, be regarded as the type of a new genus, Phymatopterella, described on a later page.

As the swelling on the wing is a very unusual type of structure I have been tempted to compare it with certain other, possibly similar, wing structures, known to occur in other insects. In the family Phoridæ it appears to be unique so far as is known. Several species, notably of the genus Megaselia from various parts of the world have the costal vein moderately or more rarely excessively swollen or thickened, but such developments represent strictly hypertrophy of the vein in question.

In one genus, Pelidnophora Borgmeier, the wing is said to bear an oval dark spot between the fifth and sixth veins. As Borgmeier[2] does not mention this further, I am led to believe that this spot is simply a pigmented area or perhaps a structure like that described by Malloch in *Megaselia conglomerata* Malloch[3]. The latter species has a brown patch at the tip of the wing between the fourth and fifth veins,

[1]From the Entomological Laboratory of Harvard University.
[2]Vozes de Petropolis, Vol. 17, p. 741 (1923).
[3]Proc. U. S. Nat. Mus., Vol. 43, p. 445 (1912).

due to the approximation of the very minute hairs on the surface of the wing and is quite distinct from any thickening or darkening of the wing membrane.

In another family of Diptera, an African species of Stenobasipteron bears a bulla or swelling near the base of the second longitudinal vein in the first basal cell. This is mentioned by Dr. Joseph Bequaert[1], who called my attention to the reference and also kindly allowed me to examine a specimen of this rare species (*S. wiedemanni* Licht). The spot lies close to the radius just below the fork which gives rise to R_{2+3}. It is darker in color than the remainder of the wing surface due to a slight thickening and denser patch of hairs. Above it is convex, below concave and not so clearly defined as Lichtwardt has figured it in his extensive paper.[2]

The bulla is distinct in both sexes, but much more prominent in the male. Certain other species of Stenobasipteron show the same structure, but to a very slight degree.

In Hymenoptera certain species of Ichneumonidæ of the subfamily Ophioninæ, particularly Henicospilus and several related genera bear on the wing membrane in the discocubital cell one or several chitinized spots or "maculæ." These are apparently structureless depositions of yellow or brown material seemingly similar to the veins, except that they are not linear, appearing as small quadrate comma-shaped or irregular areas. Their presence is usually associated with abnormalities of the wing surface surrounding them, involving the disappearance of the hairs which normally occur on the wing surface and sometimes marked changes in the course of the nearby veins, although the loss of hairs and the thickening and bending of veins occurs in a number of related forms where chitinous maculæ are not developed. The chitinous thickenings may be either bare or clothed with hairs. Related Hymenoptera of the family Braconidæ belonging to Gyroneuron and allied genera exhibit somewhat similar abnormalities in the

[1]Psyche, Vol. 32, p. 17 (1925).

[2]Beiträge zur Kenntnis der Nemestriniden, Deuts. Entom. Zeitschr., 1909, pp. 113-127; 507-514; 643-651: 1910, pp. 371-388; 589-624.

venation of the fore wings which are, in this case, also associated with glabrous areas of the wing surface.

Another type of structure seen on the wings of insects belonging to several diverse groups are small, thickened spots usually deeply pigmented and frequently surrounded by darkened areas that show no apparent chitinization in excess of that on the general wing surface.

These structures, which are known by the general term of nygmata, have been briefly described by Forbes (Entom. News, vol. 35, pp. 230-232, 1 pl. (1924)), who notes their presence in certain Megaloptera, Neuroptera, Trichoptera, Mecoptera and Hymenoptera. When examined in dried specimens that have been mounted in balsam, it appears probable that they represent glands and they may quite possibly be moulting fluid glands as has been suggested by Forbes (*l.c.*). In a Megalopteron (Chauliodes) they are in the form of minute tubercles, lying at the center of a small area where the wing hairs are extremely abundant and closely placed, causing a darkening of the wing surface (Fig. 4) each hair having the basal portion greatly swollen. In a hymenopteron (Arge) one prominent nygma in the second submarginal cell (Fig. 5) seems probably to be glandular in structure with strongly pigmented dendritic outgrowths apparently between the wing membranes, but in another more primitive saw-fly, Neurotoma, the nygmata are much smaller and appear to be of simpler structure.

Still other minute structures, evidently true sensillæ, occur on the stigma or on veins near the stigma. An extensive account of these in the Hymenoptera has recently been given by Hoffmeyer.[1]

The large swelling in Phymatoptera appears to be utterly unlike any of these structures except perhaps those mentioned in Henicospilus. Externally it gives no indication of glandular structure and certainly it has no visible opening. Above, it is slightly convex with the surface dull, below the surface is shining and deeply furrowed basally (*i.e.* toward the base of the wing) by six or eight furrows run-

[1]Ueber Sensillen in den Hymenopteren-Flügeln, Entom. Medel., vol. 18, pp. 58-74: (1932).

ning parallel to the axis of the wing. Beyond this greatly thickened oval structure is another slight thickening in the wing, indicated principally by its darker color as shown in the photograph; this is not perceptibly elevated above the wing surface on either side, and is distinctly separated from the strongly thickened area.

Phymatopterella, gen. nov. (Figs. 1 and 2)

Front bristled, as in Megaselia; four post-antennal bristles, one pair of upwardly and inwardly directed antial bristles; lower frontal row of only the two lateral bristles, upper row of four, and four ocellar bristles. Costal vein long, with short setulæ; first vein entering the costa at its middle, third vein simple, not forked; four light veins: membrane of wing below the tip of the first vein with a large, dark, oval, thickened button-like thickening between the third and fifth veins; mediastinal vein not developed; antennæ small, oval, with dorsal arista. Mesopleura bare. Middle and hind tibiæ each with a double row of strong bristles.

In general structure and habitus this genus is similar to Megaselia and Phalacrotophora, but the third vein is entirely without fork at apex. The chitinous thickening on the wing membrane is, so far as I know, absolutely unique in the family Phoridæ. In Schmitz's key to genera (Revision der Phoriden, p. 87) it will run in the neighborhood of Parametopina Borgmeier or Syneura Brues to which it is obviously not related. On this account it seems necessary to propose a new generic name.

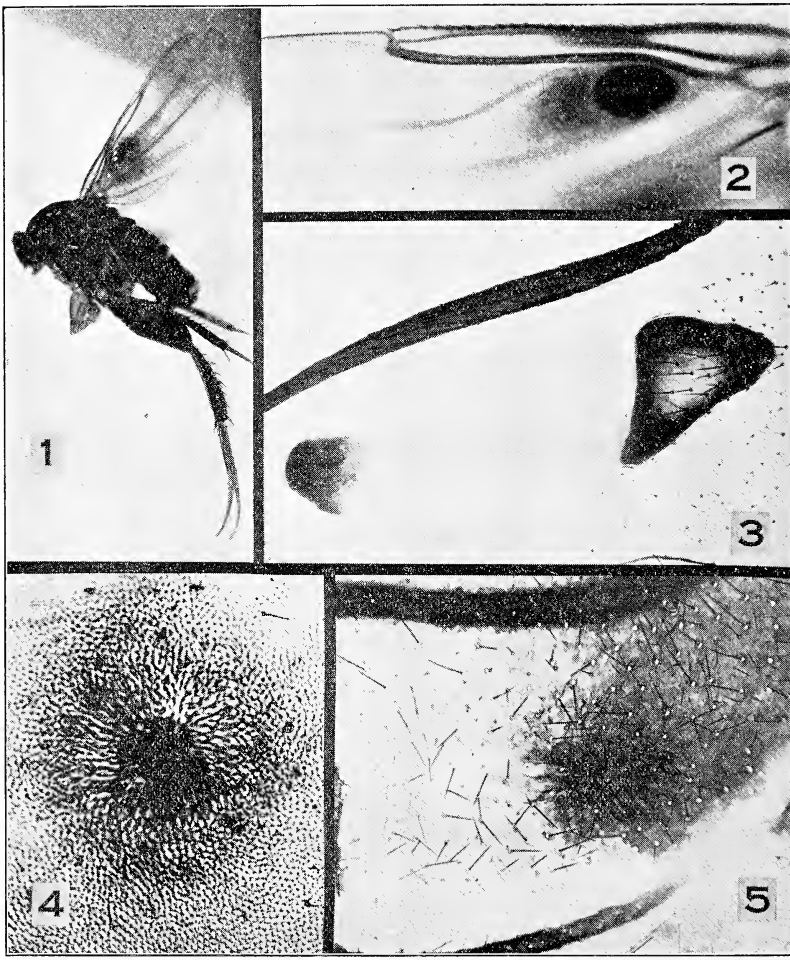
Phymatopterella shannoni, sp. nov.

♀. Length 1.9 mm.; wing 2.2 mm. Front and thorax above pale brownish yellow, the disc of the mesonotum darker; abdomen piceous with the posterior edges of the tergites whitish, more broadly so on the fifth and sixth segments; the fourth and fifth tergites each with a pair of lateral yellowish spots; coxæ and legs brownish yellow, the four hind femora much darker; pleuræ and venter black. Wings tinged with yellow; heavy veins dark, the costa whitish at tip; thin veins yellowish; thickened spot on wing disk fuscous, with a small brown cloud beyond. Halteres black. Head short, with strongly vertical front; front one-fourth longer than wide, rather conspicuously hairy; four strong, nearly equal post-antennal bristles, the lower pair much below the upper ones and close together, upper pair separated by one-third the width of the front; antial bristles but little further from the eye-margin than the lateral bristles of the lower row which set above them; middle bristles of lower row (intermedials) absent; upper frontal row of four about equidistant, forming a nearly straight line; ocellar tubercle black; post-ocellar bristles strong. Cheek with three strong bristles and a series of four short ones extending forward along the oral margin. Antennæ small, rounded, with long, pubescent arista; palpi small with moderate bristles below. Mesonotum shining, but thickly pubescent; its lateral margins fringed with closely placed bristles that are much longer behind; one pair of strong dorsocentral macrochætæ and six bristly hairs between them along the posterior margin; scutellum short and broad with two long marginal bristles. Pleuræ entirely bare, but the middle coxa bears a closely placed series of rather long appressed bristles along its anterolateral edge. Abdomen above more or less shining; second tergite not lengthened and its sides without bristly hairs, sixth tergite lengthened, as long as the third, fourth and fifth together; following ones membranous, retracted in the type specimen, the whitish apical margins of the tergites are very narrow on the first to third but broader on the fourth to sixth segments. Middle femora slightly and hind ones strongly widened and flattened; middle tibiæ with a row of about 9 strong setulæ dorsally, just inside the seam and a second row outside the seam of about seven setulæ, not extending beyond the apical third of the tibiæ; hind tibiæ with two similar rows, the outer one not extending beyond the apical third of the tibia. Wing long and narrow, barely more than one-third as wide as long (4:11), with very short, closely placed cilia; costa three-fifths as long as the wing; first vein entering the costa somewhat nearer to the humeral cross-vein than to the tip, the costa slightly swollen at the broad area of contact; third vein sharply approaching the costa then running nearly parallel with it; fourth vein curved at base, then running straight and ending slightly before the wing-tip; fifth, sixth and seventh veins nearly straight. Chitinous thickening of wing membrane broadly oval, convex and smooth above, convex below with several longitudinal corrugations basally; lying very close to the third and fifth veins near the basal fourth of the wing; beyond the button-like thickening is a subquadrate spot of about the same area of brown color, but not very evidently chitinized.

Type, one female from Iquitos, Peru; March-April, 1931 (R. C. Shannon). Type in the U. S. National Museum.

Explanation of Plate 5.

1. *Phymatopterella shannoni* sp. nov. Lateral view.
2. *Phymatopterella shannoni* sp. nov. Upper basal part of wing, seen from above.
3. *Enicospilus purgatus* Say. Discocubital cell, showing chitinous thickenings of the wing membrane.
4. *Chauliodes pectinicornis* Linn. Nygma, in cell R_5 of front wing.
5. *Arge cœrulea* Morton. Nygma in second submarginal cell.



Brues—Phoridae

PSYCHE

VOL. XL DECEMBER, 1933 No. 4

A NEW LESTODIPLOSIS

By E. P. Felt,

Stamford, Conn.

A number of specimens were received from Mr. C. W. Collins, U. S. Bureau of Entomology laboratory, Melrose Highlands, Mass., and bearing the note number 9590c43, dated January 26, 1932, the record being by Mr. A. B. Proper. The following are the essentials of the original record. On July 11, 1931, an adult Dipteron issued from a pupa which had been formed in a vial in the Laboratory. The larva from which it came was reddish and of a sort commonly encountered while looking at spruce twigs. In this case, it was near or upon a dead larva of *Epinotia nanana,* which larva was saved and mounted upon the same slide as with the pupal case and the fly. It was not possible in many cases to tie up any host with this type of larva, which tends to throw doubt upon the authenticity of this apparent host relationship. The same type of Dipterous maggot has been encountered occasionally when making examinations for infestation of pine twigs by *Rhyacionia buoliana.*

The above record, in connection with the fact that Lestodiplosis larvae are known to be predaceous and have been reared rather commonly from galleries inhabited by Coleopterous borers, leads us to believe that this tentative association is correct and that the Lestodiplosis maggots were actually preying upon the Epinotia caterpillars and presumably prey upon those of Rhyacionia. The species approaches closely in general characteristics our *Lestodiplosis scrophulariæ*, though it appears to be distinct and is characterized below.

Lestodiplosis novangliæ n. sp.

Male. Length .9 mm. Antennae one-half longer than the body, thickly haired, fuscous; 14 segments, the fifth with stems having a length three and two and a half times their diameters respectively, the terminal segment with a stem six times its diameter, the distal enlargement with a length four times its diameter and rounded apically. Palpi quadriarticulate. Mesonotum dull reddish brown, sparsely haired. Scutellum yellowish, postscutellum reddish yellow. Abdomen reddish orange, fuscous basally. Wings hyaline. Halteres pale yellowish. Legs mostly pale straw, the distal tarsal segments a variable fuscous. Dorsal plate long, broad, deeply and triangularly emarginate, the lobes narrowly rounded. Ventral plate long, broad, and broadly rounded apically.

Female. Length 1 mm. Antennae nearly as long as the body, sparsely haired, light fuscous; 14 segments, the fifth with a stem as long as the enlargement, the latter with a length two and a half times its diameter, the terminal segment cylindrical, with a length two and a half times its diameter and broadly rounded apically. Mesonotum light brown. Scutellum yellowish, postscutellum darker. Abdomen pale yellowish, with the basal segments fuscous. Ovipositor short, the terminal lobes sparsely haired and with a length two and a half times the width. Other characters practically as in the male.

THE TROPISMS EFFECTING COPULATION IN THE BED BUG.

By Ezekiel Rivnay

The fact that the female of the bed bug has a special asymmetrical opening for the reception of the male copulatory organs, rather than the ordinary vagina, makes this study extremely interesting. It is astonishing that this fact escaped the attention of early investigators and that the copulatory organs of so well-known an insect were unknown until comparatively recent years. A complete and detailed description of copulation in bed bugs was pub-

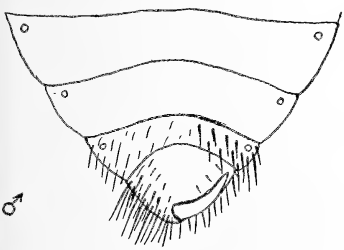

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Fig. 1

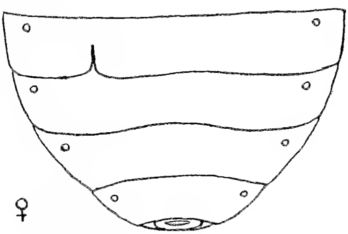
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Fig. 2

Ventral view of abdomen of the bed bug; Fig. 1, male; Fig. 2, female

lished by Hase (1918), and the most complete study of the sexual organs and their functions was made by Cragg (1914, 1920 and 1925). Copulation of bed bugs was observed by the present writer during the course of rearing them in connection with other studies. The peculiarity in this act is that the male mounts the female obliquely in such a manner that his head falls over the left side of the pronotum of the female; his left legs grasp the posterior part of her abdominal margin; and his posterior abdominal segment is bent deeply so that the tip reaches the right side of the ventral segments of the female where the copulatory slit is located (Fig. 2). They remain in this position anywhere from one to several minutes.

No attempt was made by previous observers to establish the facts as to how the male locates the female, and what tropic reactions govern the act of copulation, which is so unique in this insect. In the following paragraphs, the results of a study are given wherein the writer attempts to discover some of the facts regarding this problem.

In some insects, chemotropic reactions are of extreme importance in bringing together the two sexes of the same species for mating purposes. Mayer (1900) demonstrated what attracting force the odor from the female of the *C. prometha* moth has upon the male. In the case of the Japanese beetle, the female apparently diffuses some odor which is attractive to the males. On several occasions, the writer observed in the field, early in the season, over twenty males clustered around one female. Several of these males were attempting to mate with each other, a phase which will be discussed later. The ball-formed cluster, with the female in the center, would lead one to believe that some odor emanating from her attracted all these males. However, observations and experiments described below indicate that the "smell mind" idea cannot be applied in the case of *Cimex lectularius*.

A female approached a male from the rear and remained in this vicinity for a long time, yet the male did not perceive her. Only when the female passed in front of the male did the latter take cognizance of her and soon made attempts to mate with her. Such observations occurred upon other occasions. If odor signals the presence of a female, its effects should be manifested regardless of the position of the female, as long as she is in the proximity of the male. This did not seem to be the case in the above-mentioned observations. In order to verify these casual observations, the following experiments were conducted.

Five females were placed in a vial, 2 cm. in diameter and a piece of cheese-cloth was spread and fastened over its opening. This was then turned upside down so that the cloth served as the foothold for the five bugs; it was then placed in a petri dish, allowing space for free circulation of air and odor. A similar vial, not containing bugs, was placed in the dish as a control. Five vigorous males were put in the dish and left there for 30 minutes. Although the males were in close proximity of the females, they did not pay any attention to them but contrarily made attempts to mate with each other. This experiment was repeated several times with similar results. If there is a secretion, the odor of which serves to entice the male, one would expect this odor to be characteristic of the female only. As a result, one would presuppose that a few males, if brought near females, would cluster around them or around their container in the attempt to mate with them. This was not the case in the experiments.

Again, three males were placed in a petri dish. Not long after, one female was placed together with them. All remained inactive because the room temperature was rather low. Upon increasing the temperature slightly, the bugs became more active. One male soon mated with the female, while the other male attempted to copulate with the third one. Contrary to expectation, the three males did not crowd around the single female as would have been the case had the female radiated some attractive odor.

From the observations mentioned previously, the writer was inclined to believe that it is more likely that the sight of the moving image guides the male to the female rather than the odor. The following experiments were carried out to discover whether such was the case.

A dead female was placed at the rear of a male and was left there for two or three minutes. The male did not observe her. The dead female was then placed about 15 mm. in front of the male and left there for three or four minutes. Here, also, the male did not notice her. The female was then moved slowly with the aid of a fine camel's hair brush, imitating the crawling of a live bug. The male, which had remained inert all this time "woke up," extended his antennae in the direction of the dead female, and suddenly jumped upon her and made every effort to mate with her. Similar procedures were carried out several times and also at other occasions with different males, and very often similar results were obtained. On one occasion, the two were tipped over so that the writer could observe, under the microscope, the protruded genitalia, attempting to open the copulatory slit situated between the fourth and fifth abdominal sternites of the dead female.

The question will arise as to whether the dead female bed bug had some odor emanating from her which stimulated the male. It might, also, be suggested that the odor of the glandular secretion, if there is such, may be preserved in the female a long time after she is dead. Attempting to clarify this matter, one female was chosen which had been preserved in 70% alcohol for sixteen weeks. After she had been blotted and dried, she was placed in front of the male and was then moved slowly with the brush, imitating the crawling of the live bug. The male reacted to this dead female in the same manner as described heretofore. However, a still better proof that the sight of the crawling female, rather than the odor emanating from her, brings the male to her, may be derived from the following experiment.

A piece of cork was carved out into the size and approximate shape of a bed bug. After it was painted with ink and dried, it was placed in front of a male and moved slowly with the brush, again imitating the crawling of a bug. The male suddenly jumped upon it in the same manner as if it were a live female bed bug, but soon dismounted. A few other males reacted in like manner.

It is clear, therefore, that not the odor, but the sight of a moving female, awakens in the male when he is under proper physiologic conditions, the desire to come in direct contact with her. It is also a noteworthy fact that the males lack the faculty of distinguishing between the two sexes, or even a lifeless object of the same size and shape. Recognition of the female occurs through the sense of touch when the male is in direct contact with her. It is then that the male orients himself in a different manner with reference to the surface of the body of the female.

Such reactions were observed by the writer in some beetles. In the potato beetle, *L. 10-lineata,* the male is of the same hemispherical shape as the female; consequently males attempt, often, to copulate with others of their own sex. They even fail to differentiate between mature larvae and adults which are of approximate size and shape. The identical shape of the two sexes in the Japanese beetle, *P. japonica*, was also the reason for similar behavior in the case described above. The odor may have guided the males to the female; however, upon coming in close contact with each other, they failed to discriminate between the two sexes. The male of the lady beetle, *C. 9-punctata*, previous to the act of mating, places the forelegs over the middle of the hemispherical body of the female and pivots over her, touching with his posterior legs and the tips of his ventrum the margins of the female. One observer relates how a male of the Scarabaeid species, *Dynastes tityus* L., having been permitted to crawl over his fingers, upon reaching the thumb, oriented himself upon the nail and attempted to insert his genitalia in the space between the nail and skin. One who is familiar with the size and shape of this beetle, and the similarity of the same to a thumb nail, will understand the cause of such a reaction.

Reactions of such a nature were designated by early observers as "stereotropic"—meaning reactions to solid objects. This term, the writer believes, is not specific and he suggests the term "morphotaxis" for the particular kind of reaction discussed previously. This term is more suitable because it is the particular shape of the surface of the female or her specific form which calls forth the definite orientation. Morphotaxis may be considered as a more specific division of stereotaxis. The general term "thigmotaxis," substituting "stereotaxis," the writer believes, is entirely inappropriate for this reason: Most, and perhaps all of the technical names of the various tropisms are based on the Greek name of the stimulus which causes the reaction and not on the name of the sense by which the stimulus is perceived. Thus the terms are "phototaxis" or "chemotaxis" and not "optiotaxis" or "olfactotaxis." Hence, why should "thigmotaxis"—orientation according to touch—substitute "stereotaxis"—reaction to solid objects?

In the case with the above-mentioned Coleoptera, although the males manifested definite orientations with respect to the characteristic shape of their own species, they lacked the faculty to "recognize" the female even after they came in direct contact with the other individual. The bed bug in this respect is more sensitive. It is true, by the sense of sight it does not distinguish a dead object from a live individual, but, upon coming in contact with it, it immediately recognizes the female. As mentioned above, the piece of cork was mounted and dismounted very quickly. The crude carving could not produce the natural shape of the bed bug and the male recognized the imitation very readily. When a male mounts another male, the lower one usually bends the tip of his abdomen upward; he thereby causes a change in his normal shape and form which, in turn, causes the upper male to dismount. Otherwise, the latter orients himself in the characteristic fashion as if he were a female. The shape of the latter stimulates the male to orient himself obliquely as described in the foregoing, rather than laterally. The sense organs of touch along the ventral sides of the last abdominal segments of the male are unequally distributed (Text figure 1). It seems that the shape of the female in this position is so stimulating that even a dead individual calls forth the final copulatory reactions.

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THE PERICOPID GENUS *COMPOSIA* (*Lepidoptera*)

BY MARSTON BATES,
Museum of Comparative Zoology, Cambridge, Mass.

Genus COMPOSIA Hübner

Hübner, Ver. bek. Schm., p. 179 (1822). Genotype, *Bombyx credula* Fabricius, sole species.

Forbes (1930) has reviewed the two previously known forms of the genus, giving some bibliography that has not been repeated here.

Key to forms.

1. Hindwing with two rows of white spots on the disc, in addition to the submarginal row ..... 2.
   Hindwing immaculate except for the submarginal row of white spots ..... 3.
2. Base of costa of forewing above with three white spots, which do not extend below the radial vein ..... 1. *C. credula.*
   Base of costa of forewing with a red triangular area, which reaches the cubital stem below ..... 2. *C. utowana.*
3. Costa of forewing above with three distinct red spots, limited as in *credula* ..... 3a. *C. f. fidelissima.*
   These spots usually in part confluent, the outer spot extending below the radial vein, across the cell.
   ..... 3b. *C. f. vagrans.*

1. **Composia credula** (Fabricius)

Bombyx credula Fabricius, 1775, p. 584; *id.*, 1793, p. 475.
[*Phalaena*] *sybaris* Cramer, Pap. Ex., I, p. 112, pl. 71, fig. E. (1775).
Composia credula Hübner, Verz. bek. Schm., p. 179 (1822); *id.*, Samml. ex. Schm., II, pl. 188, 4 figs. (1819-1826).
Composia sybaris Forbes, 1930, p. 40.

There are eight specimens of this species in the Museum of Comparative Zoology from Hispaniola and Jamaica; they show no racial differences. Puerto Rican specimens are said to agree with these also.

2. **Composia utowana,** n. sp.

The front is black, with white lateral stripes; the palpus is black and white: the third joint proportionately smaller than in *credula* or *fidelissima.* The thorax is black with three transverse rows of small spots above: the first two rows yellow, the last white, in the male, only the first row yellow in the female; beneath, the white is more extensive. The legs are marked much as in *fidelissima.* The abdomen is blue, the anterior edge of each segment marked with white, which forms a complete transverse band, except for a narrow mid-dorsal interruption.

The wings are black, with most of the hindwing, and the base and a small area at the tip of the cell of the forewing, irridescent blue. A red patch on the forewing covers the base of the cell and the lower half of the costa; three rows of white spots on this wing are similar in number and position to the spots on *fidelissima,* but much larger, and there are three additional spots in the median area never found in that species. The three rows of white spots on the hindwing are arranged as in *credula,* but are larger and more irregular. The pattern of the upper surface is repeated below.

Holotype (♂), and allotype (♀), No. 16594, in the Museum of Comparative Zoology, from Mariguana Island, Bahamas, Feb. 25, 1933, T. Barbour and David Fairchild.

This lovely moth is named after Allison V. Armour's yacht, the Utowana: the means through which our knowledge of tropical island life in both hemispheres has been greatly enlarged.

3a. **Composia fidelissima fidelissima** H. S.

Composia fidelissima Herrich-Schäffer, 1866, p. 132; Gundlach, 1881, p. 250; Forbes, 1930, p. 41.
Phaloësia olympia Butler, 1871, p. 290.

The seven specimens of this form in the M. C. Z. show a very constant wing pattern. They come from Habana and Cienfuegos, in Cuba. I have seen no Central or South American specimens, but a specimen from Swan Island agrees closely with those from Cuba.

3b. **Composia fidelissima vagrans,** n. subsp.

Composia fidelissima Dyar, 1890, p. 105.
Composia olympia French, 1890, p. 153.

Bahaman specimens of this species differ strikingly from Cuban individuals in the character of the red markings on the costa of the forewing. The two basal spots are usually confluent, and the outer spot is much elongated, with a branch directed posteriorly across the cell. In New Providence specimens, this cell mark is a broad band; in specimens from Andros Is., Berry Is. and Crooked Is., it is much narrowed, and in Watling specimens it becomes white, near the cubital vein at least. Florida specimens show all of these variations, and some even approach the typical Cuban race very closely, having no spur across the radial vein at all on the upper surface; below, however, a red spur reaches the cubital vein in all of the specimens before me.

Holotype (♂) and allotype (♀) No. 16595 in the M. C. Z., from Nassau, New Providence, Dec. 31, 1931, Allison V. Armour Expedition. There are 12 paratypes from New Providence, Andros, Berry, Crooked and Watling Islands, dated Feb., Apr. and July. There are also 11 Florida specimens, which belong to this race, from Lake Worth, Key West, Coconut Grove and Miami, dated Mar., Nov. and Dec.

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CONDITIONED BEHAVIOR AMONG TERMITES (ISOPTERA)

By Alfred E. Emerson
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At the present time, no adequate observation indicating that the behavior of termites may be conditioned has been recorded. In several instances, so-called "intelligent" behavior of termites has been described or assumed (Bugnion, 1927; Hingston, 1929, 1932), but in none of these cases is it clearly shown that a termite behaves differently in the same situation before and after an experience. In as much as conditioned responses have been adequately demonstrated in various insects including ants, bees and cockroaches, it seems entirely possible that termites also are capable of learning, but experiments with rigid control have not been performed on termites with positive results. Julius F. Bosen has performed preliminary experiments with a simple maze similar to that used successfully by Gates and Allee (1933) for cockroaches. No indication of conditioning was detected, possibly owing to the fact that blind worker termites were used. The reward was a relatively moist chamber to which the termites reacted positively.

The following observations were made three years ago on a captive colony of *Reticulitermes arenincola* Goellner collected at Miller, Indiana, in the Lake Michigan sand dunes. Publication was delayed in the hope that further observations and experiments might bring more data to bear upon the problem, but this hope has not materialized.

The captive colony, containing many workers, several soldiers, several nymphs, two mature second form queens and one mature third form queen resided in apparent harmony in a glass dish with a ground glass cover for a month.

On August 15, 1930, one of the second form queens and the third form queen were noticed jerking themselves violently and exhibiting great agitation. When they came in contact with each other they fought vigorously. Upon separating they remained excited, jerking themselves in the manner characteristic of all disturbed termites. Workers often attempted to lick these queens, at no time showing hostility to them during the conflict. The other second form queen was not involved in the fight in any way. The fighting queens continued the combat whenever they came into chance contact after intervals of separation, each seeming to be equally belligerent. During a half hour they fought and separated ten times. In the final encounter, the second form queen lost a leg and the third form queen was seriously bitten on the under side of the head. After a short time, the queens separated and the workers and nymphs immediately attacked the third form queen, biting and chewing it for a half hour until it was quite weak. The workers also attempted to bite the injured leg stump of the second form queen, but she managed to protect herself from serious injury by violently jerking. Other workers, busy with nest repair work in close vicinity to the injured queens, were not observed paying any attention to these events.

The termite workers and winged nymphs attacking the third form queen bit holes in her abdomen and head and seemed to give as much attention to all parts of her as they did to the injured parts. At any given moment seven or eight workers were eating this queen. The second form queen was licked and massaged by the workers and after about a half hour, the injured leg received no special notice.

The fight was first observed at about 12 noon. At 2 P. M. the third form queen had been decapitated and two separate groups of termites were eating the head and body. The second form queen at this time was quiet and several workers were licking her with no manifest hostile actions. At 3 P. M. the third form queen had been entirely eaten and the second form queen was quiet and in good condition. Six days later this second form queen was still alive and evidently healthy. The other second form queen which had taken no part in the fight was also still alive and well.

This observation does not readily fit into the class of inherited instinctive behavior. If either or both queens had had any characteristic which would stimulate general hostile action, one would assume that the workers and soldiers would have shown hostility and possibly the third queen would also have been involved in the fight. General hostile action toward a strange termite or other insect often has been observed, but in such cases any termite coming into contact with the stranger will attack it. These two queens, however, showed hostility only to each other (indicating an interesting ability to recognize each other) and no other termites exhibited hostility to either of them until they were badly injured, when the cannibalistic activities well known in termite colonies appeared. The observation is interesting as an example of naturally induced cannibalism.

The presence of the third queen gives a fairly good control against the possibility that this antagonistic behavior between the queens was a caste pattern. The fact that all three of the queens lived together in harmony before the fight occurred also offers a fair control against the possibility that this hostile action was induced through hereditary caste differences. Field observations summarized in table I indicate no evidence of common antagonism between the different reproductive castes or individuals, which are often found living together harmoniously in the same nest.

Possibly one might explain such action as inherited individual differences occurring at a certain stage in the life cycle. It is also possible that the antagonistic behavior was in some way induced by an internal physiological influence not present at the same time in the third queen.

Although it must be admitted that these interpretations are possible, it seems to the writer that the mutual hostility displayed by these queens is best explained on the basis of a conditioned response. The nature of the experience which may have conditioned these queens to such individualistic action, however, remains unknown.

TABLE I

Records of reproductive castes found living together in the same nest. Numbers refer to the number of each caste collected.

	1st form king	1st form queen	2d form king	2d form queen	3d form queen
Reticulitermes flavipes (Kollar). Cold Spring Harbor, N. Y.	—	—	113	126	—
Reticulitermes flavipes (Kollar). See Banks and Snyder (1920)	1	—	—	X	—
Reticulitermes arenincola Goellner Miller, Indiana	—	—	—	2	1
Rhinotermes (R.) *tenebrosus* Emerson Kartabo, Br. Guiana	—	—	—	1	1
Armitermes (A.) *albidus* (Hagen) Kartabo, Br. Guiana	—	1	1	2	—
Armitermes (A.) *percutiens* Emerson Kartabo, Br. Guiana	—	—	2	78	—
Armitermes (A.) *percutiens* Emerson Kartabo, Br. Guiana	1	—	—	7	—
Armitermes (A.) *minutus* Emerson Kartabo, Br. Guiana	1	—	—	35	—
Nasutitermes (N.) *costalis* (Holmgren) Grenada, West Indies	30	46	—	—	—
Nasutitermes (*Subulitermes*) *parvellus* (Silvestri) Kartabo, Br. Guiana	1	—	—	5	—

SUMMARY

No valid case of a conditioned response in termites has been reported. The behavior described in the literature can readily be interpreted as the result of hereditary influences and thus may be referred to as instinctive. A fight between two queens in a captive colony in the presence of workers, nymphs, soldiers and another queen, none of which exhibited any antagonistic response to either of the

fighting queens, may be interpreted as a conditioned response leading to individualistic action.

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CICADAS IN TEXAS

East central Texas is a veritable cicada paradise. I have never visited a region where so many species are as abundant as occur in, for instance, the Madison County region. They are numerous in many parts of the post oak woods, but are most plentiful in the alluvial forests and groves in the lower grounds along the Navasota and Trinity Rivers. Here in June and July, the air is vibrant with the songs of *Tibicen superba, T. pruinosa, T. resh, T. marginalis, T. chloromera, T. lyricen and Diceroprocta vitripennis.* The chorus becomes most intense late in the afternoon, when *pruinosa* may predominate. The songs of the species mentioned differ considerably and are quite easily recognizable. *Tibicen resh* is often found in great numbers in some large detached oak or other tree standing in the open, the trunk of which may bear scores of the cast skins of this species. *Resh* may be silent for long intervals, when suddenly the whole population may burst into song simultaneously, resulting in an ear-splitting din which subsides as suddenly as it arose. The great cicada-killing wasp (*Sphecius speciosus*) is a constant attendant of the cicada aggregations, its deep hum being audible among the branches where an occasional agonized shriek of an unfortunate victim reveals the success of the wasp's hunting. These wasps vary greatly in size, and I have seen the smaller individuals (25-35 mm. in length) capturing the smaller cicadas as *Diceroprocta vitripennis.* Undoubtedly the larger individuals (40-50 mm. in length) select the larger species as *resh* or *marginalis.* Lurking in openings in the forests may be seen individuals of the robber-fly, *Microstylum morosum,* the largest American Asilid, sometimes reaching a length of 50 mm. This species frequently pounces on cicadas, carrying them off in its long legs to a bush or branch. Here the fly, suspended from the twig by a front leg and pressing the cicada to its long sharp beak with the others, feeds on its victim. I have seen this fly seize *D. vitripennis,* and Mr. F. F. Bibby and Mr. W. C. O'Dowd once took a large *T. resh* which had been captured by this *Microstylum.*

STANLEY W. BROMLEY.

A MIGRATORY FLIGHT OF *CATOPSILIA EUBULE* (LEPID.: PIERIDÆ).

By Harold O'Byrne

Webster Groves, Missouri

The butterflies belonging to the genus *Catopsilia* are frequent migrants, and many records of their migratory flights have been published. But these records are often vague as to the identity of the species, or they lack the precise data necessary to explain the problems that arise in connection with migratory behavior.

During September and early October of 1932, the writer has had an opportunity to witness a migratory flight of *Catopsilia eubule* L. which was in progress over a large part of St. Louis County, Missouri. Most of the observations were made at Webster Groves, but the flight was also seen in various other places. It was first noticed on September 3rd, and had probably already been going on for some time. The butterflies were flying almost due south (their direction being only a few degrees to the east) during the hours when butterflies are usually active, and on days when weather conditions were favorable to butterfly activity. On cool or cloudy days, as well as during the early morning hours, few or none were to be seen. They were most numerous between 10 A. M. and 3 P. M. The direction of the wind did not influence their flight. This was always in a southward direction although the prevailing winds were from the west and northwest. They flew from two to ten feet from the ground with an average of about five or six feet. Both sexes were observed in the movement.

Mr. Stuart L. O'Byrne, brother of the writer, made counts to determine the frequency with which the butterflies passed between him and a point approximately 100 feet east of his position, and the results are shown in the accompanying table. As already stated, all the butterflies flew southward, with only one lone individual flying in any other direction; this one changed its course from south to west, and disappeared in that direction.

FREQUENCY ON 100-FOOT FRONT

Date 1932	Time (Central Standard)	Elapsed time	No.	Average rate per hour	Wind	Weather
Sept. 3	1:08-1:20 P. M.	12 min.	21	105	Northwest	Part cloudy
Sept. 3	1:20-1:30 P. M.	10 min.	20	120	Northwest	Part cloudy
Sept. 3	3:24-3:36 P. M.	12 min.	18	90	West	Clear
Sept. 4	11:17-11:32 A. M.	15 min.	62	248	Variable; light breeze	Clear
Sept. 4	1:19-1:30 P. M.	11 min.	32	176	None	Part cloudy
Sept. 4	1:30-1:39 P. M.	9 min.	29	194	None	Part cloudy
Sept. 4	2:39-3:00 P. M.	21 min.	25	72	Variable; light	Part cloudy
Sept. 13	12:59-1:15 P. M.	16 min.	53	199	East-north-east	Part cloudy

Total time, 106 minutes; 260 butterflies counted; average rate, 147 per hour. All observations made at Webster Groves, Missouri.

It is interesting to note that the butterflies kept at a uniform height above ground, adapting their up and down flight to the knolls and depressions of the ground. The direction was not altered by encountering obstacles such as knolls or buildings; but the butterflies flew over them instead of around them. Upon reaching a railroad embankment, they flew downward, maintaining their usual distance from the ground, until they were just above the tracks; then, as they approached the shadow of a nearby viaduct, they turned upward and flew over the bridge, when they could have flown under it much more easily.

Their flight differed from the usual mode of this species in being a little less rapid, and not so erratic. They frequently stopped at flowers, sipping the nectar from one or more of the blossoms. Their stops were short; they seemed impatient to resume their march, and showed a restlessness that indicated a desire to press onward. There was no pairing, and they showed no flocking tendency; each individual was flying independently. Other species common hereabouts during this migration included *Colias eurytheme* Bdv., *Zerene caesonia* Stoll, and *Junonia coenia* Hbn., but they showed no disposition to join *eubule* in its southward flight.

Discussing the migration of butterflies, Clark ('32) suggests that the aggregation of male pierids about puddles of water is evidence of overcrowding, such assemblages being composed of the weaker individuals that have been unable to secure food because of competition and persecution by their more vigorous fellows; they therefore gather on muddy areas to obtain water. They subsequently begin to wander, and this leads to the formation of large migrating swarms which are almost wholly composed of males. They usually fly against the wind. He considers the migrations of *C. eubule* to be of this type, and that they therefore represent the end of the natural process of the elimination of surplus males. This explanation does not fit the facts in the present instance. During 1932 very few assemblages of pierids in muddy spots were seen in the region where the flight took place, although they were exceedingly numerous in 1931. This suggests that the heat and drought of 1931 brought them together at wet places, and that overcrowding had little to do with this phenomenon. Furthermore, these aggregations consisted mostly of *Eurema lisa* Bdv. & LeC., with some *Colias*, but only one or two *eubule* were ever seen in any one such group. In the migration observed in 1932, many females were seen. There was no tendency to fly against the wind; on the contrary, their flight was independent of wind direction.

There is good reason to believe that migration southward is an annual event in the life of this species in many parts of the United States. Scudder ('99) refers to it as a frequent migrant in the eastern states, and Brower ('30) says that in the neighborhood of Willard, Missouri, it "migrates through August, September, and October, coming from the northwest." Williams ('30-a) has collected many records of migration in the genus *Catopsilia;* many of these refer to *C. florella* Fab. in South Africa, and *C. eubule* and *C. statira* Cram. in tropical America. Most of the published records of "Catopsilia sp." or of "yellow butterflies" probably belong to these three species. In another paper Williams ('30-b) gives the results of counts made to determine the frequency with which butterflies in migration passed a given point. Observations of this kind on *C. florella* show that its migrations are indeed similar to the one observed by the writer in *C. eubule*. The large number of migration records in this genus are evidence of the frequency of its occurrence, and indicate that such behavior is no small factor in the biology of its species.

There is no evidence that a return flight takes place in *eubule*. The repopulating of the northern part of its range may be accomplished by a gradual dispersal northward during the summer, or through the increase in numbers of the few that manage to survive the winter. Of interest in this connection are the many records of individual northern occurrences of various southern species of this genus; for some recent records, reference is made to Calkins ('32), on *C. philea* L., *agarithe* Bdv. and *statira* in western Kansas, and citations by O'Byrne ('32) of some northern occurrences of *C. philea*. Such records refer to them as "strays," and indicate a possible way in which a northward spread of *eubule* could take place without attracting attention.

The foregoing data on *C. eubule* have important bearing on the nature of migration in insects. The question, whether insect migration is purposive, or is merely the result of their being blown about by the wind, is answered by the fact that the butterflies continued their flight day after day in the same direction, despite changes in the direction of the wind, and regardless of the contour of the ground and presence of obstacles. This has been fully discussed by Williams ('26), but the question still keeps bobbing up. The fact that the manner and speed of flight differed somewhat from the usual behavior indicates that the butterflies were in an abnormal physiological or mental state. The results of dissections of migrating females of *C. florella* by Williams ('30-a) give further weight to this suggestion, for they indicate that flight starts during a condition of sexual immaturity, and ceases when oviposition is ready to begin. It may be that the climatic changes of a temperate autumn are accompanied by internal changes in the butterflies. This is reasonable in view of the fact that the genus *Catopsilia* is almost exclusively tropical; *eubule* itself is most abundant in tropical America, where it probably originated. It may never have become completely adjusted to the seasons of a temperate zone. If this is true, then the southward migration can be regarded as an adaptation to avoid the necessity for overwintering. Some individuals do survive the winter, however, either as pupae or as imagines, but the scarcity of the species in early summer makes it probable that most of them either migrate or perish. This suggestion does not explain the frequent migrations observed in the tropics.[1]

Whatever the cause or purpose of migrating flights in *Catopsilia* may be, the notes confirm the conclusions of Williams ('26), that uni-directional flight is the active expression of an internal physiological or psychological state in the butterflies. This impels them to undertake self-contributory flight in a particular direction, which neither obstacles nor wind can prevent or even modify. This state may be produced by external conditions, but the flight itself is the result of volition or effort on the part of the butterflies. In this respect it is essentially similar to the migrating flight of birds, differing chiefly in its greater irregularity and in not being repeated by the same individuals. In its seasonal relations, the flight of *C. eubule* is similar to that of *Danaïs plexippus* L. (which likewise is a species of tropical origin), but differs in not being preceded by any concentration into large aggregations.

Anyone who observes this species in migration in the future can aid materially in solving its problems by making records of the pertinent facts in as great detail as possible. Such observations ought to be made in many localities and over a period of years. It is only through the co-operation of many observers that the mystery of the

[1]The late Walter Heape, in an exhaustive work on animal migration and related phenomena ('31), distinguishes between emigration, in which no return flight is made, and true migration, in which a return flight is always made and which recurs periodically. He would therefore class the present flight of *eubule* as an instance of emigration. Heape believes that overcrowding and shortage of food is the chief cause of emigration in butterflies, but it is not clear whether he refers to shortage of food plants for the larvae or of flowers for the adults. He recognizes sexual condition as a contributing factor, which weakens somewhat the distinction he makes between the two kinds of behavior.

movements of countless butterflies can be explained, and it is to be hoped that intelligent efforts will be made to solve the problem of butterfly migration.

Summary

1. A southward migratory flight of *Catopsilia eubule* Linn. was observed in St. Louis County, Missouri, during September and early October, 1932.

2. Wind and obstacles did not change the direction of the movement. There was no mating, or formation of aggregations, and no other species accompanied them.

3. It is shown that although migration in this species may be related to environmental factors, or to internal and possible sexual conditions, yet the actual flight is due to voluntary efforts on the part of the butterflies.

4. No return flight has been observed; repopulation is effected by means of the gradual northward spread of stray individuals, or through the increase in numbers of the few that survive the winter in the north.

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THE GIANT TICKS OF THE MALAYAN RHINOCEROSES; WITH A NOTE ON *IXODES WALCKENAERII* Gervais

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In January, 1932, Major Arthur S. Vernay obtained, in Lower Perak, for the British Museum, one of the few remaining specimens of the Sunda Rhinoceros, *Rhinoceros sondaicus* Desmarest. At the suggestion of my friend and colleague, Harold J. Coolidge, Jr., he undertook to collect the ecto- and endoparasites of this animal. The helminths have been reported upon by my colleague, Dr. Jack H. Sandground (1933, Jl. of Parasitology, XIX, pp. 192-204). Of ectoparasites, only numerous ticks were found; but shortly after the animal was shot, a number of horse-flies (*Tabanus brunneus* Macquart) were observed biting through the thick hide.

More recently (June, 1933) Major Vernay commissioned Major Rawley to secure, if possible, another *R. sondaicus*. An animal believed to be of that species was located in Selangor; but, after being shot, it proved to be a Sumatran Rhinoceros, *Rhinoceros sumatrensis* Cuvier. Again the only ectoparasites met with were ticks; these were very few in number, eight in all being collected.

Since the ticks obtained from these two Rhinoceroses belong to two different species, one of which is as yet imperfectly known, some notes on these parasites may be of interest. I am much indebted to Major Vernay, Major Rawley, and Mr. Coolidge for the efforts they made in order to secure the specimens; and to Dr. P. H. Hodgkin, Entomologist, Institute for Medical Research, Kuala Lumpur, for preserving and mailing them.

Amblyomma crenatum Neumann

Amblyomma crenatum Neumann, 1899, Mém. Soc. Zool. France, XII, p. 214, fig. 52 (♀; off a Rhinoceros supposedly from the Cape of Good Hope); 1901, *Loc. cit.*, XIV, p. 297 (♀ ♂; Sumatra; no host); 1911, Das Tierreich, Lief 26, Acarina, Ixodidæ, p. 77, fig. 34 (♀ ♂). Robinson, 1926, Ticks, IV, *Amblyomma*, pp. 12, 21 and 75, figs. 32-33 (♀ ♂).

Amblyomma subluteum Neumann, 1899, Mém. Soc. Zool. France, XII, p. 263 (♂; two without locality, one of them supposedly off an African Rhinoceros).

? *Acarus elephantinus* Linnaeus, 1758, Syst. Nat., 10th Ed., I, p. 615 ("Habitat in India", no host); 1767, *Loc. cit.*, 12th Ed., I, pt. 2, p. 1022. Gervais, 1844, in Walckenaer, Hist. Nat. Ins. Aptères, II, p. 250. Neumann, 1911, Das Tierreich, Lief. 26, Acarina, Ixodidae, p. 126. A. C. Oudemans, 1926, Tijdschr. v. Entom., LXIX, Suppl., p. 95; 1929, *Loc. cit.*, LXXII, Suppl., p. 207 (with references to the older literature). Not of Schrank, 1776.

? *Ixodes elephantinus* Fabricius, 1805, Syst. Antl., p. 351.

? *Amblyomma elephantinum* C. L. Koch, 1844, Arch. f. Naturgesch., X, pt. 1, p. 230; 1847, Uebersicht des Arachnidensystems, IV, p. 19. Neumann, 1899, Mém. Soc. Zool. France, XII, p. 282.

Specimens Examined.—Twenty-four males and twelve females (two fully engorged), off *Rhinoceros sondaicus* Desmarest, shot four miles north of Teluk Anson and south of the Sungei Lampan, Lower Perak, Federated Malay States (Major Arthur S. Vernay and Dr. P. H. Hodgkin).

The true country of origin and correct host of *A. crenatum* are now definitely established with this material. The information available thus far was summarized by Robinson as follows: "*Amblyomma crenatum* is an African species and the only known host is the *Rhinoceros.* Neumann's earlier description of the female was based on a single specimen off *Rhinoceros*, Cape of Good Hope (Paris Mus.); his description of *Amb. subluteum* was based on two males, one of unknown origin, the other off Rhinoceros, Africa. The Berlin Museum collection contains 2 males and 2 females labelled as having been collected by Mösch, in Sumatra. It would seem improbable that this tick is to be found in two parts of the world so remote as Africa and Sumatra without its occurrence being recorded in intermediate parts, and the indication of origin of the Berlin specimens is probably erroneous." The present collection from Perak shows, on the contrary, that the locality "Sumatra" was correct, while there is no reliable evidence of this tick occurring in Africa. Neumann's specimens were most likely obtained from animals kept in captivity in Europe. Ticks have frequently been collected in large numbers in Africa from both the White and the Black Rhinoceros; but, so far as I know, *A. crenatum* was never found among them.[1]

A. crenatum is one of the largest ticks in existence. In our series of 24 males, the scutum of the largest measures 9 mm. in length (not including the capitulum) and 7.8 mm. in greatest width, and that of the smallest 5 mm. and 4.8 mm. respectively. It is noteworthy that the smaller the specimen, the more the scutum approaches the perfect orbicular shape. The 10 unengorged females are 8 to 9 mm. long (without the capitulum) and 7 to 8 mm. wide, the scutum proper being about the same size in the largest and smallest specimens. Two engorged females are enormous, reaching 21 and 22 mm. in length (without the capitulum), 20 mm. in greatest width, and 16 and 17 mm. in thickness. Capitulum and legs also are unusually long. The coloration is remarkably uniform in the series seen and agrees well with Robinson's account. The most remarkable feature is the absence of metallic spots in the male, while the female has three distinct coppery areas, one in each corner of the scutum, that of the apical corner the largest.

The holotypes of *A. crenatum* (♀ and of *A. subluteum* (♂) are at the Paris Museum.

I strongly suspect that Linnaeus based the following

[1]I am unable to account for Neumann's including "Liberia" in the range of *A. crenatum* (1911, Das Tierreich, Lief. 26, p. 78), since there is no *Rhinoceros* in that country and he does not mention it in his earlier papers.

description of his *Acarus elephantinus* upon *A. crenatum:* "A. orbicularis depressus: macula baseos ovata. Habitat in India. Magnitudo seminis Lupini albi, depressus, lividus, margine crasso, subtus utrinque 3 sulcis. Macula baseos nigra, ovata, trifida." No host is mentioned and the name refers, not to the supposed host, as Houttuyn surmised, but to the unusual size ("elephantine"), this being one of the largest ticks known to Linnaeus. In answer to an inquiry concerning this tick, Professor Ivar Arwidsson writes me that the type is not in Linnaeus' collection at the Zoological Museum of the University of Uppsala. Perhaps it is kept at the Linnaean Society of London, a point which I have not yet been able to investigate.

Amblyomma infestum infestum C. L. Koch

Amblyomma infestum C. L. Koch, 1844, Arch. f. Naturgesch., X, pt. 1, p. 226 (♀ ♂; no host; Bintang Island near Singapore); 1847, Uebersicht des Arachnidensystems, IV, p. 68, Pl. XII, figs. 41-42 (♀ ♂).

Amblyomma infestum infestum Schulze, 1932, Zeitschr. f. Parasitenk., IV, pt. 3, p. 468 (♀ ♂; after Koch's types).

Amblyomma testudinarium Robinson, 1926, Ticks, IV, *Amblyomma*, pp. 17, 23 and 253 (in part; not the description and figures).

Specimens Examined.—One male and three females (two partly engorged), off *Rhinoceros sumatrensis* Cuvier, shot on the Bernam River, Selangor, Federated Malay States (Major Rawley).

A. infestum is a much smaller tick than *A. crenatum*, with the capitulum and legs of normal length.

P. Schulze has recently claimed (1932, Zeitschr. f. Parasitenk., IV, pt. 3, p. 468) that the tick described and figured by Robinson (1926) as *A. testudinarium*, was not Koch's species of that name, but a new tick, which he calls *A. fallax* P. Schulze. Robinson's specimens came from Mouse-Deer (*Tragulus* sp.) at Biserat, Jalor, Federated Malay States. P. Schulze also attempts to separate *infestum* Koch and *testudinarium* Koch as distinct races of a species for which he uses the name *A. infestum* (because it comes before *testudinarium* on the same page of Koch's paper). Although I have seen no ticks agreeing with Robinson's descriptions and figures, I am inclined to believe that Schulze was correct in introducing *A. fallax* as a new species. At any rate, the male off Sumatran Rhinoceros ventrally lacks the small muscular scutes shown in Robinson's figure, while the peltæ run parallel with the festoons (in Robinson's figure they are oblique, slightly salient at the postero-internal angles. In the three females, the inner margin of the scapulæ is yellowish (not brown, as in Robinson's figure); and the median anterior area of the scutum is almost wholly yellowish (not dark, as in Robinson's figure), although I am not able to see that the yellow color forms two longitudinal stripes.

I am, however, by no means convinced that *infestum*, proper, and *testudinarium* are racially distinct. Obviously, Schulze's material was insufficient to show that they are geographically segregated. Of *infestum*, proper, he saw only Koch's types from Bintang Island near Singapore, one of the Rhio Archipelago, not 75 miles off the Northeast coast of Sumatra. Of *testudinarium*, he saw, in addition to Koch's type from "Java," 4 males and 4 females from Soekaranda, Sumatra.

The male of *infestum*, proper, is said to be smaller (length, including palpi, 6 mm.; width, 5 mm.), with much white enamel among the coarse punctures of the alloscutum. That of *testudinarium* would be larger (8 by 6 mm.), with reduced enamel among the coarse punctures. The single male from Selangor measures 7 mm. (with the palps) by 4.8 mm., and the enamel is quite extensive. According to Schulze, in the female of *infestum*, proper, the scutum measures 3 by 5 mm. and has the scapular stripe well-defined, dark brown. In that of *testudinarium* the scutum is larger (4 by 5 mm.), with the scapular stripe obsolete, pale brown. In all three females from Selangor the scutum measures 3 by 4.5 mm.; but the scapular stripes (on the anterior margin, between the scapulæ and the eyes) are dark brown and sharp in two specimens, very faint and pale in the third. While the Selangor specimens are undoubtedly typical *infestum*, the value of *testudinarium* as a distinct race remains a question.

In the foregoing bibliography, I have not included Neumann's references to *A. testudinarium* (1899; 1901; 1911), nor those of Krijgsman and Ponto (1931; 1932), since these authors may have confused more than one species under that name. Neumann (1901) synonymized with his *testudinarium*, *Ixodes auriscutellatus* Koningsberger (1900, Teysmannia, XI, pt. 1, p. 6) and later (1911) also *Amblyomma compactum* Neumann (1901, Mém. Soc. Zool. France, XIV, p. 296; ♀; Sumatra; no host). The standing of these two names remains open to discussion. Robinson's many locality and host records of *testudinarium* probably cover more than one species. In view of this fact the true distribution and range of hosts of *A. infestum* cannot be given.

Hyalomma (?) walckenaerii Gervais

Ixodes walckenaerii Gervais, 1842, Ann. Soc. Ent. France, XI, Bull. Séances, p. xlvii (off Rhinoceros; without description); 1844, in Walckenaer, Hist. Nat. Ins., Aptères, III, p. 246, Pl. XXXIV, fig. 11 (no sex; no locality, off a rhinoceros of unknown species). Neumann, 1911, Das Tierreich, Lief. 26, Acarina, Ixodidae, p. 133.

Amblyomma (?) *walckenaerii* Neumann, 1899, Mém. Soc. France, XII, p. 279.

Gervais' species is as yet unrecognized. Neumann merely suggested that it might have been an *Amblyomma*. The original description reads: "Corps roux-grenat, un peu plus pale en dessous, passant au roux-cannelle ainsi que les pattes qui sont allongées et fauves à leurs articulations; abdomen ridé en dessous; point de taches sur le dos; denticules des machoires médiocres; palpes un peu velus montrant un pore terminal à leur dernier article; ouverture génitale au niveau de la deuxième paire de pattes; hanches de la première paire bispinulées à leur bord postérieur; celles des autres simplement échancrées; stigmates dans une impression en fossette subréniforme à l'aisselle de chaque patte postérieure. Longueur du corps, 0.005 [m];

de la patte postérieure, 0.006 ½ [m]. Cette espèce, dont les hanches antérieures ressemblent à celles de l'Ixode de Savigny, a été prise sur un Rhinocéros dont nous ignorons le nom spécifique; nous l'avons dédiée à M. de Walckenaer, de qui nous tenons l'unique exemplaire que nous en avons observé." The rather crude figure represents the ventral side of what appears to be an unengorged female.

Surmising that Gervais' type might be preserved at the Paris Museum, I wrote to Mr. Marc André, who kindly informed me that none of Gervais' ticks are in their collections. Neumann evidently never saw them and I have been unable to trace whether or not they are lost.

I believe, however, that a study of the description and figure might help to recognize the species. Turning first to the *Amblyomma* known to occur on Rhinoceroses, *A. crenatum* is ruled out at once by the size, the hind legs of that species measuring 11 to 12 mm. in length. On the other hand, none of the smaller Rhinoceros ticks could be described as having the body "roux-grenat", all being distinctly spotted dorsally. The statement about the color, and even more so the comparison of the coxæ I with those of *Ixodes savignyi* Gervais, induce me to regard *Ixodes walckenaerii* as based in all probability upon a female *Hyalomma*.[1] Ticks of that genus have been found repeatedly on the African Black Rhinoceros; and P. Schulze bases his *Hyalomma planum* (1919, Sitzungsber. Ges. Naturf. Fr. Berlin, pp. 195 and 196; ♂ ♀; Tanganyika Territory) on ticks taken from this host. Might not *H. planum* and *H. walckenaerii* be one and the same species?

[1] *Ixodes savignyi* was based upon the common cattle *Hyalomma* of Egypt. According to P. Schulze (1930, Zeitschr. f. Parasitenk., III, pt. 1, p. 28). *Hyalomma savignyi* (Gervais) is the correct name of the cattle tick which thus far has been called *Hyalomma aegyptium* (Linnaeus.

COURTING AND MATING PERFORMANCES OF AN ASILID FLY *(HETEROPOGON LAUTUS)*

On September 13, 1932, in a mesquite pasture near Spur, Texas, the small robber-fly, *Heteropogon lautus* Loew, was very abundant, numbers perching on the tips of dead twigs of the mesquite five or six feet from the ground and on the barbs of a wire fence enclosing the pasture. They betrayed interest in passing objects by quick movements of their heads, but were not wary and could easily be captured by hand. Several were seen feeding on small winged formicids. But what attracted our attention particularly (Mr. W. C. O'Dowd of the Texas Agricultural Experiment Station was with me and together we watched the phenomenon) were their peculiar actions which observation proved to be courtship and mating. Hovering in front of the female at a distance of about an inch, the male would poise, oscillating somewhat from side to side and waving his front tarsi, which are clothed with appressed white hairs, toward the female. He might continue in this position for a period of thirty seconds or more. Often the female appeared to ignore his presence; at other times she watched him eagerly, waving her front tarsi in return and spasmodically half-raising and lowering her wings. The male would then fly over, turn in midair and alight in back of the female, coition then taking place. At other times males were seen to alight in back of the females and press their mystacal bristles against the spines of the cerci surmounting the ovipositor. At such times, the female would half-raise and lower her wings as described before. Frequently the male would then spring to his hovering position in front of the female and the tarsi waving would begin again. In one instance, an additional male was noted hovering in front of a pair in copulation.

STANLEY W. BROMLEY.

NOTES ON THE FULGORIDAE WITH SOME NEW SPECIES.

By E. D. Ball,

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The large and showy representatives of the sub family *Fulgorinæ* are largely tropical, only a few of the smaller and more somber forms appearing along the southern boundary of the United States. Owing to the fragmentary character of our knowledge of the tropical forms it has been difficult to correctly place even the few we have. In a recent survey the following additions and corrections appeared to be warranted.

Calyptoproctus marmoratus Spin. 1839 (=*Crepusia glauca* Metc. 1923). Spinola and Stal describe *Calyptroproctus* as having the *fifth* dorsal segment of the *female* abdomen as long as the three preceding segments and *tricarinate.* Metcalf, in his key, gives *ninth* abdominal segment elongate *quinquecarinate* for *Calyptroproctus* Spin. and *ninth* abdominal segment not elongate, not quinquecarinate for *Crepusia* Stal. (italics mine). He must have misinterpreted the description and overlooked the fact that this character is only present in the females and examined only males of his *Crepusia glauca,* of which he reported 12 males and only one female. The females of this Arizona species have the elongate tricarinate segment and answer in every way to the description of *marmoratus* and to Dozier's figure of the Mississippi example.

This species is now definitely known from Mississippi, Brownsville, Texas, and from a number of places in the southern half of Arizona.

Crepusia is apparently one of the many genera proposed by Stal in his Hemiptera Africana keys that were never described or to which no species was referred. The characters given in his "Key to the American Fulgorid Genera" are inconsistent with those given previously. It seems best therefore to fix *glauca* Metc. as the type of *Crepusia* Stal. which will make it a synonym of *Calyptoproctus* if *marmorata* is correctly referred to *Calyptoproctus* as represented by *elegans* L & S its type.

Poblicia fuliginosa Oliv (1791) (=*missella* Stal (1864) (=*thanatophana* Kirk (1907). This large dark species has a line on the vertex, the transverse veinlets towards the apex of the elytra as well as scattered small spots, creamy white. It varies in shades of brown or black but the posterior two-thirds of the abdomen above is always scarlet red with four lines of black dots, which agrees with the various descriptions. It is found from North Carolina, Ohio, Kansas and Southern Arizona, south to Georgia, Texas and Mexico.

Cyrpoptus vanduzeei Ball n. sp.

Similar to *nebeculosus* but smaller and darker. The smallest darkest species in the genus. Dark brown, vertex creamy, with a broad, medium black stripe. Length (with elytra) 10 mm.

Form of *metcalfi,* smaller with a relatively shorter, thinner, more depressed and foliaceous vertex. Vertex evenly rounding, little if any longer than pronotum, half longer on middle than against eyes. Pronotum with a definite median carina and traces of lateral ones behind the eyes. Mesonotum with three broad carinae indicated. Elytra with the lateral margins but slightly sinuated, the apical margin scarcely oblique.

Color dark brown mottled, the vertex and apex of mesonotum creamy with a broad black median stripe throughout. Elytra with the basal two-thirds dark, the apical third subhyaline, heavily brown flecked in more or less concentric rows. Underwing hyaline with smoky veins, the basal third pale yellow, the angle of the folded area with a small dark cloud, abdomen pale yellow above. Face soiled tawny, the lower part of clypus and coxae dark brown; venter finely irrorate.

Holotype ♀, one ♀ and two male paratypes Baboquivari

Mountains, April 11, 1932. Allotype ♂ Santa Cruz River April 22, 1932, and one paratype ♀ Tucson, April 27, 1930. All taken in Arizona by the writer from bunches of mesquite grass (*Muhlenbergia porteri*) growing under spiny shrubs. Named in honor of E. P. Van Duzee whose foundation work on the Fulgoridae of Temperate North America will long endure.

Cyrpoptus metcalfi Ball n. sp.

Smaller and narrower than *belfragei*, much paler. Pale testaceous, the subhyaline elytra allowing the orange and black of the wings to show through. Length (with elytra) 12-14 mm.; expanse 26 mm.

Vertex roundingly produced, the margin thick and the surface depressed, longer than the pronotum, twice as long on middle as against eyes, front as seen from side strongly concave, the upper part and vertex compressed foliaceous, little if any thicker than the margin.

Color, uniform pale cinnamon with a tawny tinge, no definite spots or markings, face and below pale creamy, occasionally finely irrorate with scarlet above. Vertex creamy, base of pronotum washed with brown omitting a median carina. Elytra subhyaline, under wings hyaline with orange nervures, the basal third reddish orange, the apex of the fold black, abdomen yellow above.

Holotype ♀, allotype ♂ and 14 paratypes, August 25, 1929, Yuma, Arizona. These were taken by the writer sweeping on arrowweed (*Pluchea sericea*) and mesquite in the Colorado River bottom. Named in honor of Dr. Z. P. Metcalf who has recently published upon the Fulgoridae of the Eastern United States. From *nebeculosus* this species can be separated by its smaller, narrower form, lack of dark spotting and the convex ventral surface of the male plates while in that species they are furrowed. It is smaller and has a longer head than *suavis*, from Mexico.

Ormenis quanta Ball n. sp.

Form and size of *pallidacosta* nearly, broader, with angularly produced front. Green. Length ♀ 14 mm. ♂ 12 mm. Width of ♀ elytra at apex 8 mm.

Front narrow, extending forward and downwards three-fourths its length, then abruptly retreating in line with the clypeus forming a right or slightly obtuse angle, lateral margins foliaceous and broadening to the antennae, a median carina extending to the angle, mesonotum large, convex, polished, faintly tricarinate. Elytra as in *pallidacosta* expanding apically where they are truncate with the inner angle acute and the outer (costal) very slightly rounding. Two rows of transverse veinlets slightly more definite in *pallidacosta.* Color pale green, probably deep green in life, with the front and clypeus paler, shading to straw.

Holotype ♀ allotype ♂ and one paratype Iguala Gr. and three paratype males Cuernavaca, all taken in Mexico in September 1898 by O. W. Barrett. This species would run to the genus *Lechara* Stal in Melechar's key on the angled front, but this group is from the Celebes and quite distinct in other structures. This species seems to be a typical *Ormenis,* near *pallidacosta* and is so placed. It is easily separated by the green, rather than the blue-green color of that species and by the angled front.

Ormenis yumana Ball n. sp.

Small, powdery green or slaty white, with a smoky tip, resembling *leucophaea* in the slender form but with two definite transverse lines. Length ♀ 8 mm. ♂ 8 mm., width of elytra 3 mm.

Front broader than long, the margins rounding, disc flat with a very feeble median carina and traces of one on the vertex margin; elytra more than twice longer than wide, the margins parallel, the apex slightly obliquely truncate with the angles equally rounding. Two distinct lines of transverse nervures, with only about 10 full length cells between them instead of very indistinct with about 14 cells in *saucia* and only one line in *leucophaea.*

Color, pale green becoming smoky posteriorly with scarcely a trace of blue-green as in *relicta,* or almost entirely slaty with the nervures green, or becoming white on the darker apex. The costal margin is paler becoming almost white in the slaty examples.

Holotype ♀, allotype ♂, November 2, 1929, a pair of paratypes August 25, 1929, two males March 16, 1930, two pairs March 29, 1932, two females June 9, 1931, all from Yuma, Arizona, and one female, Calixico, California, June 10, 1931. All collected by the writer. The specimens taken in March were all slaty. Those taken in the summer, green.

Acanalonia servillei Spinola (=*Acanalonia latifrons* Walk)

There is certainly but a single large blunt-headed species of this genus occurring in the United States. The definite median carinae from vertex to mesonotum, renders it strikingly distinct in the group. *A. servillei* was described from Philadelphia, while *latifrons* was from New Orleans. The writer has collected this species abundantly on the grounds of Swarthmore College near Philadelphia, and again in still greater abundance in Florida. He has a large number of examples from Hayti and has examined material from Pennsylvania south to South America in different collections and feels certain that there is but one species involved.

Acanalonia saltonia Ball n. sp.

Form of *clypeata* nearly, much larger, with the front rather than the clypeus inflated. Long, narrow, pale green with an obtusely conical head. Length ♂ 9 mm., width of elytra 4 mm.

Vertex resembling *clypeata,* more definitely angled than in *virescens,* flat on disc. Elytra long, narrow, parallel margined and almost truncate at apex, much longer than in *virescens.* Face sloping, the front inclined to be inflated, the clypeus broader above than in *clypeata* and less inflated. Pale powdery green in life, fading to pale straw.

Holotype ♂ and two paratype males taken by the writer at Imperial, California, June 18, 1909.

Acanalonia virescens Stal. A male that agrees with Mexican material of this species was taken by the writer at Marco, Florida, May 15, 1928.

Acanalonia mollicula V. D. The writer has collected this blue-green species in Southwestern Utah, Southeastern Nevada and Northwestern Arizona, in addition to Mojave and Jacumba, California.

Acanalonia concinnula Fowl. The writer took a male of this species at Venice, Florida, July 27, 1927. This example agrees with China's recent drawings and has the brown stripe on the suture. It appears to differ from *fasciata* in a number of characters.

Acanalonia planata Ball n. sp.

Resembling *concinnula* but with a longer, flatter carinate vertex and almost semicircular elytra. Pale green. Length ♂ 6 mm.; width of elytra 3 mm.

Vertex broad, flat, horizontal, longer than pronotum, joining the front in a right angle, the margin with a definite carina, anterior margin rounding, posterior margin concave, parallel. Front upright, the lateral margins parallel, clypeus sloping back. Elytra hemispherical entirely, rather finely, reticulate, longitudinal nervures with few branches.

Holotype ♂ and a paratype ♂, Brownsville, Texas, July. This is a larger species with a much longer and more produced head than *laticosta* from the same region.

PSYCHE

INDEX TO VOL. XL. 1933

INDEX TO AUTHORS

INDEX TO SUBJECTS

All new genera, new species and new names are printed in SMALL CAPITAL LETTERS.

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A NEW EURYTHRIPS (THYSANOPTERA) FROM TRINIDAD

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Through the kindness of Dr. C. P. Alexander, it has been possible to study a paratype of *Eurythrips ampliventralis* Hinds from the collection of the Massachusetts State College. This has resulted in the differentiation of the new species described below.

Eurythrips amplus sp. nov.

Female (macropterous).—Length about 1.5 mm. (distended, 1.9 mm.) Color brown, darkest in vertex and along sides of head and pterothorax and in distal portion of abdomen, paler in abdominal segments I-IV, in proximal angles of V-VII, in proximal fourth and distal two-fifths of tube, and in legs (particularly at ends of tibiæ and in tarsi, these being yellow); antennæ dark brown, with base of segment I, apex and middle portion of II, and pedicel of III nearly or quite yellow, IV-VII darkest basally, III paler apically; wings of fore pair pale brownish and darker at base; ocellar pigmentation red.

Head (Pl. 1, fig. 3) fully 1.42 times as long as greatest width, which is at proximal third of cheeks, the latter nearly evenly but decidedly rounded to eyes and very slightly converging in basal third, with a somewhat wider and indistinct basal collar, serrate as seen from above because of short anastomosing lines which do not extend onto dorsum of head excepting faintly at extreme base[1], and with a slight tooth behind eyes; head sharply constricted at posterior margin of eyes, at this point narrowest and about 0.8 the least subbasal width, the width across eyes nearly equal to greatest width; vertex slightly elevated, subconical, distinctly produced and overhanging, bearing the anterior ocellus at its extremity, distinctly subreticulate, and with two pairs of small setæ, one of them behind the posterior ocelli, the other on sides of vertex and very slightly in advance of front margin of posterior ocelli; cheeks with about four pairs of similar small setæ in addition to a pair behind and between postocular setæ; postoculars nearly clear, expanded at tip, 83u long and 90u apart. *Eyes* strongly protruding, composed of relatively few large convex facets, about 0.3 as long as head, their width greater than 0.9 their interval and about three-fourths their length. *Ocelli* present, the posterior ones about 17u in diameter and about 0.6 as wide as their interval, the *median ocellus with posterior margin far* (12*u*) *in advance of anterior margin of eyes.* Antennæ (Pl. 1, fig. 4) about 2.16 times as long as head, *segments VI-VIII rather compactly united because of the very short and broad pedicels of VII and VIII, which are retracted into the apices of the preceding segments, VII with pedicel about* 15*u wide and very nearly twice as broad as that of VI, VIII with pedicel* 13*u wide;* sense-cones slender, the number on inner (and outer) surface of segments as follows: III 1(2), IV 1(2), V 1(1+1), VI 1(1+1), VII with the usual one on dorsum near apex; setæ long, slender, pale and pointed. *Mouth-cone* broadly rounded at tip, supasssing middle of prosternum.

Prothorax (Pl. 1, fig. 3) along median line of pronotum about two-thirds as long as head and (inclusive of coxæ) about twice as wide as long, with a short vestigial median thickening, with a few faint lines of sculpture along posterior margin, and fused with posterior half of epimera; anterior marginal setæ minute, the others nearly colorless,

[1]In order to show these at all in the figure, it has been necessary to represent them more conspicuously than they show in the specimen.

long, and dilated at tip, the anterior laterals 80u, midlaterals 78u, epimerals 79u, posterior marginals 87u, coxals 50u. Pterothorax distinctly wider than prothorax, notal plates nearly smooth. *Legs* normal; fore tarsus with a slight downwardly-directed tooth or claw at inner distal angle of first segment. *Wings* normal, the fore pair (Pl. 1, fig. 2) without accessory setæ and with the three subbasal setæ long, knobbed, pale, and comparable with those on anterior angles of pronotum.

Abdomen about 1.4 times as wide as prothorax across coxæ, free of sculpture save for the usual dark transverse line near bases of terga II-IX, major setæ mostly knobbed, the lateral pair on VII about 113u and pointed, its homologue on VIII about 97u and knobbed, that on IX about 123u and nearly pointed; tube (Pl. 1, fig. 1) about two-thirds as long as head and *only* 1.57 *times as long as greatest subbasal width,* this twice the apical width, sides very slightly concave in distal five-sixths, its terminal setæ pale and nearly 0.9 its length.

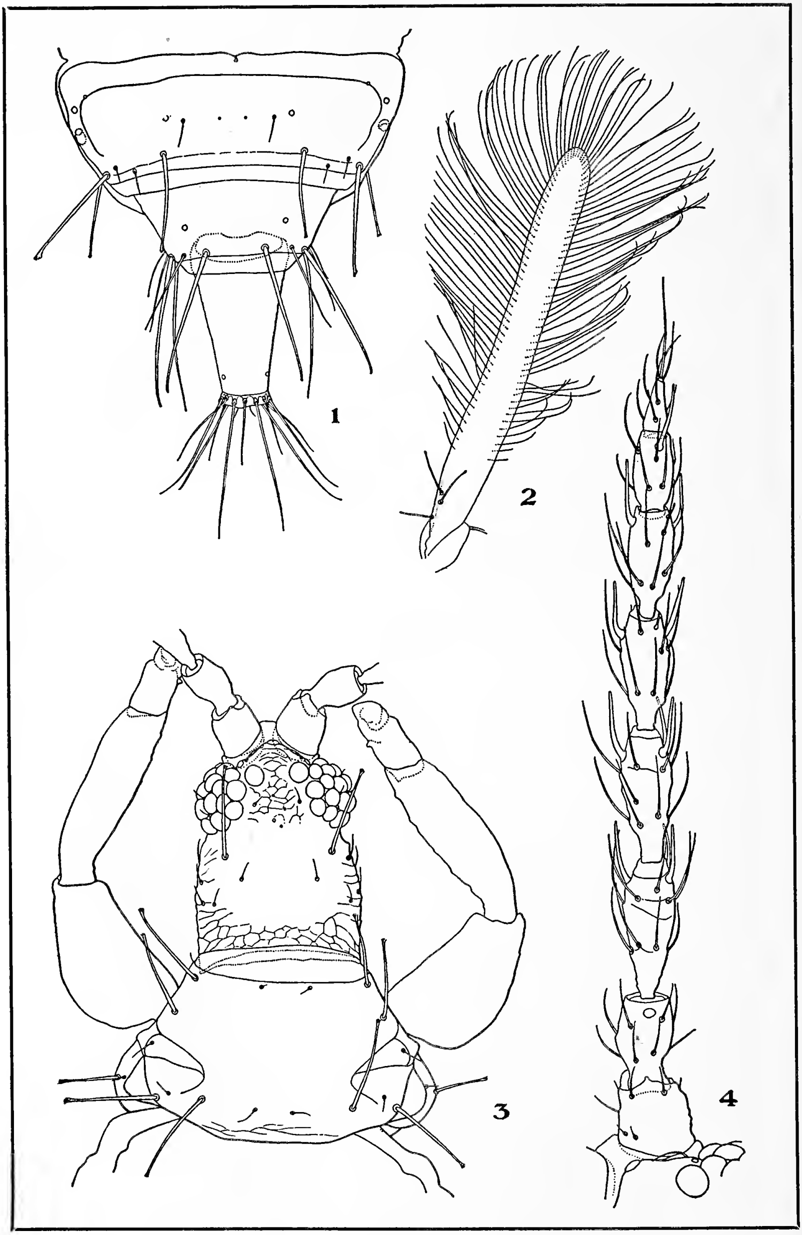
Measurements of holotype (♀): Length about 1.51 mm. (distended, 1.89 mm.); head, length 0.205 mm., greatest width (at basal fourth) 0.144 mm., width across eyes 0.139 mm., width at posterior margin of eyes 0.111 mm., least subbasal width 0.140 mm.; eyes, length 0.060 mm., width 0.045 mm., interval 0.048 mm.; prothorax, median length of pronotum 0.137 mm., width (inclusive of coxæ) 0.277 mm.; pterothorax, greatest width 0.331 mm.; abdomen, greatest width (at segment IV) 0.388 mm.; tube, length 0.132 mm., width near base 0.084 mm., at apex 0.041 mm.

Antennal segments:	1	2	3	4	5	6	7	8
Length (u):	50	53	70	66	60	59	49	37
Width (u):	42	32	30	29	27	26	22	13

Total length of antenna 0.444 mm.

Described from one female taken by Dr. C. B. Williams at St. Joseph, Trinidad, March 4, 1918, by sweeping grass.

It is in some ways difficult to compare this with the closely allied *E. ampliventralis* Hinds, because one is known only in the macropterous form, the other only in the



Hood—Eurythrips

brachypterous. One important difference, not correlated with wing development, is the peculiar structure of the pedicels of the last two antennal segments. In *amplus* these are very short, widened basally, and that of the penultimate segment is nearly twice as wide as that of the sixth. Other differences lie in the much larger size of *amplus,* in the longer and proportionately slenderer antennal segments, and in the much stouter tube. In *ampliventralis* this last is about 143 microns long and 79 microns wide near base, and the proportion of length to breadth is thus 1.81, as against 1.57 in *amplus.*

EXPLANATION OF PLATE 1.

(Drawn by Miss Helen E. Rearwin; camera lucida.)

Eurythrips amplus sp. nov.

Fig. 1.—Abdominal segments VIII-X, ♀, holotype.

Fig. 2.—Right fore wing, ♀, holotype.

Fig. 3.—Head and prothorax, ♀, holotype; all setæ omitted from appendages.

Fig. 4.—Right antenna, ♀, holotype.

NEW FORMS OF APHÆNOGASTER TREATÆ FOREL FROM THE SOUTHERN UNITED STATES (HYM.: FORMICIDÆ)

By George C. and Esther W. Wheeler
University of North Dakota

In describing new forms of *Aphænogaster treatæ* Forel, we have found the original specific description (1886) too brief. It seems desirable, therefore, to give here a few additional characteristics which we have found useful in comparisons.

Worker. Length of head exclusive of mandibles 1½ times its greatest width. Scape 1⅕ times the length of the head; lobe ¼ to ⅓ the length of the scape. The long flange bordering the lobe posteriorly[1] is low and the anterior surface of the lobe is convex except that the distal portion has a small concavity between the posterior and anterior flanges. The short anterior flange arising at an acute angle from the posterior one disappears into the anterior convexity. (See Fig. 1a and b.) The base of the epinotum is twice the declivity.

Head coarsely and longitudinally rugoso-reticulate with surface between the reticulations finely punctate. Frontal area with a median longitudinal ridge. Transverse striations on the dorsal surface of the epinotum commence at the base and merge into reticulations or indistinct striations in the region between the spines. Posterior surfaces of nodes densely and irregularly punctate. Mandibles hairy.

Thorax dark ferrugineous; head and abdomen above fusco-ferrugineous.

We have been unable to procure a female of *A. treatæ*.

[1]In this paper the anterior part of the lobe is that surface which faces forward when the scape is appressed to its groove in the head; the posterior, the area concealed thus.

MALE. Epinotum ⅓ the entire thorax, slightly longer than mesonotum. Spines usually reduced to blunt protuberances.[2] Base 3 times the declivity.

Head densely punctate. Mesoscutum smooth and irregularly pitted laterally, finely punctate above, coarser behind; scutellum punctate, mesopleuræ smooth, striated near anterior border. Anterior half of base of epinotum smooth, posterior half of its base punctate; its declivity irregularly cross-striated. Nodes faintly punctate, postpetiole with a narrow band of lateral longitudinal striations.

Abdomen shining and smooth except the posterior halves of petiole and postpetiole, which are rugosely and finely reticulate. A few hairs on the head, almost none on the thorax; scattered longer hairs on the abdomen.

Dark fuscous; legs and tip of abdomen, fusco-testaceous. Mandibles, anterior edge of pronotum, tarsi, and genitalia, testaceous.

This supplementary description of the male is taken from a specimen sent us by Dr. W. S. Creighton, collected at Lookout Mt., Fort Payne, Ala., and considered by him to be typical.

Aphænogaster treatæ subsp. **pluteicornis,** new subspecies

WORKER. Length 6 mm.

Differs from the typical *treatæ* in the following details:

Scape usually 1⅕ the length of the head exclusive of the mandibles. Antennal lobe is about ¼ the length of

[2]The epinotal spines of the males of *A. treatæ* are probably variable likewise, although Forel (1886) says "armé de deux épines." In the type nest of *A. pluteicornis* the spines are vestigial, being represented by low rounded protuberances. Sometimes these resemble spines broken off near the base. However, small hairs have been found on the apparently broken end, and also, an adult male was discovered still inside the untorn pupal exuvium with this same rounded projection. These facts nullify the possibility of the stumps being broken spines. Another nest of this same subspecies, collected at Ivanhoe, Texas, has long slender spines on all males. Emery (1895) in speaking of *A. treatæ* males reports: "Unter den mir vorliegenden ♂ ♂ aus D. Columbia finde ich nur eins mit langen und an der Spitze stumpfen Dornen; bei allen andern, darunter 2 aus demselben Fläschen wie das bedornte Exemplar sind mir stumpfe Beulen zu sehen. Ein leider sehr beschädigtes Originalexemplar des ♂ aus N. Jersey hat kurze, stumpfe Dörnchen."

the scape. The flange bordering it posteriorly is higher and the anterior surface of the lobe next to this flange is very concave. (See Fig. 1c & 1d.) Spines on the epinotum a little longer, varying from 1/3 to 1/2 the base.

Hairs even more sparse; short and coarse on head, prosternum, dorsa of thorax and petiole; finer on abdomen. A few scattered, very small hairs, suggestive of rudimentary pubescence, on the gastric dorsum in addition to the usual longer hairs.

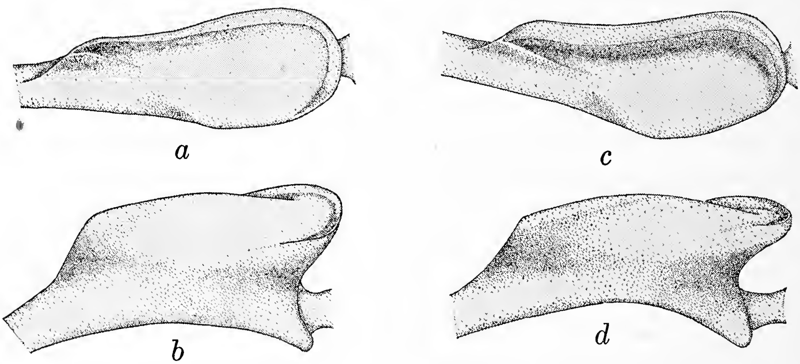


Fig. 1. *a*, left antennal lobe of *Aphænogaster treatæ*, anterior view; *b*, lateral view of same; *c*, left antennal lobe of *Aphænogaster pluteicornis*, var. *oklahomensis*, anterior view; *d*, lateral view of same.

Head not so coarsely rugoso-reticulate. The feeble transverse striations on the dorsum of the epinotum are almost immediately indistinguishable from reticulations. Petiole and postpetiole more faintly punctate laterally and less rugose above. Very fine reticulations of the first gastric segment extend indistinctly to the posterior edge.

Ferrugineous throughout except the abdomen which varies from ferrugino-fuscous to ferrugino-testaceous with a tendency to be lighter at the apex.

Female. Length 8 mm.

Differs from the worker in having the lobe a trifle longer in proportion to the scape. Length of head exclusive of mandibles $1\frac{1}{5}$ times the width. Scape shorter, 1 1-15 times the length of the head.

Sculpture coarser, gaster duller. Mesoscutum striated above longitudinally; on the mesoscutellum these ridges curve into cross striations posteriorly. Transverse striations of epinotum regular, not reticulate. Petiole rugose, reticulations becoming somewhat diagonally striated behind. Area between the reticulations punctate. Keel on the ventral surface sharp. Anterior dorsum of postpetiole reticulate, somewhat coarser and transversely striated behind. First gastric segment finely striated longitudinally at the base, merging into fine reticulations and fading out posteriorly.

Hairs relatively shorter and more abundant.

Color ferrugineous to fusco-ferrugineous, lighter specimens with darker parapsidal furrows. Metanotum, teeth of mandibles, area between ocelli, margins of thoracic sclerites, bands on the apices of gastric segments, fusco-ferrugineous; when completely retracted the lighter bands are concealed.

MALE. Length 5 mm.

Differs from the male of *A. treatæ* as follows:

Irregularly transverse ridges of the epinotal declivity fewer. Epinotal spines variable,[2] sometimes reduced to low rounded protuberances. Thorax piceous, femora and tibiae darker also.

These ants were collected by the authors in open woods (mostly *Quercus marilandica* Muench.), where the soil was a sandy loam.

Oklahoma: Poteau. VI-17-'29. Numerous workers, 1 deälated female, 3 winged females, 4 males, and a few larvæ and pupæ. On a steep slope in the soil and under dead leaves beside a stone. (Type nest.)

Oklahoma: Poteau. VII-16-'22. Small colony under a stone on a steep hillside.

Texas: Ivanhoe (Fannin County). VI-27-'29. Numerous workers, 8 deälated females; 7 winged females, 3 males, a few larvæ and pupæ. In the buried end of a small decayed branch.

Aphænogaster treatæ pluteicornis var. **oklahomensis,** new variety

WORKER. Length 5½-6 mm.

Differs from *A. treatæ pluteicornis* in the following respects: Scape 1⅕ to 1¼ the length of the head exclusive of the mandibles. Lobe ¼ the length of the antennæ and more concave next to the posterior flange, which is higher. (See Fig. 1c & 1d.) Epinotal spines about ½ the base, but variable. Epinotum more definitely striated. The first dorsal segment of the gaster more faintly reticulate. Posterior surface of the node of the postpetiole less densely punctate above. Fulvous, with head more ferrugineous, teeth of mandibles fuscous, and gaster light fulvo-fuscous.

FEMALE. Length 8 mm.

Differs from the female of *A. pluteicornis* in these characteristics: Antennæ shorter, scape 1 1/11 times the length of the head. Lobe ⅓ the scape. Posterior dorsum of the petiole more roughly reticulate, forming indefinite cross-striations. Postpetiole more rugose with a tendency to cross-striations. Fusco-ferrugineous, darker than most females of *A. pluteicornis.*

Oklahoma: Poteau, VII-16-'22. Numerous workers, 1 deälated female and a few larvæ and pupæ. Nest under a stone in the same environment as *A. pluteicornis.*

Aphænogaster treatæ pluteicornis var. **alabamensis,** new variety

WORKER. Length 5-6 mm.

Differs from *A. pluteicornis* in the following manner:

About half the workers have the scape of 1⅓ times the length of the head, the rest vary to 1¼. The anterior surface of the antennal lobe is usually convex with only a small shallow concavity near the low flange; in a few specimens it is deeper. The base of the epinotum varies from 2 to 2½ times the declivity.

The head is more coarsely reticulate. Posterior surface of the node of the postpetiole finely punctate. Sparse gastric pubescence entirely absent.

Color ferrugineous like *A. pluteicornis* or varying to ferrugino-testaceous.

FEMALE. Length 8 mm.

Like *A. pluteicornis* but with these few minor differences: Flange of the lobe a little higher; scape 1 1-11 the length of the head; color similar except that the frontal area is darker.

Alabama: Lookout Mt., Fort Payne, 12-VII-'29. Collected by Dr. W. S. Creighton.

Compared with *A. treatæ*, the head of the worker is not so coarsely reticulate, but the antennal lobe is similar except that the anterior flange is longer; the transverse striations of the epinotum usually merge sooner into reticulations which disappear between the spines, but a few specimens approach nearer *A. treatæ* in rugosity; the hairs are fewer and the color is always lighter.

This variety exhibits more variability within the nest than do our other forms of *A. treatæ*. The sculpture of the worker including the striations of the epinotum, and the shape of the antennal lobe are intermediate between *A. pluteicornis* and *A. treatæ*.

KEY TO THE FORMS OF APHAENOGASTER TREATAE

1. Lobe at the base of the antenna short, 1/5 or 1-6 the length of the scape[3] .... 2.
   Lobe longer, 1/3 to 1/4 the length of the scape........ 3.
2. Lobe narrow and very short, 1-6 the scape. Ferrugineous, head and abdomen slightly darker........
   treatæ subsp. *harnedi* W. M. Wheeler (1919).
   Lobe 1/5 the scape. Dark fuscous to piceous........
   treatæ var. *ashmeadi* Emery (1895)[4].
3. Lobe broadly angulate in front. Dark fuscous to piceous.
   treatæ subsp. *wheeleri* Mann (1915).
   Lobe not broadly angulate but evenly rounded........ 4.

[3]The lobe is measured from the point where the scape begins swelling to the tip of the anterior surface, nearest the antennal insertion.

[4]Mayr (1886) first mentioned this variety but failed to name it.

4. Dark ferrugineous, head and abdomen ferrugino-fuscous above. Transverse epinotal striations extend to the spines ....*treatæ* Forel (1886).
   Color lighter. Striations of epinotum not so extensive. Sculpture less rugose. Punctation on first gastric segment finer ....5.

5. Dorsum of epinotum usually reticulate, not striate. Ferrugineous, abdomen varying to ferrugino-testaceous........
   treatæ subsp. *pluteicornis,* new subsp.
   Transverse striations present on base of epinotum........6.

6. Less hairy. Concavity of antennal lobe deep and flange high. Striations of epinotum very faint. Thorax light fulvous, head ferrugineous, gaster light fulvo-fuscous......
   treatæ pluteicornis var. *oklahomensis,* new variety.
   More hairy. Concavity of antennal lobe small and flange lower. Striations of epinotum definite. Apex of postpetiole more reticulate. Coarseness of sculpture intermediate between *A. treatæ* and *A. pluteicornis.* Ferrugineous to ferrugino-testaceous ....
   treatæ pluteicornis var. *alabamensis,* new variety.

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ON THE TICKS OF CUBA, WITH DESCRIPTION OF A NEW SPECIES, *AMBLYOMMA TORREI*, FROM *CYCLURA MACLEAYI* GRAY.[1]

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In the literature on Ixodoidea I find the following information relating to species recorded from Cuba.

F. J. Balmaseda (Enfermedades de las aves ó Ensayo sobre Patornitología y consideraciones sobre Higiene Pública en la Isla de Cuba. Havana, 1889) cites two species: "*Ixodes reticulatus*" (pp. 272 and 275) on cattle, and "*Ixodes ricinus*" (p. 272) on dogs.

G. Neumann (Mém. Soc. Zool. France) records *Rhipicephalus annulatus* (1897, p. 412) ; *R. bursa* (1897, p. 393) ; *Amblyomma cajennense* (1899, p. 208) ; *A. tuberculatum* (1899, p. 236) ; *A. albopictum* (1899, p. 244) ; *Rhipicephalus annulatus*, typical (1901, p. 279) ; and *R. annulatus* var. *microplus* (1901, p. 280).

C. W. Stiles and A. Hassall (U. S. Dept. Agric., Bur. Anim. Ind., Circ. No. 34, 1901, p. 3) cite *Boophilus australis* as present in Cuba.

Nuttall, Warburton, Cooper and Robinson (A Monograph of the Ixodoidea, 1908-1926) repeat in part the records given by Neumann.

A publication issued by the Secret. Agric. Com. y Trab., Habana, (Circ. No. 57, 1919, p. 7) states that "*Boophilus annulatus* or *Margaropus annulatus*" is the most common species.

N. S. Mayo (First Annual Rept. Agric. Exp. Sta. Cuba, 1906, p. 44) lists from Cuba *Dermacentor nitens*, *Margaropus annulatus*, and *M. annulatus australis;* and later (Second Rept. Agric. Exp. Sta. Cuba, 1909, p. 27), he also mentions *Rhipicephalus texanus* as a Cuban species on dog.

[1]Translated, from the original Spanish MS, by J. Bequaert.

W. A. Hooker (Jl. Econ. Entom., II, 1909, p. 415) gives a list of the ticks known at the time from Cuba. He repeats most of the previous records and includes the following species of which he saw Cuban specimens in the collection of the U. S. Bureau of Entomology: *Amblyomma albopictum, Argas miniatus, Margaropus annulatus, Ornithodoros marginatus* (Banks, MS. name).

In 1910 (Proc. Ent. Soc. Washington, XII, p. 6), N. Banks describes *Ornithodoros marginatus*, from a cave in the Guanajay Mountains, Cuba (collected by Palmer and Riley), and also from a West Indian bat (collected by Barrett, probably in Porto Rico).

The foregoing data might call for some discussion, but I prefer to give the following brief summary.

1. *"Ixodes reticulatus"=Dermacentor reticulatus* (Fabr., 1794). It is evident that Balmaseda used this name for the ticks he found on cattle, because *"Ixodes reticulatus"* is the best known tick name. The presence of this species in Cuba could only be explained as accidental, through introduction with cattle from Europe. Given this possibility and in view of its origin, this species should be struck out from the Cuban list.

2. *"Ixodes ricinus"=Ixodes ricinus* (Lin., 1758). Up to the present the occurrence of this tick in the island has not yet been positively established. It seems certain that Balmaseda cited it only because he was familiar with the name.

I mention the foregoing two species only because they have appeared in print.

3. *Amblyomma albopictum* Neumann, 1899. The occurrence of this tick in Cuba has been confirmed.

4. *Amblyomma cajennense* (Fabricius, 1787). This species is very common in Cuba.

5. *Amblyomma tuberculatum* Marx, 1894. This tick was collected by Gundlach and identified by Neumann. Dr. Bequaert is of the opinion that Gundlach obtained his specimens off gopher turtles brought to Cuba from the United States, where the species is indigenous. In view of this, this tick must be eliminated from the Cuban list.

6. *Rhipicephalus annulatus, R. annulatus* var. *microplus*, and *Boophilus australis* all refer to *Boophilus microplus* (Canestrini 1888), in so far as the species of Cuba is concerned.

7. "*Margaropus annulatus* or *Boophilus annulatus*." I have searched for this tick with special care, examining lots coming from many different parts of the island, but I have never seen it. If it occurs on cattle imported from the United States, it must be very rare.

8. *Dermacentor nitens* Neumann, 1897. The occurrence of this tick in Cuba is certain.

9. *Argas miniatus* Koch, 1844. This name is now regarded as a synonym of *Argas persicus* (Oken, 1818), which is well known as a Cuban tick.

10. *Ornithodoros marginatus* N. Banks, 1910. Dr. Bequaert, who saw cotypes in Mr. Banks' collection at the Museum of Comparative Zoölogy, Cambridge, Mass., informs me that it is an extremely remarkable species. As Mr. Banks states, it is "readily known from all other species by the row of tufted humps on margins of body." It probably is peculiar to West Indian caves, where it doubtless feeds on bats.

11. *Rhipicephalus bursa* Canestrini and Fanzago, 1877. This is mainly a tick of the Old World, where it is found on cattle, horses and other hosts. It is rather similar to *R. sanguineus,* and it is possible that the specimens seen by Neumann from Cuba were that species and not the true *R. bursa.* In any case, the record needs confirmation and I do not therefore include the species in my list. It should be noted that Neumann did not mention *R. sanguineus* from Cuba.

12. *Rhipicephalus texanus* N. Banks, 1908. The correct identity of this species is open to question. The Cuban specimens which Mayo referred to it, were, however, beyond doubt *R. sanguineus,* the common dog-tick of the island.

I shall now give a list of the species of ticks at present positively known to occur in Cuba, with the hosts on which they may be found, as well as the localities.

IXODOIDEA Banks, 1894
I. *Argantidæ* Agassiz, 1846
G. **Argas** Latreille, 1796

1. *A. persicus* (Oken, 1818) Fischer, 1827.—Host: *Gallus gallus*. Localities: Provinces of Havana, Matanzas, and Santa Clara. This species has been known in the island for many years. The country-people call it and its larvae "*garrapatillas*." As in other countries, it has been shown rather frequently in Cuba that this parasite transmits spirochetosis of poultry.

G. **Ornithodoros** Koch, 1844

2. *O. megnini* (Dugès, 1883) Neumann, 1896. Host: *Equus caballus*. Locality: Province Havana. It does not appear to be common. I have only encountered it once, on a native horse, and I cannot assure that it is actually indigenous. If it is shown later not to be indigenous, it should be struck out from the list.

3. *O. marginatus* Banks, 1910. Locality: Guanajay Mountains, Prov. Pinar del Rio. It is restricted to bats. Two larvae, possibly of this species, were taken by Mr. P. Bermudez off a bat, *Eumops glaucinus* (Wagner), at Caibarien, Prov. Santa Clara.

II. *Ixodidæ* Murray, 1877
G. **Dermacentor** Koch, 1844

4. *D. nitens* Neumann, 1897.—Hosts: *Equus caballus, Bos taurus,* and also *Epicrates angulifer* Bibron. Localities: Provinces of Havana, Pinar del Rio, Santa Clara, Matanzas, and Camaguey. This tick was first recorded from Cuba by N. S. Mayo (1906). It is widely distributed over the entire island. I have found it parasitizing indiscriminately equines and bovines, but more particularly the former, in the ears, in the region of the anus and perineum. I have found it also once on a "Majá de Santa María" (*Epicrates angulifer*) captured at Calabazar de Sagua (Prov. Santa Clara).

G. **Rhipicephalus** Koch, 1844

5. *R. sanguineus* (Latr., 1806) Koch, 1844.—Host: *Canis familiaris*. Localities: Provinces of Havana, Ma-

tanzas, and Santa Clara. This is the common dog-tick of Cuba, widely distributed, probably, over the entire island. I have not seen it outside the provinces mentioned.

G. **Boophilus** Curtice, 1891

6. *B. microplus* (Canestrini, 1888). Hosts: *Bos taurus, Equus caballus.* Localities: Provinces of Havana, Matanzas, Pinar del Rio, Santa Clara, and Camaguey. This species has been recorded by various investigators (Neumann, Stiles, Bequaert). It is the common tick of our cattle. I have taken specimens from deer ("venado"), *Odocoïleus virginianus,* at Artemisa, Prov. Pinar del Rio.

G. **Amblyomma** Koch, 1844

7. *A. cajennense* (Fabr., 1787) Koch, 1844. Hosts: *Equus caballus, Bos taurus.* Localities: Provinces of Havana, Pinar del Rio, and Santa Clara. This, as well as *Boophilus microplus* and *Dermacentor nitens,* are our most common ticks, which parasitize cattle.

8. *A. albopictum* Neumann, 1899. Host: *Cyclura macleayi* Gray. Locality: Province of Havana. The species was first described by H. Lucas (1852; as *Ixodes variegatus*), from specimens collected near Havana by Gundlach. The present author has also found it.

9. *Amblyomma* species? (near *scutatum* Neumann, 1899). Hosts: *Bufo peltacephalus* Tschudi (vernacular name: "sapo"), *Cyclura macleayi* Gray. Localities: Provinces of Havana (Laguna de Ariguanabo) and Oriente (San German; collected by M. Jaume). The true identity of this tick is as yet undecided. According to Dr. Bequaert, it is quite different from *A. dissimile* Koch, and possibly represents an undescribed species.

10. *A. torrei,* new species. Host: *Cyclura macleayi* Gray (*carinata* of authors; vernacular name *"iguana"*).

Locality: Province of Havana.

Description: *Amblyomma.*

Male: Length, 3.2 mm.; greatest width, 3 mm. Body slightly oval, without marginal groove; cervical groove short and deep; eyes of median size, not orbited, quite apparent; scutum convex, ornate; eleven quadrangular festoons; five ventral plates; dentition 3:3.

Scutum convex; color pale chestnut, with two large and continuous pale spots, placed symmetrically on each side; each spot occupying about one-third of the total length, and extending without interruption from the outer half of the scapular angles to the first two festoons. The pale chestnut fringe extends without interruption from the internal half of the scapular angle to the festoons 3-7, narrowing in its posterior two-thirds like a belt, and continuing without interruption, but with a very irregular inner border, along the margin to the eye. In the pale areas there is a narrow green band, which in the center is of a pale porcelanous violet color and toward the outside with a yellowish tinge and small green spots. Festoons as wide as long. Dorsum with fine, uniformly distributed punctures. Venter glabrous; genital orifice slightly anterior to coxa II; anus one-third of the total length from the hind margin. Stigmal plate subtriangular, with rounded angles. Five ventral plates, nearly circular, placed approximately opposite the festoons 2, 4, 6, 8, and 10. Coxa I with one triangular, median spur and another short spur, a little projecting from a broad base. Coxa II with a triangular spur, but smaller than that of coxa I. Coxa III with a spur similar to that of coxa II, and a slightly marked projection on its base. Coxa IV with a spur similar to that of coxa III, and a projection or raised portion, slightly marked at the base. Tarsi gradually attenuated. Capitulum 1.2 mm. long; basis capituli 0.56 mm. long and 0.76 mm. wide. Palpi 0.8 mm. long; segment I short; segment II, 0.32 mm. long; segment III, 0.24 mm. long; segment IV rudimentary. Hypostome dentition 3:3.

Female: Unknown.

The species is dedicated to the learned Naturalist, Dr. Carlos de la Torre y Huerta.

[*Note.*—The collection of the Museum of Comparative Zoölogy contains two males of *A. torrei,* taken off *Cyclura macleayi* Gray, in the valley of Luiz Lazo, Prov. Pinar del Rio, Cuba, by Dr. C. de la Torre and Dr. Thomas Barbour. I have compared them with a paratype, kindly sent by Dr. Vigueras, and they agree in every respect.—J. Bequaert.]

NOTES ON A PSYCHID NEW TO NORTH AMERICA (*FUMEA CASTA* PALLAS, Lepidoptera: Psychidæ)

By Donald W. Farquhar[1]
Harvard University

In 1931, workers from the Gipsy Moth Laboratory in Melrose Highlands, Massachusetts, found examples of an unknown case-bearer associated with the introduced beech scale, *Cryptococcus fagi* Bar., near Jamaica Pond, Boston, Massachusetts. Specimens of the case-bearer brought into the laboratory were observed to feed on the eggs and agamic females of the scale, but since this choice of food was decided to be purely incidental and the chief interest of the laboratory was in the scale rather than in the case-bearer, no further work on the latter was done. The writer, however, was interested in the identity of the insect and sent examples of the cases to Dr. Frank Morton Jones of Wilmington, Delaware, who was unable to place them among any of the known North American forms and suggested that an attempt be made to secure adults. In 1932 two male adults were obtained, and in 1933 over 2,000 adults of both sexes were reared from larvæ collected just prior to pupation; this ample material enabled careful study, resulting in the determination of the insect as the European *Fumea casta* Pallas. A discussion of the characters establishing its identity is given in the paper which follows, while the present paper deals with the distribution and biology.

[1]The writer wishes to express his deep appreciation to Frank Morton Jones, specialist in the Psychidæ, who has been most generous in giving of his time and knowledge. A paper which follows, and which bears the name of the writer of the present paper as coauthor, is almost entirely Dr. Jones' own work.

Thanks are also given to Harold Morrison, C. F. W. Muesebeck, A. B. Gahan, and R. A. Cushman, all of the taxonomic unit of the Bureau of Entomology, who examined parasitic material and made determinations where possible.

In the Old World, *Fumea casta* Pall. is widely distributed in England, on the European mainland, in Asia Minor and Algeria. The first specimens discovered in North America were found between Jamaica Pond and the Arnold Arboretum, in Boston, Massachusetts; and subsequent scouting showed this region to be near the center of an area of some 50 square miles (Fig. 1), heavily infested at the center, and

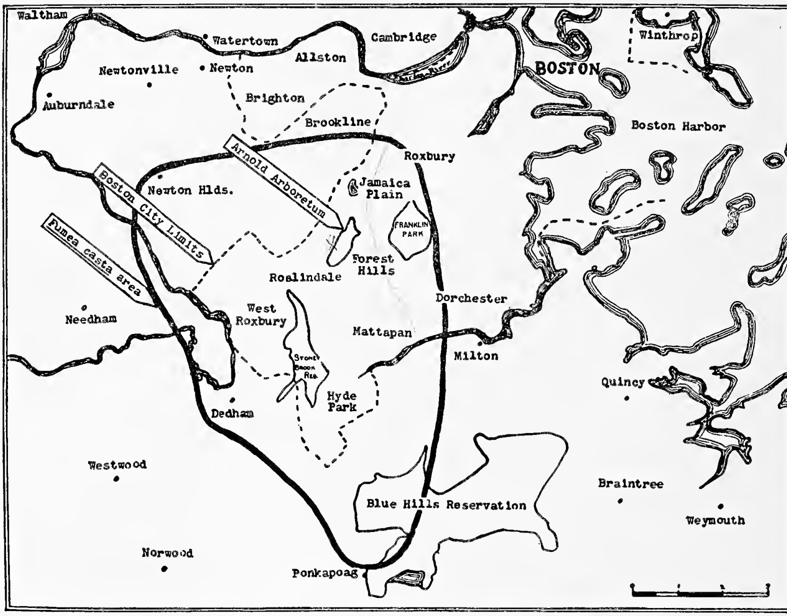


Fig. 1. Map showing regions in Boston and vicinity infested with *Fumea casta* Pall.

gradually diminishing in density toward the edges. Approximately half of the area comprised those sections within the limits of the City of Boston known as Jamaica Plain, Forest Hills, Roslindale, West Roxbury, Hyde Park, Mattapan, the Arnold Arboretum, Stoney Brook Reservation, and Franklin Park; the remaining 25 square miles were in Brookline, Newton Highlands, Dedham, Milton, and the Blue Hills Reservation. A second, and far removed, colony was later found by Dr. Jones in the Morris Arboretum, near Germantown, Pennsylvania; females from this colony readily mated with Massachusetts males; many of the older plantings in the Morris Arboretum are said to have originated in the Arnold Arboretum, which may explain the mode of introduction. A third colony is indicated by empty cases, apparently identical with those of Fumea, found by Dr. W. T. M. Forbes in Bancroft Woods, in Worcester, Massachusetts. Other colonies are to be anticipated.

Larva and Case. The larvæ hatch during June and early July, and at once each individual constructs a small silken case, or "bag," in which, enlarged from time to time, it spends its entire larval and pupal period. This elongate bag is adorned on the outside with bits of grass and other ground debris, longer pieces being attached lengthwise and often projecting slightly beyond the posterior end of the bag. Through an anterior opening, the larva is able to thrust out its head and thorax for purposes of feeding, moving, or working on the case; the posterior end of the case has a smaller opening, usually collapsed but readily opened from within for the expulsion of excrement. During resting and molting periods the anterior edge of the bag is firmly attached by silken threads to some object of support.

Food is taken only during the larval period, and consists chiefly of grasses, mosses, lichens, and other low plants, although the insect may occasionally exhibit carnivorous tendencies, as evidenced by feeding on scale insects and, in the laboratory when very hungry, on the living larvæ and helpless adult females of its own species.

As in many other members of this family, the larval period is very protracted (Fig. 2)—occupying approximately eleven months—and growth is correspondingly slow. From the time of hatching in June or July until the onset of winter, the larval case attains a length of but three millimeters. Hibernation takes place in crevices in the bark of tree trunks, or beneath stones, branches of trees, and other objects resting on the ground. In the spring, feeding is resumed, and growth is more rapid. When the larvæ are mature, in late May and early June, the cases of the females are generally larger than those of the males. Measurements of fifty female cases at this time, inclusive of the loose material projecting beyond the end of the case proper, showed a range in length from 8 to 16 mm., with an average of 12.1 mm.; measurements of the same cases, exclusive of the loose material, ranged from 7.5 to 10 mm. with an average of 8.8 mm. Fifty male cases ranged from 7.5 to 13.5 mm., with an average of 10.2 mm., inclusive of the loose material; when measured without the loose material, these male cases ran from 6.5 to 8 mm., with an average length of 7.5 mm.

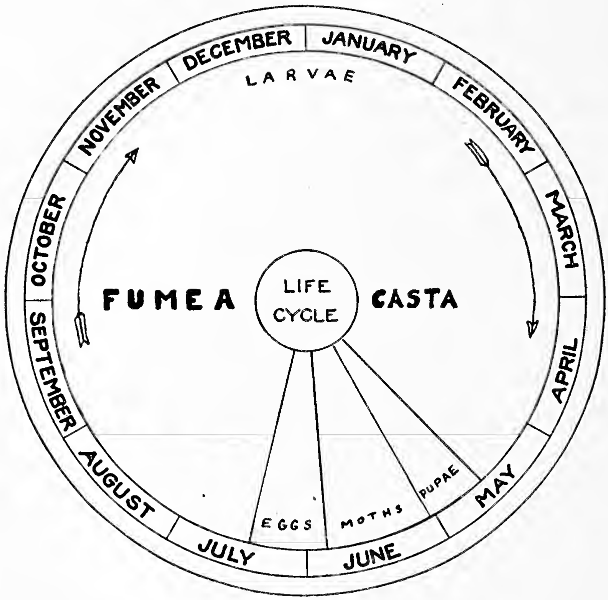


FIG. 2. Life cycle of *Fumea casta* Pall. in Massachusetts.

When the larvæ become full grown, they forsake the ground and low plants on which they have spent their entire lives up to this point, and climb up tree trunks, telegraph poles, fence posts, stone walls, sides of dwellings, etc., to attach their cases for pupation. The height to which the larva ascends before attaching the case varies from a few inches to twenty feet, but few are attached above six feet. Although the larvæ on the ground easily escape notice even in densely populated colonies because of the close resemblance of their cases to the surroundings, the cases attached for pupation are conspicuous and often render unsightly the objects of attachment.

Pupa. Like the larval period, the pupal period is passed within the bag. After firmly attaching the bag and closing its anterior end in preparation for pupation, the larva reverses its position within the bag so that its head comes to lie at what was previously the bag's posterior opening. Rarely, the larva fails to reverse its position, but in such instances the adult is unable to escape from the bag and perishes within it.

The pupæ of the two sexes are quite different in appearance. That of the male measures from 4.5 to 5 mm. in length, and has the general appearance of orthodox moth pupæ. That of the female measures 5.3 to 7.5 mm. in length, and is noteworthy because of the marked reduction in size of the antennæ, wings, and legs, all of which occupy a very limited area of the anteroinferior portion of the pupa.

In both sexes, when the pupa is ready to yield the imago, it squirms forward in the bag until the head of the pupa projects from the bag's opening; in the male this squirming continues beyond the stopping place in the female, until not only the head projects, but also the thorax and three to five segments of the abdomen. In this position the adult emerges.

The duration of the pupal period is about twelve days in the male, and about seven days in the female.

Adult Male. (Plate 2, figs. C and F.) The male moth is uniformly dark brown in color, and is provided with strong wings to which the scales are loosely attached. The alar expanse varies from 10.5 to 13 mm. (Chapman and Tutt give measurements of 9-15 mm. for European *casta.*) No food is taken by the adult, and the duration of life is but a very few days at most.

Adult Female. (Plate 2, figs. A and B.) In the higher Psychidæ, to which all the North American Psychids belong with the exception of *Solenobia walshella* Clem., the females are maggot-like and devoid of antennæ, eyes, and legs. In the lower or less specialized Psychidæ, the females are provided with functional legs, antennæ, and eyes. In this latter group belong the native *Solenobia walshella* and the introduced *Fumea casta.* The female is wingless, and the body is practically naked save for a thin scattering of pale hairs and a dense ring of pale, silky hairs at the end of the abdomen surrounding the base of the long, extensible ovipositor. After the female *casta* has feebly squirmed her way out of the pupa-shell, she takes up her waiting posture at the lower end of the bag, still maintaining contact with the interior of the bag by means of her metathoracic legs; often her head, antennæ, and prothoracic legs remain encased in the corresponding parts of the pupa-shell which are broken away from the rest of the shell during emergence. Like the adult male, the adult female takes no food, and her life in this stage is limited to a very few days.

Mating. Immediately after emerging, the female liberates the attractant which summons males within perceiving distance. A male receiving this attractant evidences its perception by becoming suddenly very much excited. He takes flight and follows an erratic course in the direction of the female. Seldom is the sense of perception sufficiently keen to enable a flight direct to the object of search; the usual course is to fly to the general vicinity of the female, then after alighting, with vibrating antennæ and quivering wings, the male continues his quest on foot. His excitement increases in pitch when he attains the bag on which his mate is waiting, and he usually makes several impetuous attempts to clasp nearby objects before making successful contact with the female genitalia. The commencement of copulation is indicated by the male suddenly becoming quiescent, resting with the wings sloped sharply downward (in a "sloping-roof" posture). Seven timed matings indicate a copulation period of six to thirty-eight minutes, with an average of 20.4 minutes. Both sexes may mate more than once, although such successive matings in the female usually occur only when the original mating has been interrupted before completion.

Eggs. As soon as mating is completed, the female probes with her ovipositor to reinsert it in her empty pupa-shell, which lies within the bag; in this process of probing she is assisted by the metathoracic legs, the tibia and tarsus of which are still within her bag, and probably facilitate the reinsertion of the ovipositor by acting as a guide. The eggs are pale in color and very delicate, and are deposited by means of the extremely manœuverable, telescopic ovipositor, which, when fully extended, equals the length of the remainder of the female's body. When the last of her 150-odd eggs have been deposited, the female withdraws her ovipositor, closing the opening to her egg-filled pupa-shell with a plug of fuzz from the tip of her abdomen; she then relinquishes her hold on the bag, and drops to the ground to die. The eggs hatch in thirteen to fifteen days, the young larvæ leaving the parental bag via its open end.

Dispersal. Since the adult female is incapable of flight or other locomotion, the dispersal of the species depends on the wanderings of the larvæ, and especially their transportation by other agencies. Just as human beings have unwittingly brought this insect to America, so, too, its dispersal within America is probably greatly assisted by man's conveyances. Another factor in the dispersal is the wind; as soon as the newly hatched larvæ have constructed their tiny cases, they have the habit of dropping themselves down on a silken thread, in which condition they are easily picked up by wind currents to be dropped perhaps at some distance away. Since evidence indicates a sojourn of the insect in this country of at least two decades, with these various factors aiding in its distribution, the insect probably will soon be found in many, and possibly widely separated localities.

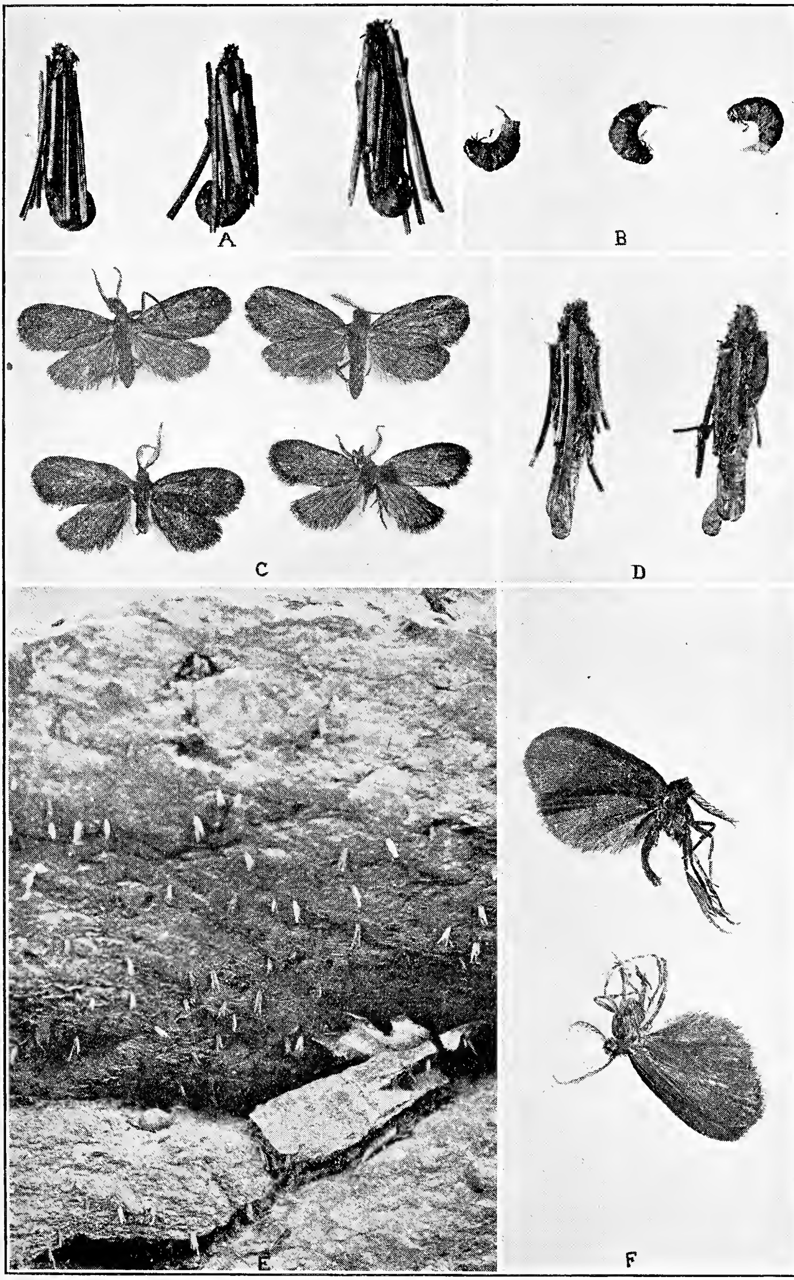
Parthenogenesis and Preponderance of One Sex. Although parthenogenesis has been recorded in the genus Fumea in Europe—and, indeed, has been reported in *Fumea casta* (Fauna Boica II, 91, Schrank)—no evidence of this phenomenon has been observed in Massachusetts *casta.* Fifteen unmated females from the Boston colony were isolated in an experiment designed to detect evidences of parthenogenesis. All died without ovipositing, within five days after emergence.

In both Europe and America, authors have remarked upon the occasional striking preponderance of one sex over the other in Psychid rearings. In parthenogenetic species, females are either the only form known or greatly outnumber the males. In America, Dr. Jones has mentioned (Tr. Am. Ent. Soc., LIII, 310, 1927) a collection of thirty-odd cases of *Eurukuttarus edwardsi* Heyl. of which only one was female; the same author (Ent. News, XXXIII, 130. 1922) bred some forty males without a single female from a collection of *Psyche celibata* Jones. Returning to *Fumea casta,* a similar numerical ration between the sexes was found in many of the Massachusetts collections, as shown in the following table based on adults bred from cases collected at time of pupation; where cases failed to yield adults, they were opened and the sex determined from the enclosed pupæ; in those few cases where the larvæ died, accurate sex determination was not considered possible, and such individuals are ignored in the tabulation:

TABLE 1.—Sex ratio in certain collections of *Fumea casta* in Massachusetts.

Date of collection	Place of collection	Number of individuals	% ♂♂	% ♀♀
May 6, '33	Arnold Arboretum	7	100	000
May 6, '33	Stoney Brook	70	100	000
May 12, '33	Stoney Brook	69	100	000
May 13, '33	Arnold Arboretum	100	100	000
May 22, '33	Arnold Arboretum	130	100	000
May 22, '33	Fenway	25	100	000
May 22, '33	Jamaica Pond	100	93	7
June 5, '33	Jamaica Pond	375	34	66

Interpretation of the above table is complicated by the fact that the Jamaica Pond colony was some two weeks behind the other colonies in reaching maturity; in fact, for a time the larvæ of this colony were considered as possibly of another species because of their smaller size. Therefore, the high percentage of females in the latest collection does not necessarily mean that similar results would have obtained if later collections had been made at the other sites. It appears from the table that the earliest larvæ to pupate are the males, which conforms with the condition in many other Lepidoptera. The striking preponderance of males



Farquhar—*Fumea casta*

may be due to some peculiar habit of the female in choosing different or more concealed places for pupation than the males, thus rendering their cases less liable to detection by the collector.

Parasites. Apparently *Fumea casta* has become established in America without its European parasites. Although the writer reared over 2,000 adult moths from cases collected at the time of attachment, only eleven parasites emerged from the material, and probably all eleven of these emerged from a single host. They proved to be a new species and genus of Eulophidæ related to *Elachertus,* as yet undescribed. Several hundred cases collected in Massachusetts were sent to Dr. Jones, and from them he reared eleven specimens of *Dibrachys boucheanus* (Ratz.) [A. B. Gahan]. Dr. Jones also reared two specimens of *Itoplectis conquisitor* (Say) [R. A. Cushman] from cases collected in the Morris Arboretum in Pennsylvania.

In addition to these definite instances of parasitism, two species were found in the field associated with *Fumea casta*: A female of *Ephialtes equalis* (Prov.) [R. A. Cushman] was taken in the field with its ovipositor thrust through a bag attempting to oviposit in the contained pupa. A specimen of *Eunotus lividus* Ash. [A. B. Gahan] was found in a tube in which cases of *casta* were being collected, and probably gained entrance to the tube by being on or within one of the cases when it was collected.

Explanation of Plate 2.

Fig. A.—Adult females on their bags (x2).

Fig. B.—Adult females (x2).

Fig. C.—Adult males (x2½).

Fig. D.—Bags from which adult males have emerged leaving their empty pupa-shells protruding from the bags (x2½).

Fig. E.—Bags attached for pupation on a stone wall in a heavy infestation (⅓ natural size).

Fig. F.—Adult males (x3½).

THE IDENTITY OF AN INTRODUCED PSYCHID, *FUMEA CASTA* PALLAS (Lepidoptera, Psychidæ)

By Frank Morton Jones and Donald W. Farquhar

When in 1931 the larvae and larval cases of this small Psychid were first observed in the Boston area in Mass., it was apparent that the insect could not be identified with any known North American species of the family. A very few adult males were secured in 1932, and these sufficed to refer the insect to the European genus *Fumea,* hitherto unrecognized in the western hemisphere, and to indicate that we were dealing with an introduced species. Abundant material of both sexes, bred in 1933, confirmed the generic reference and permitted a careful comparison with exotic material and the literature of the genus. Since the insect has already extended its range in two States and is destined to take permanent place in our fauna, it seems advisable, in addition to the biological notes included in the preceding paper, to put on record those details of its structure which should suffice for its ready recognition in this country.

Fumea, in much of its extensive European literature, obviously has been made to include species structurally divergent, and even under identical specific names there has been such lack of agreement that mixed series or mistaken identities seem the only explanation. We have profited by the careful work of Chapman, of Tutt, and of Burrows, and have accepted their identifications of *casta* Pallas, the most abundant and widely distributed species of the genus, as the basis of our comparisons. That some of the characters we describe and illustrate should be generic rather than specific, is necessitated by the confusion of literature we have indicated. In addition to the general habitus of the insect, we have found useful for comparison the following characters:

Venation, wings of male (Plate 3, fig. 1).—This Psychid is an 11-7 veined insect. In both wings the media divides the cell and does not fork within the cell. On the fore wing, the 1st anal does not reach the margin, and the 2nd and 3rd anals, coincident from near the base, extend to the margin without fork or branch; some variation exists in the origin of the two lower radials, which may arise from a point at the cell, may be shortly stemmed to the cell, or may be separated at their origins on the cell.

The hind wing has three anal veins, the 2nd sometimes tending toward union with the 1st by exhibiting a slight angulation and trace of a spur; the radius and subcosta are not joined beyond the base; M_1 may arise as in the figure, or as a direct continuation of the media.

This is all in accord with *Fumea casta* as illustrated by Chapman, but not in agreement with *Bruandia* and *Proutia* (which have media of fore wings forked within the cell), included under *Fumea* by Seitz.

Legs of male (Plate 3, fig. 5).—In *Fumea* and its allies the length of the anterior tibial spur (the epiphysis) has been extensively used in the separation of genera and species. Chapman's measurements, thus used and quoted, though designated as spur ratios, really relate to "the ratio of the length of the tibia beyond the origin of the spur, to the whole length of the tibia." For *Fumea* (excluding *germanica*) Chapman gives this ratio as .77-.81. This range is evidently too narrow, for Burrows, who inherited Chapman's collection and added to it, measured 236 *Fumeas* (including Chapman's series), and found a ratio range of .72 to .81. Evidently the method of preparation and measurement, as well as individual variation, affect the rigid application of this character.

Balsam mounts of the legs of Massachusetts *Fumeas* give us an average ratio of .76, with a minimum and maximum of .72 and .79.

Legs of female (Plate 3, fig. 6).—These agree with *casta* in having five joints to the tarsi of all legs. A single vestigial apical spur is sometimes present on the fore tibia, rarely present on the mid-tibia; may be present on one tibia, absent from the corresponding opposite tibia of the same insect. When present, it varies in shape from almost globular to elongate with a length twice its diameter. These conditions prevail in both English and American examples.

In both sexes, irregularity exists in the relative length of the legs (the third pair always the longest), due chiefly to the variability of the first tarsal joint.

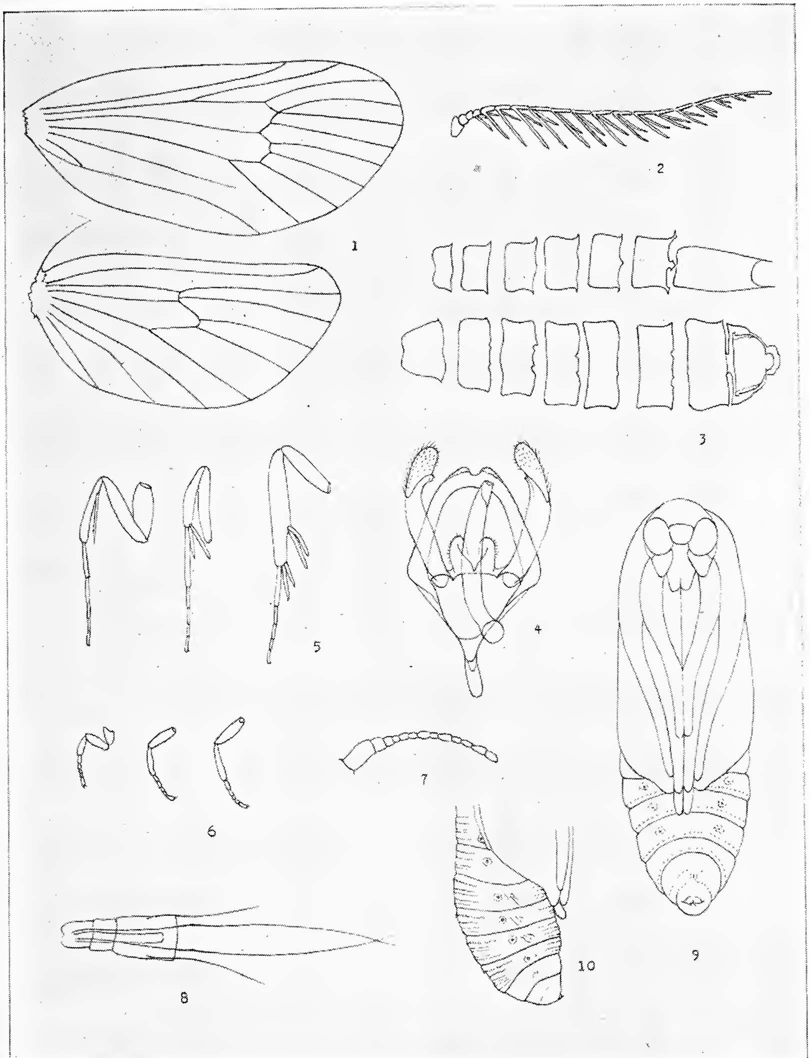
Antenna of the male (Plate 3, fig. 2).—Bipectinate from the third or fourth joint. The third joint, sometimes showing a short pectination, is usually more or less fused with the fourth; and the distal joint may be simple or bipectinate, according to its degree of fusion with the next. The longest pectination (balsam mount) measures .52 mm. The shaft and dorsum of the pectinations are clothed in appressed scales (these and the fine hairs of the pectinations not shown in the figure). The apparent number of antennal joints is usually 20, but these by fusion may be reduced to 18 or 19, and in one instance we were able to count 21 joints.

Antenna of female (Plate 3, fig. 7).—Simple, bead-like, consisting of 13 joints of irregular size. Occasionally 14 joints may be detected.

Abdominal plates and genitalia of male (Plate 3, figs. 3 and 4).—By direct comparison we detect no essential differences in these structures, between our Massachusetts insects and *casta* as identified by English entomologists.

Ovipositor of female (Plate 3, fig. 8).—The ovipositor is capable of extrusion until it equals the entire length of the remainder of the insect. Balsam mounts of the female abdomen show prominently three sets (of 2 each) of hair-like black rods, which function in the telescopic mechanism. Mounts from English *casta* show these rods to be identical in number, shape, and position with those of Massachusetts insects; and this apparent identity extends to *relative* length of the three sets, with such exactness that specific identity of the insects seems assured. Preparations by identical technique, drawn and measured at the same magnification, for the three sets of rods give these ratios of length:

5 English *casta*, from the Chapman and Burrows collections	36 : 48 : 147
3 Massachusetts *casta*	36 : 50 : 147



SOME STRUCTURES OF AN INTRODUCED PSYCHID
(*Fumea casta*, PALLAS)

1. Venation of male (10x)
2. Antenna of male (12x)
3. Abdominal plates of male (12x)
4. Genitalia of male (37x)
5. Legs of male (10x)
6. Legs of female (10x)
7. Antenna of female (27x)
8. Rods of ovipositor (10x)
9. Male pupa, ventral view (11x)
10. Male pupa, lateral view (11x)

Pupa of male (Plate 3, figs. 9 and 10).—In the male pupa of *Fumea,* the fore wings, the legs, and the antennæ are free at their apices, standing out slightly from the abdomen, so that according to the degree of its extension they may overlap the fifth abdominal segment or may barely reach its anterior margin. As far as we have been able to make comparison, the general characters of the pupa as shown by our illustration are in accord with English *casta.*

We are aware that the form of the generic name (Tutt, British Lepidoptera, II, 317, 318, 1900), its genotype, and the properly included species, are all subjects for differences of opinion and will require review, and that in the European literature the status of *casta* Pallas, with reference to its synonyms, its geographical races, and the number of possibly distinct but closely related species remains a matter of opinion. Tutt follows Chapman in treating *intermediella* Bruand as a race intergrading with *casta,* while Seitz considers *intermediella* a pure synonym. By Tutt's analysis, in this "protean species represented by various local races," our insect in size and structure comes nearest to variety *intermediella,* which is supposed to be of more frequent occurrence on the European mainland rather than in England. In view of the impossibility of determining the place-origin of our insect and of the intergradation of the partially localized and illy-defined varieties or races of *casta,* we believe that for the present this recent addition to our fauna may be most satisfactorily designated in our literature by the oldest and best-known name for this widely-distributed insect, *Fumea casta* Pallas.

SPIDER BITE BY OLIGOCTENUS (Fam. CTENIDÆ)

By L. F. Pinkus,
High School, St. Louis, Missouri

During June, 1929, a student brought into the laboratory a spider which has been identified by Prof. A. Petrunkevitch as a new species of Oligoctenus of the family Ctenidæ. According to Comstock the members of this family wander about in search of their prey and are active mainly at night. Some of the tropical species are very large. They make no webs for a dwelling, but some species appear to inhabit burrows in the ground.

My specimen was taken from a bunch of bananas, so its real origin could not be determined. It was placed in a rather large insectarium, of which the bottom was filled with earth. The spider was very inactive most of the time and hid in the corners of the container.

After about two weeks it was brought home because of the close of school. A visitor, noticing the cage, inquired what might be seen there and in order to show off my trophy I opened the cage and pushed the spider with the index finger of my left hand, in order to induce him to move about. Instantly I was bitten.

Here are my notes concerning the effects of this bite:

June 12, 1929:—4.30 P. M.—Bitten by spider (Oligoctenus) on index finger of left hand. Index finger swelled. The instant piercing pain was quite severe. After approximately ten minutes the swelling had covered the whole finger. The finger was numb, but painful with a prickly crampy sensation, interrupted by throbbing, jerky pains. A little dizziness accompanied this, and after fifteen minutes, for just a few seconds, became quite severe, and perspiration collected on my forehead. My lips became blue for a short while and the pain continued intense for about an hour. After two hours the swelling extended over a larger area of the hand, covering the index finger and the greater part of the back of the hand and reaching all the way over to the metacarpals of the third finger; in other words, leaving free only the metacarpal and phalangeal region of thumb and little finger. By this time the intensity of the pain had diminished, there was no discoloration, while the temperature of the swollen area rose to some extent. At this time the prickling pain was accompanied by a slight burning sensation in the region of the greatest swelling, which had enlarged the knuckle of the index finger to twice its original diameter. During all this time I was unable to bend the first three fingers of my left hand.

June 13, 1929—6.30 A. M.—On awakening, I found that the swelling had subsided considerably, but the numb feeling still extended over the same area. The pain was the same prickly sensation as when a limb has "fallen asleep," as the popular saying is.

4.30 P. M.—Swelling entirely disappeared. No pain.

For scientific records pertaining to spider bites and their effects one should recall the admirable and heroic experiments of Dr. Baerg and his experiences with the Tarantula and Black Widow.

I offer this record as an addition to the few scattered records pertaining to spider bites. No medical attention was administered, and the only treatment given was to place the hand in warm water, which somewhat relieved the pain.

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NEW LYCOSIDÆ FROM FLORIDA

By Elizabeth B. Bryant

Museum of Comparative Zoölogy, Harvard University

Through the kindness of Mr. H. K. Wallace of the University of Florida, I have had the opportunity to examine a collection of spiders made by him. Among them are three species that are new. The types are deposited in the Museum of Comparative Zoölogy collection.

Lycosa carrana sp. nov. (Fig. 1)

♂ 10.5 mm. long, ceph. 5.6 mm., abd. 5.5 mm.

1 leg, 16. mm., IV 21. mm.

Cephalothorax light yellow, the black about eyes is continued from p.l.e. as two parallel stripes of dark hairs to posterior margin, median light stripe wider than dark stripes, a narrow marginal dark stripe, a narrow line of white hairs between p.m.e. which does not extend to margin of clypeus; abdomen with a wide median dark stripe on posterior half which is continued as two converging lines forward to near the anterior margin, a stripe of white hairs each side of median stripe bordered by a dark gray stripe, the median dark stripe on the posterior half is the most conspicuous marking on the abdomen; sternum light with a cloudy gray center; venter almost covered by a sharply defined black spot, near the middle of which, three pairs of white muscle spots are distinctly seen, black before the epigastric fold; legs light yellow without marks, but I metatarsus and tarsus much darker; spines, I tibia, 2-2-2, 1 lateral which appears almost as ventral, metatarsus 2-2, 1 median apical; eyes, anterior row straight by the upper margins, shorter than second eye row, a.m.e. larger than a.l.e. and separated by less than half a diameter, almost touching a.l.e., p.m.e. separated by more than half a diameter, p.l.e. separated by almost three diameters; palpus, patella and tibia of about equal length, tarsus little longer than tibia, palpal organ as figured.

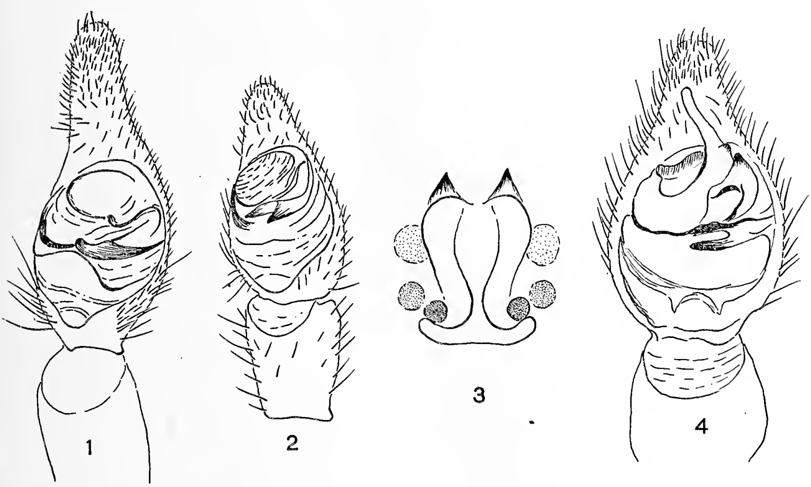
Holotype ♂ Florida, Big Pine Key, 20 December, 1933, A. F. Carr, coll.

This species has the narrow line of white hairs between the median eyes as in *Lycosa helluo*, but the light stripe is very much broader and the dark stripes narrower and the black spot on the venter is never found in the former species. It is named for the collector, Mr. A. F. Carr.

Arctosa incerta sp. nov. (Figs. 2 and 3.)

♂ 4. mm., ceph. 2. mm., abd. 2. mm.

Cephalothorax rather flat, reddish brown, sides veined with black, tegument glabrous with a very few black hairs,



Figs. 1-4. 1, *Lycosa carrana* sp. nov., palpus; 2, *Arctosa incerta* sp. nov., palpus; 3, *Arctosa incerta* sp. nov., epigynum; 4, *Schizocosa floridana* sp. nov., palpus.

a bright yellow triangle with apex at dorsal groove gradually darkening towards eyes, eyes surrounded by black, a bright stripe from dorsal groove to posterior margin, a very narrow black marginal line; abdomen reddish brown sparsely covered with long black hairs, a pair of irregular black marks at base with bright yellow between, usual spear mark very faint, margined with black dots, many small black spots closer together about middle, sides thickly covered with dark spots; sternum pale, darker about margin, venter heavily spotted with black; labium higher than wide; coxæ light; legs covered with black hairs, femora with three interrupted dark rings, tibiæ darker, spines, I spine on III or IV tibia above; eyes, anterior row shorter than second row, slightly procurved, equidistant, a.m.e. larger than a.l.e., p.m.e. less than diameter apart, quadrangle of posterior eyes almost square; palpus, femur longer than patella and tibia, patella and tibia about equal length, tarsus once and a half as long as tibia; palpal organ as figured.

♀ 4.1 mm. long, ceph. 2. mm., abd. 2.4 mm.

Markings the same as in male but brighter and the basal marks at base of abdomen not as large; spines and eyes the same as in male; epigynum with the usual median septum and terminal transverse piece as figured.

Holotype ♂ Florida; St. Petersburg, 8, April, 1933, H. K. Wallace, coll.

Allotype ♀ Florida.

The generic position of this species seems uncertain. Following the generic key given by F. O. P. Cambridge in the Biologia Centrali-Americana, it would be placed in the genu *Arctosa* because it lacks a spine at the base of the III and IV tibia. The male palpus is very similar, but it is very much smaller than others in the genus. The quadrangle of posterior eyes is almost square, a character usually found in *Pardosa,* but the cephalothorax is very low so it could not be placed in that genus and the palpus is very unlike that of other species. In all specimens seen the yellow spot in front of the dorsal groove is very conspicuous.

Schizocosa floridana sp. nov. (Fig. 4.)

♂ 4.5 mm. long, ceph. 2.4 mm., abd. 2.2 mm.

Cephalothorax with a wide median yellow stripe with irregular margins which extends beyond the third row of eyes, bordered by a dark brown stripe veined with black, a supramarginal light stripe, black about the eyes; abdomen with usual basal spear mark rather indistinct, followed by dark chevrons, a pair of dark spots at base with a bright yellow area between, sides spotted; sternum yellow, venter spotted with black; legs yellow with three poorly defined dark rings on femora, I tibia and metatarsus darker, with few long hairs but no brush as in *Schizocosa ocreata;* eyes, anterior row straight, shorter than second row, a.m.e. larger, separated by half a diameter and almost touching a.l.e., p.m.e. separated by less than a diameter; quadrangle of posterior eyes slightly wider behind; clypeus black, as high as diameter of a.m.e., palpus patella and tibia of about equal length, tibia only slightly swollen, about as wide as long; palpal organ similar to *Schizocosa ocreata* but anterior horn longer and more slender, central tenaculum not bidentate.

Holotype ♂ Florida, Gainesville, 31, March, 1933. H. K. Wallace, coll. No. 134D.

This species differs from *Schizocosa ocreata* by the smaller size, lack of brush of hairs on the first tibia and the differences in the palpal organ.

GROWTH AND DETERMINATE SIZE IN INSECTS

By Charles T. Brues.

In common with nearly all metabolic activities, growth is essentially a determinate process, and size since it is the ultimate result or end product of growth, is inherently determinate also. To speak of the determinate size of an individual animal is therefore only to restate a self evident fact, and he who attempts to expound upon its truth may be accused of considerable naiveté. During the recent cycle of biological investigation much attention has been given to the phenomena of growth, especially by physiologists, geneticists and statistical biologists. These workers have defined in mathematical terms certain of the more evident features of growth both in individual organisms and in populations, but I believe that it remains for some one more deeply interested in another phase of biology, namely taxonomy, to consider size as in a sense a static phenomenon in spite of the fact that it is clearly a measure of growth. This is particularly appropriate in dealing with insects, since in them the growth process is ordinarily very rapid, ceasing abruptly and not gradually slowing down. Such observations are necessarily less precise than the data just mentioned, but they serve to demonstrate the existence of a deep-seated and stable genetic constitution which determines size and the growth process by which it is attained in individual animals. Size as we shall consider it, results from the interaction of a series of excitatory and inhibitory stimuli during the development of an individual whereby its growth follows quite closely a definite and predictable course, terminating when adult size is attained. Such termination is particularly definite in the case of insects where almost without exception the imaginal or reproductive stage marks sharply the attainment of final size and form.

This determinate and definitive size involves certain gross characteristics, irrespective of the multiplicity of factors which have produced it, that are patent to any student of taxonomy. Those to which I shall refer to-day relate to comparative imaginal size in insects, although, since absolute size is directly dependent upon rate and time of growth, these cannot be eliminated completely from any discussion of size.

We usually speak of insects as small animals, but there exist great variations in size in practically every extensive taxonomic group. We find that some beetles, for example, are in bulk several million times as large as other beetles, if we compare the largest Scarabæoidea with certain minute Ptiliidæ. Many less striking differences appear in other orders and I have been tempted to draw upon an admittedly scattered knowledge of insects in general to illustrate certain size peculiarities in various groups.

Insects are by no means an exception among extensive groups of animals by reason of their great variation in size, as very similar or greater diversity may be pointed out in other classes of animals, as the Crustacea, fishes or mammals, or in the Phylum Mollusca, if we compare certain minute gastropods with giant squids. In all animals size shows a marked correlation with taxonomic groupings, *i. e.*, size must be regarded as having an inherently stable genetic basis which is its primary determinant. Secondarily it is modified with reference to food or climate, but such modifications do not show any great constancy, regularity or extent. Thus in the tropics the size of certain types of insects is increased, for example, many scarabæoid beetles are represented there by species much larger than those in cooler regions, and the same is true in some other groups. On the other hand the reverse obtains among other types, although it must be admitted that tropical climates on the whole favor larger size in insects if we compare members of the same group and especially species in single families. Among marine invertebrates large size is very often associated with cold waters, but a reverse condition occurs in some groups. The largest living terrestrial mammals are tropical, yet in some families the species are decidedly larger in cold climates. Among reptiles the largest forms are very clearly those of the tropics. Without multiplying examples further it is evident that neither warm nor cold climates can be regarded as constant stimuli to large size among animals in general. Thus certain types appear to wax larger in one to which they are usually said to be best adapted. The accuracy of such a conclusion is certainly open to question, as it is based on the dubious assumption that increased size is indicative of a more perfect adaptation to the environment.

I shall hope to be pardoned for introducing the foregoing long series of commonplace statements, but it appears necessary to have them in mind before going any further.

In general, the average size of insects has probably decreased during the history of the group on the earth, at least during its early history, but these changes have been very slight compared with the great increases in size that occurred, for example, very early in the history of the mammalia, in certain special groups of mammals, and among the mesozoic reptiles during their period of ascendency. Among these mammals and reptiles this great increase in size has consistently led to the extinction of the groups in which it occurred. Since some primitive types of living insects are of very small size, we may reasonably believe that such small forms were more abundant during the early history of insects than actual paleontological discoveries have yet been able to show. We know in some cases like that of the early giant dragon-flies that comparatively large size still persists as a general characteristic of recent Odonata. The same is true generally in other groups like the Blattariæ, Orthoptera, Mantodea and Corrodentia which tend to adhere rather closely to the size-range which prevailed among their ancient prototypes. Thus conservatism in size appears to be a characteristic of insect groups over long periods of time. The failure of any insects to attain a size comparable to that of certain giant Crustacea is usually attributed to their aërial habitat which renders their soft bodies highly susceptible to gravitational and traumatic deformation at the time of molting. This is certainly not the entire story, however, as there are no unusually large aquatic insects, and the body-shape of large insects is not that which would lessen gravitational stresses. We must certainly admit that there is some good reason, probably dependent in great part upon the insect's respiratory and circulatory systems, which acts still more strongly to keep its body-size below certain limits. However, as the vast majority of insects do not tend to approach these limits, such factors are obviously not important ones in regulating size as between minute, small or moderate-sized forms. We may expect to find correlations between the size of the egg or its contained embryo and the size of the imaginal insect, and it would be totally unexpected if definite correlations were not to be found. It is surprising to note, however, that such a correlation is by no means universal. Many rather large insects, like meloid beetles, produce a large number of small or minute eggs, and a survey of such cases reveals quite universally some type of development which exposes the early stages to great vicissitudes of life. On the other hand some small or minute insects produce comparatively very large eggs or young, such as certain phorid flies and aphids, and the pupiparous Diptera. There are also very striking examples to be found among the parasitic tachinid flies where closely similar forms produce either many small, or a few large eggs, respectively, irrespective of the size of the parent flies. In all such cases differences in size at birth are not correlated with imaginal size, and represent highly adaptive modifications with reference to post-embryonic growth which have not in the least affected imaginal size.

Since the primary requirement for growth is food we may expect to find size in insects dependent at least to some degree upon abundance or type of food. Vegetarian diet furnishes a much more constant and plentiful source of food materials than that available for forms that depend upon animal foods, but larger amounts are necessary to supply equal energy. It is very evident in groups where both types of food habits occur that the vegetarian forms are more numerous in individuals, but do not develop to greater size. This is well illustrated by the very populous colonies of those ants which subsist on plant food in comparison with carnivorous species where the colony is consistently smaller. Here individual size does not respond to abundant food supply, but instead an increase in the number of individuals or in the size of the colony occurs. This condition appears to be repeated very generally in other, non-social, groups of insects, although increase in numbers is not so patent in the case of non-gregarious species. It must be said, however, that the bulkiest of all insects like the goliath beetles, hercules beetles, certain phasmids, saltatorial Orthoptera, giant silk-worms and the like are vegetarian, although the dragon-flies, tarantula-killer wasps and mantids of carniverous habits attain exceptionally large size. Also, the largest insects which, so far as we know, ever existed were predatory dragon-flies. It may be said as a rule that the smallest insects as well are vegetarian, saprophagous or microphagous although there are many minute entomophagous parasites. Predatory or carnivorous forms are neither abundantly represented among the smallest forms of insect life, nor are they conspicuously numerous among the largest.

Abnormalities in size among certain individuals may occur through a gross insufficiency of food during growth. Certain of the larger muscoid flies that develop in fermenting or decaying materials may vary considerably in size, frequently producing some greatly dwarfed individuals where their food supply has failed before larval growth was completed. Such specimens develop completely except for size. The partly grown larvæ of certain dermestid beetles may even decrease in size when starved and again grow to produce normally sized individuals when food is restored. Such abnormalities do not of course apply to our present discussion.

Certainly no generalizations concerning size in insects can be derived from the conflicting mass of details which present themselves when we attempt to correlate size with any of the foregoing trophic, developmental or environmental differences. Nevertheless, the size range in a great many taxonomic groups is very restricted; in others size varies widely, and occasionally giant forms appear singly or sporadically in groups otherwise very homogeneous in respect to size. Speaking in very general terms, several orders of insects include consistently small or minute species, for example the Protura, Collembola, Thysanoptera, Zoraptera, Mallophaga, Anoplura, Siphonaptera, Strepsiptera and Corrodentia, the last group being less appropriately cited as it includes a few moderate-sized species. Other orders include entirely or in great part large species, such as the Phasmatodea, Mantodea, Orthoptera, Blattariæ, Odonata and Megaloptera. It is noticeable in the latter series that small forms do occur here and there in practically all of the orders cited as there are a few very small Blattariæ and Orthoptera; moreover some Mantodea and Odonata are by no means large insects. In some orders size is extremely variable, for example in the Hemiptera, Neuroptera, Trichoptera, Lepidoptera, Diptera, Hymenoptera and Coleoptera. By far the majority of insects are included in these seven orders of which the last four are far and away the most extensive.

Several matters relating to size stand out very clearly from the rough approximations just outlined. Extensive groups composed of large species produce occasionally or sporadically small or dwarf types. Thus it appears that a reduction in size has been accomplished far more easily during the course of evolution in insects than has the reverse change whereby small types have given rise to large ones. The most extensive orders where speciation has been most active and where the appearance of diverse types has proceeded at a rapid rate, exhibit the widest range in size. It follows therefore that size and form show a strong tendency to remain constant or to vary together, not to be modified independently of one another. This is strong evidence that size has a strongly fixed genetic basis since it does not readily change, except in groups where morphological diversification and adaptation has been most extensive.

Even in these orders the fixity of size is well illustrated if we compare the subdivisions such as superfamilies or families. Among the Hymenoptera, for example, certain superfamilies show great constancy in size. The superfamilies Serphoidea, Chalcidoidea, and Cynipoidea include only small or minute species, with really only a single comparatively "giant" generic type (Pelecinus, Leptofœnus and Ibalia, respectively) in each superfamily. This is true notwithstanding the fact that certain of the minute parasitic forms have developed the most unexpected method of development, known as germinogony, whereby a single egg produces enough larvæ to consume a large caterpillar. Here numbers replace size in exploiting the trophic field. On the other hand in the same order Hymenoptera other superfamilies do not show such constant size. The Tenthredinoidea, Ichneumonoidea, Vespoidea and Formicoidea include moderate-sized species with numerous small and scattered large types, showing that a wide variation in size in this extensive order is characteristic only of certain groups. The largest known Hymenoptera are Jurassic Siricoidea, a superfamily whose living representatives are still characteristically large insects with a few small, derived types.

Another very extensive order, the Lepidoptera, show more or less similar conditions with reference to size. This group was at one time rather crudely divided into "Microlepidoptera" and "Macrolepidoptera." The former group is really composed almost entirely of one superfamily, the Tineoidea with a slight admixture of more primitive forms (Micropterygoidea) that are really quite closely similar to certain much larger ones (Hepialoidea) near which they are now placed. The more rational taxonomic grouping of these primitive types into two superfamilies corresponds closely to the size of the included types.

With these facts in mind we must discard at once any supposition that relates body size in insects to fortuitous circumstances or to adaptations readily acquired in relation to a changing or specialized type of environment. Size appears as a highly stable character, deeply imbedded in the genetic constitution of at least most groups of insects.

OBITUARY

ARGYLE B. PROPER, an associate member of the American Association of Economic Entomologists, died at his home in Wakefield, Mass., on December 16, 1933, after being ill about a week with pneumonia. Mr. Proper was born in Sunapee, N. H., on March 4, 1905. He received a B. S. degree from the University of New Hampshire in 1926 and a M. S. degree from the same institution the following year, having majored in entomology. On July 1, 1927, he was appointed a Junior Entomologist in the U. S. Bureau of Entomology for work at the Bureau's laboratory at Melrose Highlands, Mass., with which station he was connected up to the time of his death.

Although Mr. Proper had published but one entomological article, another manuscript had been accepted for publication, and he was to have presented a paper at the Boston, Mass., 1933, meeting of the Entomological Society of America. At the time of his death he was preparing two other manuscripts. These and the papers he had completed had to do directly or indirectly with forest and shade tree insects. Collecting insects in the White Mountains interested him and he spent much of his vacation time on hiking trips in that region.

Mr. Proper was a member of the Cambridge Entomological Club, at the meetings of which he was a regular attendant.

T. H. JONES.

PSYCHE

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THE ORIGIN OF THE PERITROPHIC MEMBRANE IN SCIARA AND THE HONEY BEE

BY F. H. BUTT
Cornell University.

Many explanations have been given for the origin of the peritrophic membrane. Some authors maintain that it is formed from secretions of the epithelial cells of the mid-intestine and is non-chitinous in structure. Others think it is a continuation of the chitinous intima lining the œsophagus and is secreted by cells lying at the junction of the fore and mid-intestine. No investigation has been made of its origin in the embryo.*

Recently while making an embryological study of Sciara I was interested in the extreme length attained by the stomodæal membrane in the later stages. It so resembled the peritrophic membrane of the larva both in its position and in its point of attachment that a relationship between the two was immediately evident. Therefore a number of newly emerged larvæ were killed and sections were made to see if a peritrophic membrane were present in the very first stage, and if so, whether it had any resemblance to the stomodæal membrane in the embryo. The larvæ were fixed in Carnoy-LeBrun fluid for thirty seconds and were embedded in rubber-paraffin. The sections were cut at four microns, were stained in magenta and counter-stained in picro-acid-carmine.

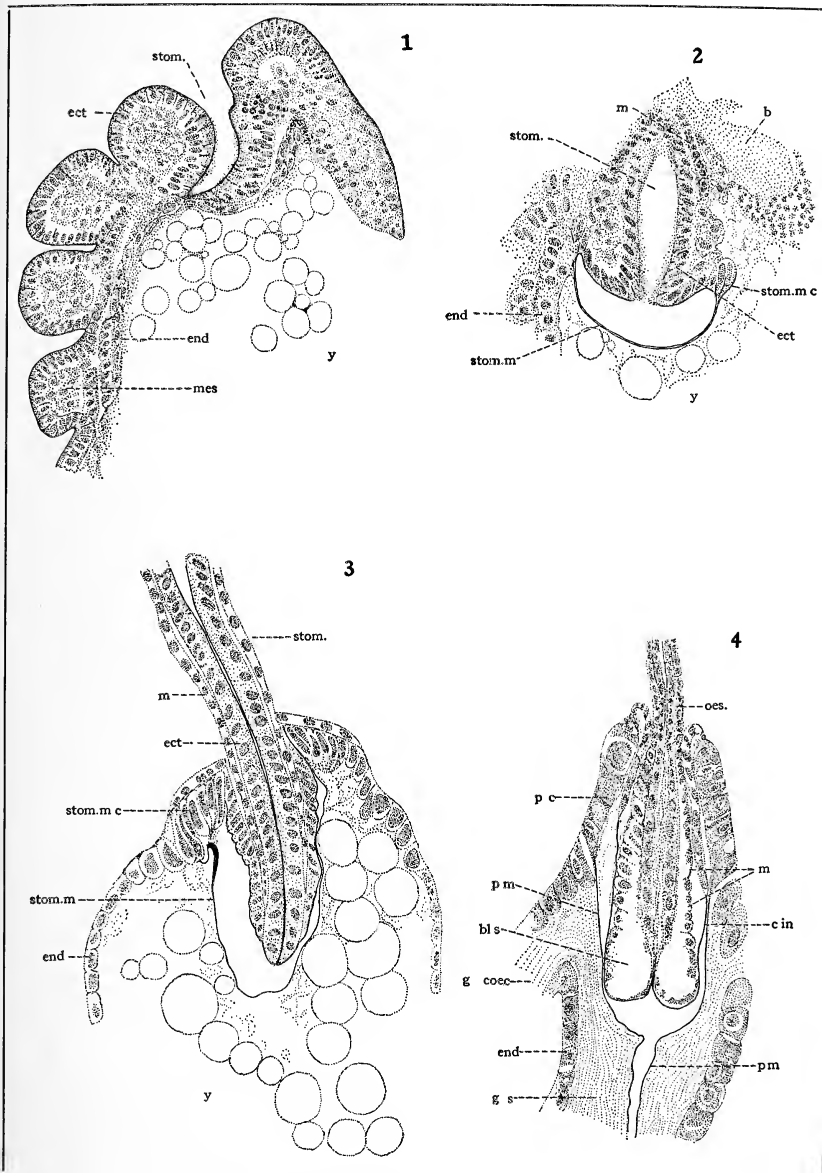
*Since this paper was submitted for publication, a paper by Gambrell has appeared (Ann. Ent. Soc. Am. Vol. XXVI:641) mentioning the origin of the peritrophic membrane in Simulium.

In the embryo, the stomodæum begins as a shallow depression in the ectoderm at the anterior end shortly after the thirtieth hour, coincident with the beginning of segmentation. As it deepens, it forms a tube closed at its inner end by ectodermal cells (fig. 1). These cells become thinner as the end of the tube widens until at the sixty-fifth hour the tube is closed at its inner end by a thin membrane in which no nuclei are present. Between the sixty-fifth and the seventieth hours the end of the stomodæum flattens and spreads out. At the same time the stomodæal membrane increases in size and hangs loosely in the yolk. The stomodæum now resembles an inverted hollow mushroom, the membrane forming the outline of the cap (fig. 2). As the stomodæum continues to grow, the flattened end folds back on itself so that the mesodermal layer (m) surrounding the stomodæum lies between two layers of ectoderm (fig. 3).

The stomodæal membrane hangs loosely in the yolk and steadily increases in size, not as the result of cell proliferation but apparently by secretions from differentiated cells located on the end of the recurved stomodæum where it joins the mid-intestine (fig. 2, stom m c). These cells are elongated, with their extremities drawn out very thin where the substance of the stomodæal membrane is given off. At the eightieth hour only a few secretory cells are to be seen. They increase in size and in number between the eightieth and ninetieth hours until they form a very conspicuous mass around the stomodæum (fig. 3). In the meantime the membrane (stom m) has lengthened. The muscular wall of the fore-intestine, lying between the two layers of ectoderm of the stomodæum, is still thin. Figure three represents the stomodæum at ninety hours, shortly before the larva emerges from the egg. The walls of the mid-intestine at this time are complete.

Between the ninetieth hour in the egg, and the time the hatched larva is ready to feed, the appearance of the stomodæum changes considerably (fig. 4). The sack-like stomodæal membrane becomes the tube-shaped peritrophic mem-

Psyche, 1934 Vol. 41, Plate 4



Butt—Peritrophic Membrane in Sciara

brane probably when the first food breaks through the sack on its passage down the intestine. The muscular wall (m) of the œsophagus (oes) that was a simple layer of cells at the ninetieth hour (fig. 3), expands into a bulb-like ring at the end of the œsophageal valve. Inside this ring is an open space which Wigglesworth (30) calls a blood sinus (bl s). This muscle with its blood sinus is a sphincter which, when expanded, closes off the mid-intestine to the entrance of food. When contracted, the passageway through the œsophageal valve is open. The ectodermal cells, lining the stomodæum, that were so large in the embryo, have thinned out and disappeared over the end of the bulbous ring, their place being taken by a thin membrane, the chitinous intima (c in). The cells secreting the peritrophic membrane (p c) which have now assumed a very regular appearance with smooth inner and outer walls, are very large and vacuolated. At the sides of the mid-intestine lie the two gastric cœca (coec) which discharge their contents into the intestine near the œsophageal valve. Their contents are prevented from bathing the œsophageal valve by the peritrophic membrane (m) which is forced together by the fluid and extends down into the mid-gut.

Nelson ('15) states that the stomodæum in the honey-bee is closed at its inner end by cells of the anterior mesenteron rudiment. He does not mention any embryonic origin for the peritrophic membrane. Snodgrass ('25) refers to Nelson in regard to the stomodæal membrane and says, "the old idea that the peritrophic membrane of insects is a backward prolongation of the chitinous intima of the proventriculus has been discredited in all recent investigations on its origin." He finds that it is formed in the adult bee from protoplasmic bodies given off from the epithelial cells of the mid-intestine. These fill in the granular layer. Wigglesworth ('30) is of the opinion that the peritrophic membrane is of two-fold origin: a chitinous basis, secreted at the anterior end of the mid-gut and a series of indefinite membranes which condense on the outside of this as it proceeds down the gut. Having access to some slides of the honey-bee embryo, I was interested to see if there were any possible embryonic fore-runners of the peritrophic membrane.

An examination of the slides indicated that the stomodæal invagination forms in the same manner as in Sciara. The cells in the floor of the invagination are a continuation of the ectoderm which forms the walls of the tube. The tube lengthens and widens at the end, the floor being reduced to a thin membrane similar to that described above for Sciara. Late in the embryonic stage the inner walls of the stomodæum protrude into the mid-intestine rupturing the membrane. Around this invaginating tube lies a thickened ring of cells that resembles the ring of cells secreting the stomodæal membrane in Sciara. It also corresponds to the basal folds of the mid-gut as figured by Wigglesworth ('30) from which, he says, originates part of the peritrophic membrane. Campbell ('29) has demonstrated the presence of chitin in the peritrophic membrane which is further proof that it arises from the ectoderm. A study of the first stage larva would undoubtedly yield more evidence but no larvæ were available at the time this study was being made.

Summary

An examination of the œsophageal valve in both the embryological and the early larval stages of Sciara indicates that the peritrophic membrane is a continuation of the stomodæal membrane and is ectodermal in origin. It arises from a group of large secretory cells lying around the œsophageal valve and attached to the upper edge of the mid-intestine. These cells which are also ectodermal in origin, begin their development from the end of the stomodæum as it widens out and reverses its direction of growth. The large bulbous muscular layer of the œsophagus which encloses the blood sinus, develops from the single layer of mesoderm which surrounds the stomodæum.

In the honey-bee the formation of the stomodæum resembles the development in Sciara except that the stomodæal membrane does not attain such a great length but is

broken when the inner end of the stomodæum pushes through. The peritrophic membrane, as described by Wigglesworth, is chitinous and arises from a mass of cells corresponding in position to the base of the stomodæum in the embryo. This indicates that the peritrophic membrane is ectodermal in origin.

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A NEW AMERICAN MYRMOSID (HYMENOPTERA: MYRMOSIDÆ)

By Neal A. Weber
Harvard University.

The following new species in a small genus of Scoloioid wasps allied to the Mutillidæ is here described in order to use the name in a revision, now in progress, of the ant genus *Myrmica* Latreille. My thanks are due Professor C. T. Brues and Mr. Richard Dow of Harvard University for their opinions concerning its taxonomic status.

Myrmosa dakotensis n. sp.

Female: Length 3.6 mm.

Color of head blackish brown with a mahogany red transverse band across the base of the mandibles and extending to a level with about the anterior ¼ of the eyes; of thorax mahogany red with a blackish brown anterior margin on the second segment, extending over the dorsal surface and down to about the middle of the sides, pronotum paler than the second segment; of first abdominal segment and margins of second, mahogany red, other sutures and pygidium duller brown; of appendages mahogany red, heavily infuscated on the apical antennal segments and on the dorsal surfaces of the femora and tibiæ.

Hairs moderately abundant, mostly subappressed and short, except on the abdomen, where longer; joints of flagellum densely and finely pubescent, sparsely and inconspicuously so elsewhere. Posterior metatarsi with long and distinct spines.

Surface of body shining; head densely and coarsely, abdomen less densely and more finely, punctate; dorsal surface of thorax sharply and irregularly vermiculate, irregularly and sharply tuberculate on the propodeum; sides of pronotum striate in a dorso-posterior direction, sides of second segment smooth; propodeum, in dorsal aspect, smooth but for sparse and minute setigerous punctation; first abdominal segment with two sharp, transverse, sinuate carinæ dorso-anteriorly, posteriorly with small tubercles, declivous surface largely smooth, with scattered setigerous punctation; pygidium microscopically punctulate, dull.

Head, in front view, evenly convex posteriorly, a distinct gibbosity in front of the eyes; face with a prominent black spine between the antennæ; ocelli slightly less than 0.04 mm. in diameter, posterior pair 0.22 mm. from each other and 0.31 mm. from the eyes; first segment of the flagellum about as broad as long, equal to the pedicel and shorter than the second. Thorax, in dorsal view, with parallel sides; in lateral view, with a distinct notch between the pronotum and the second segment, humeral angles of the pronotum rounded obliquely, posterior margins forming a rounded right angle, second segment broadly depressed; median ventral gibbosity on the propodeum faint.

Holotype: One female taken by myself at Towner, North Dakota, June 27, 1933.

This species differs distinctly from paratypes of *M.* (*Myrmosa*) *banksi* Bradley[1] in the Museum of Comparative Zoölogy in color, smaller size, larger ocelli and their disposition, less distinct propodeal gibbosity, sculpturing and in other characters. It is much smaller than *M. thoracica* Blake, which is associated by Bradley and Melander with *M.* (*Myrmosa*) *unicolor* Say, and differs also in color, sculpturing and shape. From the description of *M.* (*Myrmosa*) *blakei* Bradley it differs in smaller size, color, in the shape of humeral angles, smaller ocelli and their disposition and in the presence of distinct posterior metathoracic spines and of dorsal carinæ on the basal abdominal segment.

[1]Bradley, J. C. — Contributions towards a Monograph of the Mutillidae and their Allies of America North of Mexico. IV. A Review of the Myrmosidae. Trans. Amer. Ent. Soc., No. 764, 1917.

This wasp crawled up on my hand as I was digging up a colony of the ant, *Myrmica scabrinodis lobicornis* var. *fracticornis* Emery. The colony was in moist loam under grass roots in a partly shaded situation. The larvæ of the ants were disposed in several chambers scattered through the upper few inches of the soil. It seems possible that this species of *Myrmosa* parasitizes *Myrmica* and other ants.

AN AUSTRALIAN ANT OF THE GENUS LEPTOTHORAX MAYR

By William Morton Wheeler

Leptothorax is supposed to have a cosmopolitan distribution, if we except Australia, Papua and New Zealand, from which no species of this large genus has ever been described. A few species range well up into the north temperate zone, both in North America and Eurasia, while others occur as far south as southern Brazil, the Cape of Good Hope and Sumatra. Several subgenera have been recognized but one is inclined to agree with Emery that the characters on which they are based are rather illusive and unimportant. Furthermore, Leptothorax is not sharply differentiated in tropical America from the genus Macromischa Roger.

It now appears that Leptothorax is represented in the Australian fauna by at least one species. The late Mr. A. M. Lea of Adelaide, South Australia, sent me many years ago a large, miscellaneous collection of ants which he made in various parts of the island continent. Among the specimens, two workers which he took in the Cairns District, Queensland, unquestionably belong to the genus Leptothorax and combine the elongate petiolar peduncle of a group of species (*rottenbergi* group of Emery), peculiar to the Mediterranean Region, with the epaulate pronotum of the subgenus Goniothorax, to which Emery has assigned the Ethiopian, South African, Malagasy, Sumatran and Neotropical species. Since, however, a similar combination of characters occurs in at least one South African Leptothorax (*L.* (*G.*) *latinodis* Mayr) I am placing the Australian ant in the subgenus Goniothorax.

Leptothorax (Goniothorax) australis sp. nov.

Worker: Length about 2.7 mm.

Head somewhat longer than broad, broader behind than in front, with short, faintly sinuate posterior border, very broadly rounded posterior corners and nearly straight, anteriorly converging sides. Eyes rather large and convex, situated slightly in front of the middle of the head. Mandibles stout, with convex external borders, the masticatory borders with three terminal teeth but with the basal half straight and indistinctly crenulate. Clypeus convex, its anterior border broadly rounded and entire in the middle, sinuate on each side. Frontal carinæ thin, rounded, scarcely diverging behind; frontal area distinct, impressed, elongate; frontal groove absent. Antennæ stout, 12-jointed; scapes strongly curved at the base, their tips reaching to slightly more than two-thirds the distance between their insertions and the posterior border of the head; first funicular joint as long as joints 2 and 3 together, 2 nearly as long as broad, 3-8 decidedly broader than long, remaining joints forming a very distinct 3-jointed club, the combined two subequal basal joints of which are shorter than the terminal. Thorax in profile with broadly arcuate dorsal outline, but slightly and indistinctly impressed at the mesoëpinotal suture, broadest through the pronotum; neck large, anterior border of pronotum arcuate, its anterior angles distinct but neither acute nor dentate, its sides straight, parallel and marginate anteriorly, straight and converging posteriorly; promesonotal suture obsolete; mesonotum short, nearly twice as broad as long, with subangulate sides and somewhat flattened dorsal surface; epinotum longer than broad, subrectangular, slightly narrower than the mesonotum, its base from above subhexagonal, with very prominent spiracles, the spines stout and blunt, as long as their distance apart at the base, directed backward and slightly upward and curved inward; the declivity in profile shorter than the base, straight and abrupt above, concave below. Petiole more than twice as long as broad, its peduncle long and stout, as long as the node, with prominent spiracles anteriorly and a sharp anteroventral tooth; the node from above somewhat broader than long, subrectangular, with evenly rounded sides; in profile with concave anterior, straight and horizontal superior and short and convex posterior surface. Postpetiole distinctly broader than the petiolar node, rounded-trapezoidal, about one and three-fourths times as broad as long, broader in front than behind, with broadly arcuate anterior border, distinct but blunt anterior angles and straight, rather strongly posteriorly converging sides. Gaster elliptical, with excised anterior border. Femora and tibiæ distinctly incrassated.

Shining, the head, thorax and pedicel less so than the gaster and legs; mandibles very finely punctulate or shagreened, with sparser, indistinct, elongate punctures. Clypeus, head and thorax coarsely and reticulately rugose, the rugæ more longitudinal on the clypeus, front, thoracic dorsum and pleuræ; the interrugal spaces shining and irregularly reticulate; epinotum, petiole and postpetiole finely and regularly reticulate or densely punctate, the petiolar node also irregularly longitudinally rugose, but less sharply than the head and thorax. Gaster and legs smooth and shining, with sparse piligerous punctures; antennal scapes finely punctulate.

Hairs pale yellowish; those on the head, antennal scapes, thorax and abdomen rather abundant, regularly arranged, erect and clavate; those on the legs short, sparse, pointed and appressed.

Brown; head posteriorly and gaster, except anteriorly and posteriorly, darker, castaneous; mandibles, clypeus, bases and borders of posterior gastric segments, antennæ and legs, including the coxæ, brownish yellow or yellowish brown.

Two specimens taken by A. M. Lea in the Cairns District, Queensland.

A NEW STRUMIGENYS FROM ILLINOIS (HYMENOPTERA: FORMICIDÆ)

By Neal A. Weber
Harvard University

The ant here described was obtained through Dr. M. R. Smith from the Illinois Natural History Survey. It proves to be the sixteenth Nearctic species of a small and inconspongiform processes on the pedicel and, in many forms, by development in the tropics. The members of this genus are found chiefly in rotted wood on the ground or in damp soil under stones and are comparatively rare and little-known. They are noteworthy in the possession of six-jointed antennæ, peculiar and diverse pilosity, strange spongiform processes on the pedicel and, in many forms, by a great development of the mandibles.

Strumigenys (Cephaloxys) talpa n. sp. (Fig. 1)

Worker: Length 1.8 mm.

Head 0.56 mm. long, cordate, shallowly excised at the posterior margin, occipital margins rounded, sides anterior to the antennal insertions converging gently to the mandibles; clypeus with evenly rounded anterior margin and posterior angle obtuse; exposed part of mandibles less than $1/5$ the length of the remainder of the head, outer margins convex, inner margins armed at the apical $2/3$ with about 6 acute teeth and at the apex with several smaller acute teeth, armed at the base with a single large acute tooth; antennal scapes extending posteriorly to the maximum breadth of the head, evenly bent inwards at the base; 1st joint of the funiculus distinctly longer than the 2nd and 3rd together and about equal in length to the 4th alone, terminal joint distinctly longer than the preceding joints of the funiculus together. Thorax, in profile, evenly convex, mesoëpinotal suture faintly indicated; epinotal spines acute, low, directed backwards and slightly upwards; infraspinal laminæ low but distinct. Petiole, in profile, with a distinct peduncle which narrows anteriorly; node rising suddenly but evenly and with evenly convex dorsal surface; postpetiole subglobular. Gaster ovate with acutely pointed apex. Legs moderately long and slender.

Surface of the head and thorax irregularly reticulate, subopaque; gaster smooth and shining except for the coarsely striate basal $\frac{1}{3}$-$\frac{1}{2}$.

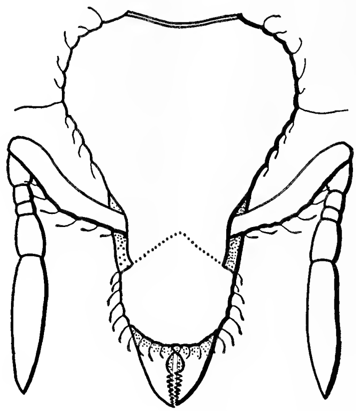


FIG. 1. *Strumigenys* (*Cephaloxys*) *talpa*, n. sp., head of worker in anterior view.

Hairs of the dorsal surface of the head moderately long, abundant, reflexed; with several long, fine and erect hairs projecting from the postero-lateral margins of the head; hairs of clypeus numerous, narrow-squamose; hairs of mandibles short and subappressed; about 6 moderately long hairs fringing the anterior margin of the scape and bent distally. Hairs of thorax long, fine, suberect or reclining. Hairs of legs long, fine, appressed and abundant. Antennal and tarsal joints with appressed pubescence. Gaster with a few long straggling hairs becoming more numerous and shorter distally. Spongiform bodies well developed, covering the anterior end of the gaster, all the postpetiole except the dorsal surface and the posterior dorsal half of the petiole.

Color ferruginous; appendages somewhat lighter; gaster with a brown band across the middle.

Holotype: One worker taken by T. H. Frison and H. H. Ross at Herod, Illinois, October 12, 1933. To be deposited in the collection of the Illinois Natural History Survey.

This species runs to *S. clypeata* Roger in Dr. M. R. Smith's key.[1] From two cotypes of *clypeata* in Dr. W. M. Wheeler's collection, however, it differs in a number of distinct characters. The open area at the base of the inner margins of the mandibles is larger and more distinct; the fourth joint of the funiculus is not distinctly longer than the first; the peduncle of the petiole is not cylindrical as in *clypeata;* the pilosity of the head is less abundant, especially on the clypeus where the hairs are narrow-squamose (the hairs on the clypeus and along the antennal scape of *clypeata* are clavate in the two cotypes). From three cotypes of *S. pulchella* Roger it differs in more converging anterior margins of the head, larger mandibles, shape of the pedicel and in pilosity.

[1]Smith, M. R., A Revision of the Genus *Strumigenys* of America, North of Mexico, Based on a study of the Workers, Ann. Ent. Soc. Amer., 1931, 24, 685-710, 4 pl.

NEW WEST INDIAN CARABIDÆ, WITH A LIST OF THE CUBAN SPECIES[1 2]

By P. J. Darlington, Jr.

Museum of Comparative Zoölogy, Cambridge, Mass.

The purpose of the present paper is two-fold: first, to describe a number of new Carabidæ which have come to hand during several years of sporadic work on the West Indian fauna, and second, to give a complete list of the species now known from Cuba. Eventually I plan to publish a revision of all the Carabidæ of the West Indies. However, this will have to await the acquisition of much more material than is now available, and I think in the meantime a Cuban list (which adds very little to the length of this paper) will be useful not only to collectors on the island, but to any coleopterists in the United States who feel a responsibility for knowing something about the Cuban fauna.

The order of genera in the list is approximately that of the *Junk Catalogue.* The Cuban species are numbered consecutively; species from other islands are interpolated without numbers. Of the 134 species here listed from Cuba (about twice the number previously known) I have seen Cuban specimens of 128. The 6 which I have not seen are noted in the list. The synonymy which I have cited is practically limited to names used for actual Cuban specimens by earlier writers, of whom the chief have been the following:

1. Jacquelin-Duval, 1857, in Ramon de la Sagra's Histoire physique, politique et naturelle de l'Ile de Cuba (French Ed.), Animaux Articulés [Vol. 7], pp. 6-24 (Carabidæ).

[1]Publication aided by a grant from the Museum of Comparative Zoology.

[2]Including as a supplement a new Masoreus (Aephnidius) by A. J. Mutchler.

2. Chevrolat, 1863, Ann. Soc. Ent. France (4) 3, pp. 186-199.
3. Gundlach, 1891, Contribución á la Entomologia Cubana, Vol. 3, part 5, pp. 12-33 (sometimes cited as of An. Acad. Cien. Habana).
4. Leng & Mutchler, 1914, Bull. American Mus. Nat. Hist. 33, pp. 393-397.
5. Leng & Mutchler, 1917, Ibid. 37, pp. 194-195.

The material I have examined includes the collections of the Museum of Comparative Zoölogy (containing Cuban specimens collected by me in 1926 and 1929, on trips made possible by grants from the Atkins Foundation of Harvard University), the United States National Museum, the American Museum of Natural History, and the Philadelphia Academy of Sciences (Poey material from Cuba); collections submitted by Prof. Stuart T. Danforth (Puerto Rico), Mr. S. C. Bruner of the Estación Experimental Agronómica and Mr. M. L. Jaume (Cuba); and smaller lots of specimens from other sources. My thanks are due to all of these persons and to the curators of the museums mentioned. I have also to acknowledge assistance given me by Mr. René Oberthür, Mr. K. G. Blair, Dr. R. Jeannel, Dr. Joseph Bequært, Mr. A. d'Orchymont, Mr. W. S. Blatchley, Mr. A. J. Mutchler, Mr. M. Bänninger, Dr. S. Breuning, and the late Prof. H. F. Wickham, all of whom have either compared specimens with types inaccessible to me, or identified material in special genera, or helped me in other ways.

1. **Calosoma (s. s.) splendidum** Dej.
2. **Calosoma (Callistriga) a. alternans** (Fab.)
3. **Pachyteles gyllenhali** (Dej.)
   pallida (Chev.)
4. **Scarites alternans** Chd.
5. **Scarites subterraneus** Fab. (varities)
6. **Clivina dentipes** Dej.

Clivina addita n. sp.

Of average form for Clivina of *dentipes* group, slightly depressed; black, appendages piceous. Head with clypeus bi-emarginate each side, but less deeply so than in *dentipes;* front with longitudinal and transverse lines as in *dentipes,* with small median puncture, otherwise impunctate; antennæ not reaching to basal angles of prothorax. Prothorax by measurement very slightly wider than long; moderately convex; posterior margin basal; posterior angles not conspicuous; disk not punctate, with usual impressed lines and also with fine, irregular, well separated transverse lines. Elytra not margined at base, rather deeply striate, striæ moderately punctate; eighth stria not continued above humerus; third stria five-punctate. Front femur with small, rounded-obtuse tooth on lower posterior edge near apex; front tibia tridentate externally above terminal digit, finely bicanaliculate on anterior face near apex, inconspicuously toothed near middle of posterior face; front trochanters not angulately prominent; middle tibia spurred externally near apex; paronychium short or absent in unique type, but probably long in fresh specimens. Lower surface without unusual punctuation; last ventral with inner pair of punctures twice as far apart as distance between them and outer punctures. Length 8 mm.

Holotype (Museum of Comparative Zoölogy no. 19489) from Mayagüez, Puerto Rico, F. Mara, sent by S. T. Danforth; unique.

In Putzeys' revision of Clivina (Ann. Soc. Ent. Belgique 10, 1866) this species would belong in group 24 (*dentipes* etc.), but it will not fit in any of the six sections of that group. It is excluded from the first four sections either by absence of a basal elytral margin or by the small obtuse femoral tooth; from the fifth, by the impunctate abdomen and only slightly and broadly emarginate epistoma; and from the sixth, by the short antennæ. It is at once separable from *dentipes,* which it somewhat resembles, by the reduced femoral tooth.

7. **Clivina cubæ** n. sp.

Slender, parallel, slightly depressed; piceous black, appendages and parts of lower surface rufescent. Head with clypeus deeply bi-emarginate each side; front shining, almost impunctate except for a punctiform impression at middle; antennæ reaching about to basal angles of prothorax. Prothorax depressed, almost square, not narrowed in front; anterior angles minutely prominent, posterior angles finely denticulate; impressed lines on disk normal for *dentipes* group; surface of pronotum very finely punctate. Elytra with striæ moderately impressed and punctate; not margined at base between first and sixth intervals; small tubercle at base of first stria; third stria with five setigerous punctures; sixth and seventh intervals finely carinate at base, sixth joining elytral margin in front of humeral angle. Front femur with a short, obtuse tooth (hardly more than a pronounced sinuation) below near apex; front tibia lightly sulcate above, tridentate externally above terminal digit, with only a very minute tooth near middle of posterior face; front trochanters not angulately prominent; middle tibia with spur on outer side near apex; paronychium about as long as claws. Pro,-, meso-, and metathorax punctate at sides below; abdomen finely but distinctly punctate, especially at sides and on apical segment; prosternum about as in *dentipes;* last ventral with inner pair of setæ separated by about one and a half times the distance between them and outer setæ. Length 5½-6 mm.; width ± 1½ mm.

Holotype (Museum of Comparative Zoölogy no. 19490) and 10 paratypes from Soledad (near Cienfuegos) Cuba, June and Oct. 31, washed from gravel banks of the Arimao River; 6 paratypes from Cayamas,[1] Cuba, May 25-June 8, E. A. Schwarz (United States National Museum); 1 paratype from Baraguá, Camagüey, Cuba, June 5, L. D. Christenson, at light (U. S. N. M.).

This species belongs in group 24 (*dentipes* group) in Putzeys' revision (*l. c.*). Within this group it falls in section 5 or 6, resembling only *C. latimana* Putz. and *C. punctiventris* Putz., both of South America, in ventral punctuation. From *latimana, cubæ* differs in having the epistoma

[1]The Cayamas from which Schwarz's specimens came is in southwestern Santa Clara, near Yaguaramas (*Cf.* Proc. Ent. Soc. Washington 5, 1903, p. 287).

not more emarginate than usual at middle; from *punctiventris,* in having shorter antennæ. A comparison of specimens would probably show other differences. From *Clivina dentipes* and *C. addita,* the only previously described West Indian species of its group, *cubæ* is distinguished at once by its smaller size and more extensively punctate lower surface.

8. **Clivina limbipennis** J.-Duval
simplex Chev.
9. **Clivina insularis** (J.-Duv.)
10. **Clivina bipustulata** (Fab.)
bipustula (Chev.)
11. **Clivina biguttata** Putz.
bisignata Chev. etc., not bisignata Putz.
12. **Dyschirius sublævis** Putz.
13. **Dyschirius erythrocerus** Lec.
14. **Oxydrepanus rufus** (Putz.)
brevicarinatus (Putz.)
15. **Ardistomus nitidipennis** n. sp.

Of average form for Ardistomus; black, not bronzed, very shining; appendages and a pair of large, rounded, scarcely oblique subapical spots rufous. Head with clypeus almost evenly truncate; vertex not impressed. Prothorax almost orbicular; lateral margins reaching base; disk with usual impressions. Elytra very shining, not at all alutaceous; striæ moderately impressed, impunctate, entire, second reaching nearly to base; third interval five-punctate on outer edge (constant in all specimens). Last ventral with two punctures each side near apex. Front tibia bidentate externally above apical digit; front tarsi rather widely dilated. Length 5½-6½ mm.

Holotype (Museum of Comparative Zoölogy no. 19491) and 12 paratypes from Soledad (near Cienfuegos) Cuba, June, Oct. 21, Nov. 7 & 9; some taken in debris after heavy floods, others secured by treading down vegetation on the edge of a tiny brook in woods.

This is the first red spotted Ardistomus known from the West Indies. It belongs in group 1, section 1 of Putzeys' revision (Ann. Soc. Ent. Belgique 10, 1866, 200-). It is close to *A. convexa* Putz., of which we have a broken specimen from Mexico, but differs in being slightly less convex, and in having the elytra shining, not alutaceous as in *convexa*. The Cuban species is also brighter, with larger elytral spots. From *A. obliquata* Putz. of the eastern United States, including Florida, the Cuban species differs in being smaller, with different outline of prothorax, and with fewer setigerous punctures on the third elytral interval.

16. **Ardistomus elongatulus** Putz.

17. **Ardistomus cyaneolimbatus** Chev.
gundlachi Putz. MS., Gundlach, etc.

18. **Aspidoglossa vulnerata** Putz.
comma Putz.

19. **Schizogenius arimao** n. sp.

Subparallel, slightly depressed; rufous (immature) or black, appendages and lower surface always more or less rufescent. Head with mentum toothed; vertex seven-sulcate, central carinæ nearly parallel, only slightly converging anteriorly. Prothorax by measurement slightly wider than long; disk impunctate, slightly wrinkled transversely, with a single longitudinal sulcus each side of the median sulcus. Elytra rather deeply striate, striæ punctate basally, not apically; third and fifth intervals each with about seven, seventh with about four setigerous punctures (exact number slightly variable). Front tibia as usual in genus. Male with three setigerous punctures placed triangularly each side of last ventral; female with two setæ each side, near margin. Length $3\frac{3}{4}$-$4\frac{1}{2}$ mm.

Holotype ♂ (Museum of Comparative Zoölogy no. 19492) and 24 paratypes from Soledad (near Cienfuegos) Cuba, June, Oct. 19, Dec. 1 & 3; all washed from low gravel banks of the Arimao River. One paratype from Cumanayagua, Santa Clara, Cuba, June 10, F. de Zayas (in Coll. Estación E. Agronómica, Cuba).

This is the first known West Indian Schizogenius. It is close to *S. tristriatus* Putz. of Mexico and Central America (several specimens examined) but is smaller and more convex than typical *tristriatus* (described as 5 mm. long) and much smaller than variety *longipennis* Putz. (described as larger than *tristriatus*). Bates, in "Biologia," gives the size of his specimens of *tristriatus* as from 1½ to 2¾ lines, which would include specimens as small as the Cuban ones. However, the identity of the various Central American forms referred to *tristriatus* seems to me very questionable, and since the Cuban form, if it really is *tristriatus* at all, is fairly constant and smaller than either of the described continental forms, it seems best to treat it as a distinct species at least temporarily. It can hardly prove to be less than a good subspecies. In Leconte's table of North American Schizogenius (Bull. Brooklyn Ent. Soc. 2, 1879, p. 34) *arimao* runs to *lineolatus* or *sallei*, but is smaller and more convex than either.

Key to West Indian Bembidiini

The following key will help to define the numerous new species of Bembidiini which are described in the following pages. It includes all previously known West Indian species except *Tachys picturatus* Putz. (possibly a member of the *vittiger* group) and *T. piceolus* Laf. (possibly near *corruscus*), which I have not been able to identify in the material I have seen. It also excludes the completely blind *Petrocharis eggersi* Ehlers of St. Thomas, which I do not know.

1. Outer apical angle of front tibia normal, rounded; size 2⅔-6 mm. .... (Bembidion) 2
   Outer apical angle of front tibia obliquely truncate or truncato-emarginate; size 3 mm. or (usually) less 6
2. Dorsal elytral punctures practically on third stria; color plain dark rufous; length 4 mm. ....
   Bembidion jamaicense n. sp.
   Dorsal elytral punctures near middle of third interval; elytra more or less variegated 3

3. Front of head not at all alutaceous; $2\frac{2}{3}$-$3\frac{1}{3}$ mm............
Bembidion darlingtoni Mutchler.

   Front of head alutaceous; size larger............................4

4. Elytral striæ apically deleted or only lightly impressed.
Bembidion viridicolle (Laf.).

   Elytral striæ entire, about same depth throughout........5

5. Prothorax with sides broadly but slightly sinuate before basal angles; latter only slightly prominent....................
Bembidion fastidiosum (Laf.).

   Prothorax with sides strongly and conspicuously sinuate before basal angles; latter rather prominent..................
Bembidion sparsum Bates.

6. Two setæ over each eye, but anterior sometimes shorter than posterior..7
   One seta over each eye; head sunk in thorax nearly to eyes ....(Micratopus)........27

7. Eyes moderate or large; antennæ sometimes moniliform, usually not...8
   Eyes much reduced, small or minute; antennæ moniliform ....(Limnastis)........28

8. Antennæ moniliform, middle joints as wide as long......9
   Antennæ more slender..10

9. Side margins of thorax broad, channeled, translucent; color castaneous with base and apex of elytra pale; size under 2 mm...
Tachys (*Tachyta*) *flavicauda autumnalis* Bates.

   Side margins of prothorax narrower, not translucent; color dark piceous, elytra each with a subapical red spot; size $\pm$ $2\frac{1}{2}$ mm...
Tachys (*Tachyta*) *hispaniolae* n. sp.

10. Elytra each with six coarsely punctate striæ beside the marginal series of punctures; size ± 2-$2\frac{1}{2}$ mm............
Pericompsus blandulus Schaum.

   Elytra with not more than five coarsely punctate striæ beside marginal series, *or* striæ not coarsely punctate..11

11. Posterior dorsal puncture of elytron (on outer edge of third interval, as a rule) much in front of apical recurved stria; body very convex 12
Posterior dorsal puncture of elytron on or within hooked tip of apical recurved stria; body usually more depressed 13

12. Elytra each with five coarsely punctate striæ or rows of punctures; mentum bi-perforate ....
Tachys (subgenus?) *immaculatus* (Bates).
Elytra each with only one or two striæ, which are impunctate; mentum not perforated ....
Tachys (*Tachyura*) *xanthopus* Dej.

13. Posterior elytral puncture directly upon hooked tip of apical recurved stria; surface not iridescent 14
Posterior elytral puncture within, not on, hooked tip of apical recurved stria; surface usually more or less iridescent 15

14. Basal angles of prothorax obtuse ....
Tachys bradycellinus Hayw.
Basal angles of prothorax right.. *Tachys occultator* Casey (and) *Tachys ensenadae* Mutchler.

15. Male with two joints of front tarsus dilated 16
Male with only basal joint of front tarsus dilated 20

16. Antennæ very slender (middle joints about three times as long as wide; tip of sixth reaching about to basal angle of prothorax); eyes moderate; length ± 3 mm. ....
Tachys albipes Lec.
Antennæ stouter and shorter; other characters variable 17

17. Eyes abruptly prominent, forming right angles with sides of head behind them; basal angles of prothorax obtuse but distinct; length just over 2½ mm. ....
Tachys abruptus n. sp.
Eyes less prominent, forming obtuse angles with sides of head behind them; other characters variable 18

18. Basal angles of prothorax very obtuse, almost rounded except for minute subprominent sinuation of margin; size $\pm 2\frac{1}{2}$ mm. .... *Tachys putzeysi* F. & S.
Basal angles of prothorax obtuse but rather distinct; size 2-2¼ mm. 19

19. Prothorax transverse, head relatively narrow (Pl. 1, fig. 1) ....*Tachys dominicanus* n. sp.
Prothorax less transverse, head broader.......................... *Tachys sp.* (Guadeloupe & Montserrat.)

20. Surface of elytra with very fine, short, sparse pubescence ....*Tachys striax* n. sp.
Surface of elytra not pubescent....................................21

21. Posterior angles of prothorax accurately and minutely formed; color testaceous with head scarcely darker....22
Posterior angles of prothorax finely blunted or bluntly subdenticulate; color castaneous, or partly testaceous with head much darker..25

22. Form unusually slender, parallel..................................23
Form broad...24

23. Base of prothorax oblique at sides; eyes very prominent. *Tachys filax* n. sp.
Prothorax squarely truncate at base; eyes less prominent ....*Tachys pumilus* Dej.

24. Median line of prothorax continued as a groove behind posterior transverse impression; first joint male front tarsus very wide; size $\pm 2\frac{1}{2}$ mm. .... *Tachys cubax* n. sp.
Median line of prothorax not continued behind posterior transverse impression; first joint male front tarsus relatively much narrower; size just under 2 mm. .... *Tachys paulax* n. sp.

25. Sides of prothorax sinuate before basal angles, which would be almost right except are slightly blunted; head and prothorax relatively narrow; size $\pm 2\frac{1}{2}$ mm.......... *Tachys scitulus* Lec.

Sides of prothorax scarcely or not sinuate before the basal angles, which are more obtuse; other characters variable 26

26. Color usually castaneous or darker; head and prothorax relatively narrower; antennæ more slender (middle joints more than twice as long as wide); first joint male front tarsus wider and with outer apical angle more strongly produced; size $\pm 2\frac{1}{2}$ mm. .... *Tachys corruscus* Lec.

Color testaceous with head much darker; head and prothorax relatively wider; antennæ stouter (middle joints less than twice as long as wide); first joint male tarsus smaller; size 2 mm. or slightly less .... *Tachys vorax* Lec.

27. Head moderate; prothorax not especially large; size about $1\frac{2}{3}$ mm. .... *Micratopus insularis* n. sp.

Head very small; prothorax relatively very large; size ± 2 mm. (Pl. 5, fig. 3) .... *Micratopus parviceps* n. sp.

28. Form slender; head relatively small; length $1\frac{1}{2}$-$1\frac{2}{3}$ mm. (Pl. 5, fig. 2.) .... *Limnastis americanus* n. sp.

Form less slender; head relatively large; length barely over 1 mm. .... *Limnastis capito* Bates.

Bembidion (Peryphus) jamaicense n. sp.

Moderately slender, convex, upper surface faintly alutaceous but rather shining; dark rufous, appendages testaceous. Head rather long; eyes prominent; antennæ slender; front with inconspicuous median puncture; frontal sulci moderate, parallel; mentum with rounded-triangular tooth at middle. Prothorax subcordate, about one-third wider than long (by measurement); basal angles acute but not much more than right, strongly carinate; disk with transverse impressions moderate, longitudinal line strong. Elytra with first and second striæ entire, third nearly entire, fourth to sixth obliterated near apex except fifth apically sulciform, seventh indicated by a few faint punctures in basal half, eighth near margin; striæ moderately punctate basally, smooth apically; intervals slightly convex, third with two distinct setigerous punctures practically on third stria. Length just over 4 mm.

Holotype ♂ (United States National Museum) and 1 ♀ paratype (Museum of Comparative Zoölogy no. 19498) from Jamaica, H. G. Hubbard.

This species is superficially similar to *Bembidion subangustatum* Hayw. (type examined) of New Mexico and Arizona, but, in addition to being considerably smaller, has a rather differently shaped prothorax and a larger head with more prominent eyes. Of the known Central American Bembidion it is related only to *rogersi* Bates, of which we have specimens, identified by description, from Cerro Central, Costa Rica. The Jamaican species is less convex, much paler, lacks æneous lustre, has the dorsal punctures of the elytra less impressed and nearer the third stria, has more slender antennæ, and differs slightly in other ways.

20. **Bembidion (Notaphus) sparsum** Bates.

21. **Bembidion (Notaphus) viridicolle** Laf.
chevrolati (G. & H.)
apicale J.-Duv.

22. **Bembidion (Notaphus) fastidiosum** Laf.

I have seen specimens from Haiti and Puerto Rico but none from Cuba, although the species is recorded as Cuban by Leng and Mutchler.

23. **Bembidion (Notaphus) darlingtoni** Mutchler.
affine auct., not Say.

Described in the *American Museum* (New York) *Novitates* no. 686, 1934, p. 3.

24. **Tachys (Tachyta) flavicauda autumnalis** Bates.
Tachys (Tachyta) hispaniolae n. sp.

Of average form for Tachyta; rufo-piceous to piceous black, rufescent below, appendages and a nearly round red spot at apical third of each elytron near middle of its width testaceous; upper surface entirely alutaceous.

Head: front with two slightly impressed, widely separated sulci slightly converging anteriorly; antennæ short, second joint shorter than third, middle joints hardly longer than wide; mentum without foraminiform punctures, with blunt tooth in emargination. Prothorax slightly more than a half wider than long (by measurement); sides rounded anteriorly, slightly and very gradually sinuate posteriorly; posterior angles acutely but very minutely denticulate, costæ within angles short and not conspicuous; lateral margins evenly explanate, wider than in *Tachys* (*Tachyta*) *inornata* (Say), less wide than in *T. flavicauda;* basal transverse impression deep, anterior faint, median line rather deep. Elytra only slightly depressed; sutural stria deep and entire, recurved as usual; other striæ all more or less abbreviated but all visible basally, either as impressed faintly punctate lines or (externally) as series of small punctures; fourth stria with fixed punctures near base and about apical third. Two basal joints of male front tarsus dilated and with anterior apical angles slightly produced. Length $\pm 2\frac{1}{2}$ mm.

Haiti, W. M. Mann: Holotype (Museum of Comparative Zoölogy no. 19499) and 3 paratypes from Grande Rivière; 2 paratypes from St. Marc.

This species is apparently not closely related to any of those known from North or Central America; its color pattern is unique. It is intermediate between the so-called genera Tachyta and Tachymenis as used by Casey (Memoirs 8, 1918, p. 3).

25. **Tachys (Pericompsus) blandulus** Schaum

26. **Tachys (Tachyura) xanthopus** (Dej.)

27. **Tachys (subgenus?) immaculatus** (Bates)

28. **Tachys (s. s.) occultator** Csy.

29. **Tachys (s. s.) bradycellinus** Hayw.

30. **Tachys (s. s.) cubax** n. sp.

Rather broad; not strongly depressed; rufo-testaceous with a small, vague, dark blotch common to both elytra behind middle; very faintly opalescent. Head with eyes only moderately prominent; antennæ with middle joints about twice as long as wide; frontal sulci parallel, deep anteriorly, abbreviated and obsolete posteriorly; mentum toothed at middle, conspicuously bi-foraminate posteriorly. Prothorax just over a half wider than long (by measurement), squarely truncate at base and apex; disk with usual impressed lines, and with median longitudinal line continued posteriorly as a conspicuous groove behind the basal impression; base broad, angles obtuse but almost right, very precisely defined, not in the least blunted or rounded. Elytra each with seven striæ in addition to the marginal one, but the seventh almost obsolete; two inner striæ entire, others abbreviated apically; several inner striæ slightly impressed, outer ones very superficial; striæ slightly irregular but not distinctly punctate; anterior dorsal puncture close to fourth stria about a third or a fourth from base, posterior puncture within tip of recurved stria. Male with only first joint of anterior tarsus dilated, with anterior apical angle much prolonged and acute. Length $\pm 2\frac{1}{2}$ mm.

Holotype ♂ (Museum of Comparative Zoölogy no. 19500) and 1 ♂ paratype from Soledad (near Cienfuegos) Cuba, Oct. 28, taken under cover beside a little brook in a *saboruco* or patch of rough, scrubby woods; 1 ♂ paratype from San Carlos Est., Guantánamo, Cuba, Oct. 4-8 (American Museum); 1 ♂ specimen, not a type, from Bath, Jamaica, Apr. 3-6 (American Museum); 1 ♀ paratype from Cayamas, Sta. Clara, Cuba, Feb. 15, E. A. Schwartz (United States National Museum); 1 ♂ paratype from Jatibonico, Cuba, Oct. 30, in soil of sugar cane field, L. D. Christenson (U. S. N. M.).

The form of the first tarsal joint of the male distinguishes this species from all our North American Tachys *s. s.* except *corruscus* Lec. As compared with the latter *cubax* is differently colored, broader, less depressed, the frontal sulci are conspicuously shorter, the antennæ stouter, the prothorax broader at base with more precisely formed basal angles and with an extreme basal median channel. The two species are not really very closely related. *Cubax* is probably closer to *Tachys platyderus* Bates, and its allies, of the Amazonian region, but the type of elytral striation combined with the barely sinuate sides of the prothorax apparently distinguish it from all of them.

In coining the name *cubax* I am following the example of Leconte, who made a habit of using two-syllable names ending in *ax* for species of this genus.

31. **Tachys (s. s.) paulax** n. sp.

Rather broad, not strongly depressed; rufo-testaceous with slight opalescent lustre. Characters in general the same as in the preceding species except that the sides of the prothorax are slightly more sinuate before the base, the median line of the prothorax is not continued behind the posterior transverse impression, the first joint of the male front tarsus is much less dilated, and the size is smaller. Length just under 2 mm.

Holotype ♂ (United States National Museum) and 1 ♀ paratype (Museum of Comparative Zoölogy no. 19501) from Cayamas, Sta-Clara, Cuba, March 2, E. A. Schwarz.

32. **Tachys (s. s.) albipes** Lec.

Tachys (s. s.) abruptus n. sp.

Broad, somewhat depressed; rather shining rufo-castaneous with slight iridescence, appendages paler. Head with abruptly prominent eyes which form right angles with the sides of the head behind them (when seen from a line perpendicular to the front); antennæ with middle joints less than twice as long as wide. Prothorax by measurement just over one and a half times as wide as long; sides barely sinuate before basal angles, which are obtuse but distinct; disk with usual impressed lines. Elytra broadly oval, each with about three inner striæ more or less distinct and one or two outer ones faintly indicated; striæ not distinctly punctulate; anterior dorsal puncture about on fourth stria a third from base, posterior puncture within recurved tip of apical striole. Male with two basal joints of each front tarsus rather widely dilated. Length just over 2½ mm.

Holotype ♂ (American Museum) and 4 paratypes (♂ ♂ ♀ ♀) from Gourbeyre, Guadeloupe; 3 paratypes (♂ ♀ ♀) from Long Ditton, Dominica, July 21, 1911. Paratypes in the Museum of Comparative Zoölogy (no. 19496) and the American Museum.

This species is distinguishable from its relatives (the preceding and the three following species) by its more abruptly prominent eyes, as well as by other characters given in the key.

Tachys (s. s.) putzeysi F. & S.

Gourbeyre, Guadeloupe, 7 specimens (American Museum). One specimen has been compared with the type in the Paris Museum by Dr. Jeannel, to whom I sent for comparison specimens of all five Lesser Antillean Tachys known to me.

Tachys (s. s.) dominicanus n. sp. (Pl. 5, fig. 1)

Rather broad and depressed; shining rufo-testaceous, iridescence very faint, appendages paler. Head relatively small, with poorly developed eyes; antennæ with middle joints rather less than twice as long as wide. Prothorax by measurement just over one and a half times as wide as long, sides oblique or just sinuate before the obtuse but distinct basal angles; disk with usual impressed lines. Elytra each with about two inner striæ distinct and several outer ones indicated; striæ irregular, almost punctulate; anterior dorsal puncture about on fourth stria a third from base, posterior puncture within recurved tip of apical striole. Male with two basal joints of each front tarsus moderately dilated. Length 2-2¼ mm.

Holotype ♂ (American Museum) and 16 paratypes from Long Ditton, Dominica, June 21, 1911. Paratypes in the Museum of Comparative Zoölogy (no. 19497) and American Museum.

The distinguishing characters of this species are sufficiently given in the key.

33. **Tachys (s. s.) scitulus** Lec.

34. **Tachys (s. s.) corruscus** Lec. (not typical)

35. **Tachys (s. s.) vorax** Lec.

36. **Tachys (s. s.) striax** n. sp.

Moderately stout, depressed; rufo-testaceous (elytra rarely piceous with base paler), iridescent lustre faint or absent; head only slightly darker. Head with eyes only slightly prominent; antennæ with middle joints about twice as long as wide; frontal grooves moderate, slightly converging anteriorly; front faintly micro-reticulate, with distinct small puncture at middle; mentum toothed at middle, with two large foraminiform perforations. Prothorax cordate, about a half wider than long (by measurement), sides strongly sinuate before the prominent and acute (but not much more than right) basal angles; usual discal impressions well marked. Elytra finely, sparsely, inconspicuously pubescent, (pubescence visible only under high magnification) ; with about five striæ including the sutural visible on each, the inner two or three somewhat impressed, irregularly and inconspicuously punctulate, or at least with sides of intervals irregular; sutural stria reaching base of elytron, it and second stria reaching apex (second sulciform apically), others abbreviated; anterior setigerous puncture almost on fourth stria about a third from base, posterior puncture within tip of hooked apical striole. Male with first joint of front tarsus moderately dilated, with anterior apical angle acutely but not strongly produced. Length 2 mm. or slightly less.

Holotype ♂ (Museum of Comparative Zoölogy no. 19502) and 19 paratypes from Soledad (near Cienfuegos) Cuba, June, Oct. 17 & 20, Nov. 7. One specimen was taken under a stone in a dry field; practically all the others, in a plowed field during a heavy flood. 1 paratype from Cayamas, Sta. Clara, Cuba, June 6, E. A. Schwarz (United States National Museum) ; 1 paratype from Cuba, Poey Collection no. 27 (Philadelphia Academy of Sciences).

This species is strongly characterized by the pubescent and striate elytra with the second stria sulciform apically. So far as I know, it has no close relatives.

37. **Tachys (s. s.) pumilus** (Dej.)

38. **Tachys (s. s.) filax** n. sp.

Slender, subdepressed; testaceous, rather shining. Head nearly as wide as prothorax; eyes very prominent; antennæ rather stout, middle joints about a half longer than wide, apex of eighth joint reaching about to base of prothorax; mentum with two foraminiform punctures. Prothorax cordate, slightly less than a half wider than long (by measurement); base oblique at sides; sides sinuate before the obtuse (but nearly right) posterior angles, which are accurately defined. Elytra each with two inner striæ slightly impressed and one or two others more or less indicated; striæ slightly irregular but not distinctly punctate; apical recurved stria well marked and long, but second stria scarcely visible at apex; anterior dorsal puncture on third interval near basal third, posterior puncture within tip of recurved stria. Length $\pm 1\frac{7}{8}$ mm.

Holotype ♀ (United States National Museum) and 1 ♀ paratype (Museum of Comparative Zoölogy no. 19503) from Cayamas, Sta. Clara, Cuba, E. A. Schwarz, Jan. 30 and Feb. 13. Also 1 (♂ ?) paratype from Cuba, Poey Collection no. 27 (associated with Poey specimen of preceding species) (Philadelphia Academy of Sciences).

This is a very graceful species which approaches the form of the *vittiger* group of Tachys, but has the characters of Hayward's *proximus* group. It is distinguished from *Tachys pumilus* (Dej.), apparently its nearest ally, by much more prominent eyes, base of prothorax oblique at sides, and more slender form.

39. **Limnastis americanus** n. sp. (Pl. 5, fig. 2.)

Small, slender, subdepressed; rufo-testaceous, head not darker. Head with front micro-reticulate; eyes small to very small (see below), flattened, sometimes slightly convex, sometimes actually concave; two supraorbital setæ each side, anterior one shorter; antennæ short, stout, outer joints moniliform; mentum without tooth in emargination. Prothorax by measurement about a third wider than long, somewhat narrowed behind, sides broadly, not strongly sinuate before base; posterior angles obtuse or finely right; anterior angles without very conspicuous setæ; disk micro-reticulate, not obviously punctate, with fine, short sparse pubescence. Elytra reaching tip of abdomen, subtruncate, slightly dehiscent near apex; about three inner striæ faintly impressed on each elytron; intervals each with a single row of fine, short pubescence; one inconspicuous discal puncture on the outer edge of the third interval, almost on the third stria, a little behind the middle. Inner wings dimorphic, well developed or reduced to about a third elytral length. Male front tarsi each with two basal joints dilated. Length 1½-1⅔ mm.

Holotype macropterous ♂ (Museum of Comparative Zoölogy no. 19504) and 16 paratypes (3 macropterous ♂♂, 7 macropterous ♀♀, 3 micropterous ♂♂, and 3 specimens with wings not examined) all from Soledad (near Cienfuegos) Cuba, June, Oct. 27, Dec. 1; most of them taken by treading down dense vegetation floating in deep water. They may possibly have been carried there by floods, but were not in real flood debris. Also 4 paratypes (all macropterous ♀♀) from Cayamas, Sta. Clara, Cuba, Jan. 2 & 29, Feb. 7 & 13, E. A. Schwarz (United States National Museum).

The dimorphism of the inner wings is correlated with the size of the eyes. The macropterous specimens have the eyes larger, usually slightly transverse, separated below from the margin of the mouth by about half or less the diameter of the eye itself. The three micropterous males have the eyes smaller, almost evenly rounded, and separated from the mouth by about their own diameter.

This species is emphatically a Limnastis, not a Micratopus, as shown by comparison with several American species of the latter genus and with a specimen of *Limnastis macrops* Jeannel kindly sent me by Dr. Jeannel himself. In the latter's table of the genus (Livre Cent., Soc. Ent. France, 1932, pp. 174 -) the macropterous form of the Cuban species runs to near *L. coomani* Jeannel of Tonkin, but has smaller eyes and differs in other ways. This does not, of course, indicate an actual affinity between the Chinese and

Cuban species, for somewhat similar species of Limnastis occur over a large part of the Old World, including the Mediterranean region. There is even one, *L. gaudini* Jeannel, in the Canary Islands, but it is completely blind. Only one true Limnastis has been known before from the New World, *L. capito* Bates. This was described from Guatemala but occurs also in Cuba. Mr. K. G. Blair has very kindly compared a Cuban specimen for me with the type in the British Museum. The distinguishing characters of the two American species are given in the key, in the preceding pages.

40. **Limnastis capito** Bates.

41. **Micratopus parviceps** n. sp. (Pl. 5, fig. 3.)

Form and proportions as figured; body depressed; surface microreticulate but moderately shining; testaceous, head only faintly darker. Head very small, with small, flat eyes which scarcely break the outline of the sides of the head; middle joints of antennæ about twice as long as wide. Prothorax very large, broadly emarginate in front, sides of base oblique; basal angles very obtuse; disk depressed, median line distinct, basal transverse impression faint, anterior impression absent. Elytra depressed, independently rounded-subtruncate at apex; striation nearly complete, but striæ very fine, shallow, and inconspicuous; one dorsal puncture near apex of third stria. Length ± 2 mm.

Holotype (United States National Museum) and 5 paratypes from Jatibonico, Cuba, Apr. 9, Apr. 20, and July 8, L. D. Christenson, in soil of sugar cane fields. Paratypes in Museum of Comparative Zoölogy (no. 19505) and United States National Museum.

This species differs from *Micratopus ænescens* (Lec.) and *fusciceps* Csy. of the United States in having the elytral striæ very fine and inconspicuous; from *withycombei* Jeannel of Trinidad (Livre du Cent., Soc. Ent. France, 1932, 168) in having the basal angles of the prothorax much more obtuse. The new species is apparently unique in the small size of the head.

Micratopus insularis n. sp.

So similar to the preceding as not to require a full description. Differs (from *parviceps*) in being smaller, slightly more convex, with relatively smaller prothorax and larger head with larger, more prominent eyes. Length $\pm 1\frac{2}{3}$ mm.

Holotype (United States National Museum) and 1 paratype (Museum of Comparative Zoölogy no. 19506) from San Juan, Puerto Rico, Aug. 11, 1933, A. S. Mills, at light.

42. **Diplochaetus rutilus** (Chev.).

43. **Perileptus (s. s.) columbus** n. sp. (Pl. 5, fig. 4.)

Form and proportions as figured; depressed; entirely rufo-testaceous; upper surface with fine, short pubescence which does not conceal the underlying surface. Head across eyes by measurement barely narrower than prothorax, but appearing slightly wider; temples parallel for a short distance behind eyes before being constricted; front shining, obsoletely punctate; antennæ slender, median joints about three times as long as wide; mentum toothed, tooth subtruncate apically. Prothorax cordate; base more than two-thirds (by measurement) as wide as widest part; sides sinuate about one-sixth from base, thence nearly straight to the regular, right or slightly obtuse basal angles; lateral margin moderate, entire, crenate near base; disk rather finely and closely punctate, basal transverse line very deep, anterior line less deep, median longitudinal line well impressed. Elytra also rather closely and finely punctate; sutural stria distinct except at base, one or two next striæ vaguely indicated; three discal punctures on position of third stria on each elytron, about a fifth from base, just behind middle, and about a tenth from apex respectively. Male with first two joints of front tarsus somewhat dilated. Length $2\frac{1}{4}$-$2\frac{3}{4}$ mm.

Holotype ♂ (Museum of Comparative Zoölogy no. 19507) and 9 paratypes (2 in collection Jeannel), including both sexes, from Soledad (near Cienfuegos) Cuba, Oct. 27 & 28, Nov. 24, Dec. 1, taken in gravel bars beside woodland brooks.

For comparative remarks see under the following species.

Perileptus (s. s.) jeanneli n. sp.

Form closely similar to that of the preceding species; depressed; piceous; mouth, bases of antennæ, palpi, legs, and feet rufescent to testaceous. Head: antennæ very slender, median joints about four times as long as wide; head otherwise about as in *columbus*. Prothorax cordate, strongly constricted at base, which is very slightly less than two thirds as wide as widest part; basal angles right. Elytra with sutural stria very lightly impressed, obsolete at base; other striæ barely or not at all suggested by irregularities of the elytral surface; three dorsal punctures on position of (obsolete) third stria. Length 3 mm. or slightly less. Male not known.

Holotype ♀ (Museum of Comparative Zoölogy no. 19508) and 6 paratypes (2 in collection Jeannel) from Kingston, Jamaica, Feb. 14, 1928; taken in gravel bars of a large stream in the outskirts of the city during half a day of collecting, all that I have ever done on the island.

This species is close to the preceding, but is perfectly distinct by the much darker color, more slender antennæ, relatively narrower prothoracic base, and slightly larger size. Both species belong to the *areolatus* group of Perileptus. Dr. Jeannel, who has very kindly examined specimens sent to him and confirmed my identification of them as Perileptus, writes that the two West Indian species differ from previously known species of the *areolatus* group only in being more depressed, more closely punctate, and with the elytral striæ more effaced. They are especially closely related to *P. nigritulus* Woll. of Madeira.

No species of Perileptus, and indeed none of the Perileptini, has been known before from the New World. The West Indian species are especially interesting in that the well characterized *areolatus* group to which they belong is known otherwise (according to Dr. Jeannel's fine monograph in l'Abeille, Vol. 32, 1926, pp. 402 -) only in Europe, North Africa, and the Atlantic Islands.

44. **Panagaeus quadrisignatus** Chev.
thomae Schaum.

45. **Coptia sauricollis** n. sp. (Pl. 5, fig. 5.)

Piceous black, shining, with rather inconspicuous pale pubescence; antennæ (except the three basal joints, which are dark), palpi, and tarsi testaceous; tibiæ and parts of femora more or less reddish. Head nearly smooth except irregularly bi-impressed between eyes; clypeus impressed each side, impressions joined by a fine, arcuate line; mentum shallowly emarginate, with a pronounced rounded tooth in emargination; antennæ slender, apex of eighth joint reaching about to base of pronotum, third joint slightly longer than following ones. Prothorax very broad, much narrowed anteriorly, emarginate in front, bi-spinose each side at base; lateral margins very deeply channeled anteriorly, gradually obliterated posteriorly near first spine; disk coarsely punctate, finely pubescent, surface between punctures shining. Elytra deeply crenato-striate; intervals convex, shining, but with minute punctures bearing fine pubescence. Lower surface shining, only partly pubescent; epipleuræ below humeri impunctate and almost without pubescence; sides of pro-, meso-, and metathorax almost without pubescence, coarsely punctate; ventral segments with only comparatively fine punctuation except sides of basal segments with a few coarse punctures. Male tarsi not dilated. Length 5¾-7; width 3-3¾ mm.

Holotype ♀ (Museum of Comparative Zoölogy no. 19509) and 6 paratypes, including both sexes determined by dissection, from Soledad (near Cienfuegos) Cuba, June, Nov. 7 & 21; all collected by myself in flood debris.

Coptia, previously known only from two species occurring in Cayenne, Venezuela, and Brazil, differs from Panagæus essentially only in having the front tarsi similar in the two sexes; secondary differences are that the antennæ are more slender in Coptia, with proportionately shorter third joint, and that the body is less obviously pubescent, more shining, and not spotted. We possess a single specimen of *C. armata* (Cast.) from St. Augustine, Trinidad. This species is figured by Kollar (Ann. Wiener Mus. 1, 1836, t. 31, figs 3a, b) and both previously known species have been accurately described and compared by Chaudoir (Ann. Soc. Ent. Belgique 21, 1878, 167-9). The present species differs from them, *i. e.* from *Coptia armata* (Cast.) and *C. marginicollis* Chd., in having a differently shaped prothorax, less narrowed anteriorly, with the basal spines better developed.

46. **Coptia effeminata** n. sp. (Pl. 5, fig. 6.)

Black, rather shining, with inconspicuous pale pubescence; antennæ (except three darker basal joints), palpi, and tarsi brownish. Head nearly smooth except bi-impressed between eyes; clypeus impressed each side, transverse arcuate line faint; mentum shallowly emarginate, with a broad short tooth in emargination; tooth truncate, even slightly emarginate apically; antennæ with apex of eighth joint reaching about to base of prothorax, third joint slightly longer than following one. Prothorax broad, narrowed anteriorly, emarginate in front, unidentate (not bispinose) each side of base; lateral margin gradually obliterated anteriorly, not deeply channeled; disk somewhat depressed near posterior angles, coarsely punctate, moderately pubescent. Elytra above about as in preceding species. Lower surface shining, mostly inconspicuously pubescent; epipleuræ below humeri with two widely separated rows of coarse punctures; all ventral segments with very coarse punctuation across their entire width. Length $\pm 8\frac{1}{2}$; width ± 4 mm.

Holotype ♀ (Museum of Comparative Zoölogy no. 19510) from Soledad (near Cienfuegos) Cuba, Nov. 9, taken at light at "Harvard House." Paratypes: 1 ♂ (sex determined by dissection) from Central Jaronú, Cuba, July 10, at light, L. C. Scaramuzza (United States National Museum); 1 (sex not determined) from Baraguá, Cuba, Nov. 12, at light, C. F. Stahl (U. S. N. M.); 1 (sex not determined) from Camagüey, Cuba, Aug.-Sept., J. M. Osorio (Collection Estación E. Agronómica, Cuba).

This species differs radically from *Coptia sauricollis* in the much reduced armature of prothorax, absence of deep channeling in prothoracic margin anteriorly, and punctuation of epipleuræ and abdomen. The species represents in these ways an approach to Panagæus, but is nevertheless referable to Coptia, as shown by the narrow male tarsi, sparse pubescence, etc.

47. **Morion georgiae** (Beauv.).
monilicornis (Latr.).

Morion costigerus n. sp.

Parallel, subdepressed, entirely black, somewhat shining. Head: clypeus obtusely quadridentate; front with two longitudinal, somewhat sinuous sulci anteriorly; eyes less abruptly prominent than in *georgiæ*. Prothorax formed nearly as in *georgiæ* but more elongate, only about a tenth (by measurement) wider than long. Elytra with moderately impressed striæ, latter impunctate; intervals only slightly convex except that seventh is strikingly costiform in about basal third; sixth interval sloping inward basally so that fifth stria is at bottom of an obtuse V-shaped depression; third interval with single puncture near second stria just before apical third. Last ventral with one setigerous puncture about a third from apex on each side. Hind trochanters practically half as long as femora, rounded apically. Length 17-20 mm.

Jamaica: holotype (Museum of Comparative Zoölogy no. 19511) from Newton, 3,000 ft., Jan., C. T. Brues; 1 paratype (M. C. Z.) from Cinchona, 5,000 ft., Jan., Brues; 2 paratypes (American Museum) from Cumberland District, Clarendon, Dec. 15-18, about 3,000 ft.

This species may be known at once from all previously described American Morion by the very conspicuously costate seventh elytral intervals, which are much more elevated than in *M. simplex* Dej. Otherwise it somewhat resembles a very large, slender *M. georgiæ*, with which it agrees absolutely in all characters of generic value.

48. **Pterostichus (Poecilus) chalcites** (Say).

49. **Loxandrus nocticolor** n. sp.

Of average form for Loxandrus; shining black, without evident iridescence; tarsi, palpi, and basal joints of antennæ partly or irregularly rufous. Head normal for genus; clypeus and front anteriorly longitudinally impressed each side; mentum tooth moderate, rounded truncate apically as usual. Prothorax a fourth or a third wider than long (by measurement); margin moderate, not wider or more explanate basally; sides almost evenly rounded from apex to base; base obliquely rounded each side to the very obtuse basal angles; disk rather flat; median line fine, abbreviated at both ends; basal foveæ deep, linear, about a third length of prothorax; base near foveæ finely, sparsely punctate. Elytra rather convex, deeply striate; striæ impunctate; intervals convex, third with puncture on inner edge before middle. Front tarsi of male with joints obliquely dilated. Length 10½ mm.

Holotype ♂ (Museum of Comparative Zoölogy no. 19512) and 1 ♀ paratype from Soledad (near Cienfuegos) Cuba, Oct. 21, taken in flood debris.

Absence of iridescent lustre combined with unusual depth and perfect smoothness of the elytral striæ make this an unusually well characterized species.

50. **Loxandrus celeris** (Dej.).
cubanus Tsch.
cruentatus (Chev.) (*Stenolophus*).

For some time I have suspected the identity of *Stenolophus cruentatus* Chev. with this species, and recently Mr. K. G. Blair has compared a specimen sent to him with Chevrolat's type (at Oxford) and confirmed my suspicions.

51. **Loxandrus crenatus** Lec.

Colpodes M'Leay and Glyptolenus Bates

The following table of the known West Indian species of these genera will show the systematic position of the several new species described below, and at the same time will summarize the West Indian fauna. I have placed asterisks before the species I have not seen. The table is based on Chaudoir's monograph (Ann. Soc. Ent. France (5) 8, 1878, pp. 279 -). The only species I have not been able to place in the table is *Metallosomus cuprascens* Mots., which is omitted in Chaudoir's monograph. The species may be near *mannerheimi*. It was described from Santo Domingo.

1. Metepisterna only a little longer than wide; color dark brown or black 2
   Metepisterna very elongate; color variable 4
2. Elytra narrowly and regularly ovate; humeri obliterated; Length $9\frac{1}{2}$ mm.; Martinique and Dominica .... *C. ellipticus* Chd.
   Elytra not evenly ovate; humeri distinct ....
3. Length $\pm$8-9 mm.; Jamaica .... *C. cinchonæ* n. sp.
   Length $\pm$11 mm.; Santo Domingo .... **C. jægeri* Dej.
   Length 13-15 mm.; Jamaica .... *C. macer* n. sp.
4. Tibiæ canaliculate above; prothorax subquadrate 5
   Tibiæ not canaliculate above; prothorax variable 6
5. Color nearly uniform piceous brown; elytra strikingly short, broad, and convex; side margins of prothorax very narrow anteriorly; $7\frac{1}{2}$ mm.; Dominica .... *Glyptolenus simplicicollis* n. sp.
   Black, elytra bluish, relatively narrow; side margins of prothorax normal; 7 mm.; Guadeloupe (and Brazil) .... *C. chalybeus* Dej.
6. Fourth joint of posterior tarsus strongly lobed externally 7
   Fourth joint of posterior tarsus not or scarcely more strongly lobed externally than internally; color never metallic 8
7. Dark piceous, elytra cœruleo-viridescent; $11\frac{1}{3}$ mm.; Santo Domingo ....**C. mannerheimi* Chd. (*jägeri* Mann.)
   Without metallic lustre; 12 mm.; Jamaica .... *C. vagepunctatus* n. sp.

8. Odd intervals (except first) of elytra foveolate; 10 mm.; Guadeloupe........................**C. alternans* Chd.
   Odd intervals of elytra not foveolate........................9
9. Striæ of elytra interrupted; 9 mm.; Haiti........................ *C. fractilinea* n. sp.
   Striæ of elytra not interrupted........................10
10. Head relatively narrow, less than half width of elytra at widest point........................11
    Head more than half as wide as elytra at widest point 12
11. Brown, dull; striæ of elytra lightly impressed; sides of prothorax broadly, not strongly rounded; 8-11 mm.; Guadeloupe..................*C. dejeani* Chd. (*brunneus* Dej.)
    Black, shining; elytral striæ more impressed; sides of prothorax more strongly rounded; 10.5 mm.; Cuba......... *Colpodes* sp.
12. Length 8-10 mm.; Guadeloupe...........*C. lherminieri* Chd.
    Length 10-13 mm.; Guadeloupe..........**C. elongatus* Chd.
    Length 13-17 mm.; Guadeloupe........**C. memnonius* Dej.

Colpodes cinchonae n. sp.

Slender, elongate, rather depressed; piceous, appendages rufo-testaceous. Head relatively broad, with usual impressions anteriorly; front smooth; antennæ rather slender. Prothorax only about a fifth or less wider than head across eyes, about as long as wide (by measurement) ; lateral margin rather narrow for genus; posterior angles right but finely blunted; disk somewhat shining, with usual impressions. Elytra broadly sinuate near apex; apices slightly prolonged, each subangulate; striæ rather fine, impunctate; intervals nearly flat, dull and alutaceous, third tripunctate, the first puncture near the third stria about basal fifth, others near second stria about middle and apical third. Inner wings vestigial. Metepisterna short; tibiæ not canaliculate externally; tarsi lightly sulcate at sides above, the sulci widely separated, fourth joint bilobed but scarcely produced externally, fifth joint not ciliate; male tarsi slightly dilated. Length $\pm$8-9 mm.

Holotype ♀ (Museum of Comparative Zoölogy no. 19513) from Cinchona Jamaica, 5,000 ft., Jan., C. T. Brues; 11 paratypes (American Museum and M. C. Z.) from the same locality, Feb. 26.

In Chaudoir's tabulation of Colpodes (*l. c.*) this species would fall nearest to *C. sphodroides* Chd. and *C. pristonychoides* Chd. of Mexico, but it is much more slender than either, with a relatively larger head, as shown by comparison with our small series of *sphodroides* from "Biologia" material. It is very similar indeed to *Colpodes lherminieri* Chd., but the metepisterna are much shorter, the head relatively larger, and the elytra more opaque than in that species.

Colpodes macer n. sp. (Pl. 5, fig. 7.)

Elongate; rather depressed; rufo-testaceous (immature) to piceous, appendages scarcely paler; upper surface finely alutaceous. Head very elongate; eyes rather large but less prominent than usual in genus; antennæ slender, middle joints about three times as long as wide; mentum at middle of emargination with a long slender tooth, pointed or very narrowly truncate at apex. Prothorax (by measurement) as long as wide, but appearing longer; sides rather widely reflexed; basal angles obtuse, narrowly rounded; disk with fine median longitudinal line and broad vague basal and apical transverse impressions, also with lateral impression on each side from near basal angles forward and outward to in front of middle. Elytra elongate, prolonged and independently subangulate apically; margin broadly, slightly sinuate near apex; striæ entire, rather deep, impunctate; intervals slightly convex, third with three inconspicuous punctures. Inner wings vestigial; metepisterna short. Tibiæ not canaliculate externally; tarsi sulcate, sulci widely separated, fifth joint not ciliate, fourth not lobed externally on middle and hind feet; male anterior tarsi slightly dilated. Length 13-15 mm.

Holotype ♂ (Museum of Comparative Zoölogy no. 19515) from Cinchona, Jamaica, 5,000 ft., Jan. 1912, C. T. Brues;

2 (♂ ♀) paratypes from the same locality, Feb. 27, 1911 (American Museum).

This species is allied to the Central American *Colpodes championi* Bates, *eueides* Bates, and especially *severus* Chd., of which last there is a single specimen from Guatemala in the Museum of Comparative Zoölogy. *C. macer* differs from all of them in its more slender form, more prolonged elytral apices, more elongate head, and more widely reflexed prothoracic margins.

Colpodes vagepunctatus n. sp.

Moderately broad, rather depressed; surface not strongly shining, with inconspicuous silky texture; rufo-piceous, without metallic lustre, legs not paler, antennæ dark rufous at base, testaceous with darker stripes from apex of fourth joint. Head longitudinally bi-impressed in front of eyes; mentum tooth triangular, pointed. Prothorax large, about a third wider than long (by measurement), slightly convex, slightly more narrowed in front than behind; sides more or less evenly rounded from base to apex; lateral margins moderately widely reflexed; basal angles indistinct, rounded-obtuse; disk with median line fine, transverse impressions poorly defined, basal foveæ rather broad and deep, vaguely rugose, surface of disk otherwise smooth except vaguely transversely wrinkled near median line. Elytra with humeri distinct, apices sinuate and slightly produced, sutural angle right; striæ rather deep, slightly irregular but not distinctly punctate; intervals slightly convex; anterior dorsal puncture on third stria about basal fifth, second and third punctures on third interval near middle and apical fourth, slightly variable, second tending to be nearer second stria, third nearer third. Tibiæ not sulcate externally; front tarsi with indistinct sulci each side above, hind tarsi sulcate each side; fourth joint hind tarsus strongly lobed externally, fifth joint not ciliate. Metepisterna long; inner wings reduced, about half elytral length (possibly variable). Length ±12 mm.

Holotype ♀ (United States National Museum) and 1 damaged ♀ paratype (Museum of Comparative Zoölogy no. 19516) from Jamaica, H. G. Hubbard.

In Chaudoir's key (*l. c.*) this species runs to page 284, the first *z,* and falls between *o* and *oo,* fitting neither. It differs from all structurally comparable species under both parts of the couplet in the entire absence of metallic lustre. It is not like any of the species described in "Biologia."

Colpodes fractilinea n. sp.

Moderately broad; very shining; rufo-piceous, without metallic lustre, femora scarcely paler, tibiæ rufo-testaceous, antennæ and tarsi testaceous. Head longitudinally bi-impressed in front of eyes; mentum tooth rounded-triangular. Prothorax large, nearly a half wider than long (by measurement), slightly convex, somewhat narrower in front than behind; sides nearly evenly rounded; lateral margins moderate, reflexed; basal angles obtuse but distinct; disk with median line fine, transverse impressions poorly marked, basal foveæ rather broad, moderately deep; surface smooth. Elytra with humeri distinct; apices slightly produced, independently irregularly rounded; striæ fine, especially externally, and interrupted to form series of more or less elongate impressed lines; scutellar stria long, better impressed; intervals flat; anterior dorsal puncture on third stria near basal fifth, second and third punctures on second stria near middle and apical fourth. Tibiæ not sulcate externally; front tarsi not sulcate above; hind tarsi sulcate on outer side, not distinctly so on inner; fourth joint hind tarsus bilobed but only slightly more produced externally than internally; fifth joint not ciliate. Metepisterna long; inner wings not reduced. Length just over 9 mm.

Holotype ♂ (United States National Museum) from Diquini, Haiti, J. B. Ferris; unique.

In Chaudoir's table (*l. c.*) this species runs to page 282, "III, 2, b" (*C. aphædrus* etc.). The lack of metallic lustre alone is enough to distinguish it from most of the species of this group, and the interrupted elytral striæ are different from those of any species of the *aphædrus* group listed by Chaudoir.

52. Colpodes sp.

The only Colpodes I have seen from Cuba is a single specimen of an undetermined species (briefly characterized in my key)from Somorrostro, (Havana), coll. Barro.

Glyptolenus simplicicollis n. sp

Piceous brown, abdomen, epipleurae, and appendages rufescent. Head bi-impressed between front margins of eyes; eyes large but not very prominent; front smooth. Prothorax subquadrate, only slightly wider than long (by measurement), slightly narrower in front than at base; posterior angles obtuse, preceded by a minute sinuation of the sides, which are otherwise nearly evenly, very broadly rounded throughout; lateral margins very narrow anteriorly, gradually broader and reflexed in posterior half; base truncate at middle, somewhat rounded-oblique at sides; disk with usual impressions, but without extra transverse rugae. Elytra relatively very broad, convex, rather deeply striate, striæ slightly uneven but not distinctly punctate; intervals somewhat convex, third very inconspicuously bipunctate, the punctures before basal fourth and behind middle. Metepisterna slender. Tibiæ canaliculate externally; tarsi strongly sulcate above; male tarsi slightly dilated. Length 7½ mm.

Holotype ♂ (American Museum) from Laudet, Dominica, June 9, 1911; unique.

This species is a Glyptolenus as the genus was used by Bates in "Biologia" (Coleop. 1, part 1, p. 98). The genus is hardly distinct from Colpodes. *G. simplicicollis* differs from all previously described species in the combination of non-rugulose pronotum and impunctate elytral striæ. The general appearance of the insect is much like that of a stout Anchonoderus.

53. Agonum (Anchomenus) extensicolle cubanum n. subsp.
extensicollis Chev.
extensicolle Gundlach (not Feronia extensicolle Say).

Head and prothorax rather bright green, but very alutaceous and not strongly shining; elytra dull brown-bronzed, outer edges green; base of antennæ, palpi, legs dull brown. Length $7\frac{3}{4}$-9 mm.

Cuba: holotype ♂ (Museum of Comparative Zoölogy no. 19517) and 8 paratypes from Soledad (near Cienfuegos), "Jan.-Feb." (C. T. Brues), July 1 (B. B. Leavitt), Oct. 31, Nov. 11; 1 paratype from Marcata, Rio Bayamo (M. C. Z.); 2 paratypes from Baraguá, Camagüey, at light, May 3 & 5 (L. C. Scaramuzza) and May 29 (L. D. Christenson) (United States National Museum); two discolored specimens, not types, from Cayamas, Sta. Clara, May 26 and June 1, E. A. Schwarz (U. S. N. M.); 1 paratype from Camagüey, "Aug.- Sept.," J. M. Osorio (Collection of Estación E. Agronómica); 2 discolored specimens from Baraguá, at light, Nov. 2, L. C. Scaramuzza, and Cumanayagua, Sta. Clara, June, F. de Zayas (both in Est. E. Agronómica). My specimens were taken in very coarse gravel beside the Arimao River.

The Cuban subspecies differs from true *Agonum extensicolle* (Say) of the eastern United States, and from practically all other forms of the species occurring on the continent north of Mexico, in having the legs infuscate, not testaceous. From Mexican specimens and others with brown legs the Cuban ones differ in the much brighter green head and prothorax.

54. **Anchonoderus subtilis** Bates.

55. **Lachnophorus leucopterus** Chev.

56. **Euphorticus pubescens æneolus** Bates

57. **Perigona nigriceps** (Dej.)

58. **Perigona laevigata** (Bates)

59. **Perigona picea** n. sp.

Slender (for the genus), rather convex; rufo-testaceous (immature) to piceous, elytra with faint opalescence in certain lights; head and disk of prothorax darker, mouth parts and appendages testaceous. Head: mandibles rather long, curved, acute; eyes moderately prominent; antennæ stout; mentum with a triangular tooth in emargination.

Prothorax by actual measurement about a fourth wider than long at middle, but appearing almost as long as wide; sides not sinuate, barely convex in profile before the rounded-obtuse basal angles; disk with a fine longitudinal line but no transverse impressions, vaguely impressed each side near base. Elytra each with two inner striæ distinct except at extreme base and apex, irregularly punctulate; several outer striæ more or less faintly visible; marginal stria normal for Perigona. Length 3-4 mm.

Holotype (Museum of Comparative Zoölogy no. 19518) and 2 paratypes from Grande Rivière, Haiti, W. M. Mann; 1 paratype from Diquini, Haiti, Mann (M. C. Z.); 1 paratype from San Carlos Estate, Guantánamo, Cuba, Oct. 4-8 (American Museum); 1 paratype from Cayamas, Sta. Clara, Cuba, Baker (United States National Museum); 1 paratype from Yateras Dist., Oriente, Cuba, W. M. Mann (U. S. N. M.); 2 paratypes from Cuba, Poey Collection no. 645 (Philadelphia Academy of Sciences); 1 paratype from Santo Domingo, A. Busck (U. S. N. M.); 1 specimen, not a type, from Gourbeyre, Guadeloupe (American Museum).

For relationships of this species, see key below.

Perigona microps n. sp. (Pl. 5, fig. 8.)

Form average for genus; irregularly castaneous, elytra with faint opalescent lustre, suture and parts of prothorax more rufescent, mouth and appendages testaceous. Head with mandibles elongate; eyes small, not prominent, only slightly breaking the outline of sides of head; antennæ moderate, less stout than in *picea;* mentum with a small tooth in emargination. Prothorax about a fourth wider than long; sides oblique but scarcely or not sinuate before the obtuse but not rounded posterior angles; disk about as in *picea.* Elytra each with two or three inner striæ slightly impressed except at base and apex; several outer striæ suggested by faint irregularities of the surface in proper light; striæ irregular but hardly distinctly punctate. Length $\pm 3\frac{1}{4}$ mm.

Puerto Rico: holotype (United States National Museum) from Bayamon, Jan.; 1 paratype (Museum of Comparative

Zoölogy no. 19519) from Fajardo, Feb. Both specimens taken by Aug. Busck.

As compared with *Perigona picea,* this species is broader, less convex, with more slender antennæ, better defined prothoracic angles, less distinct elytral striæ, and especially smaller eyes. For other distinguishing characters see the following key to the West Indian species of Perigona, of which I have seen all except *guadeloupensis.*

1. Color chiefly testaceous, head and apices of elytra blackish; length 3 mm. or less; cosmopolitan.......................... *nigriceps* Dej.
   Color piceous to testaceous (immature), apices of elytra not contrastingly darker; length 3 mm. or more...........2
2. Sides of prothorax sinuate before base; 3½ mm.; Guadeloupe.............................*guadeloupensis* Fleut. & Sallé
   Sides of prothorax not, rarely just barely, sinuate..........3
3. Eyes only slightly breaking outline of sides of head (Pl. 5, fig. 8.).. *microps* n. sp.
   Eyes much more prominent..4
4. Elytra without distinct striæ near suture; body broader, more depressed; 4-5 mm.; Cuba, Puerto Rico (and Central America)..*lævigata* Bates.
   Elytra each with at least two distinct, more or less punctate striæ near suture; more slender and convex; 3-4 mm...*picea* n. sp.

60. **Badister seclusus** Blatchley.

61. **Chlaenius niger ludoviciana** Leng.
niger Gundlach, not Randall.

This is one of the few Carabidæ known from Cuba of which I have not seen Cuban specimens.

62. **Chlaenius gundlachi** Chd.

63. **Chlaenius cubanus** Chd.
poeyi Gundlach, not Chevrolat.

64. **Chlaenius perplexus** Dej.
circumcinctus Say.
poeyi Chev.

65. **Rembus laticollis** Lec.

66. **Anatrichis picea** (Mots.).

67. **Oodes amaroides** Dej.

Recorded from Cuba by Gundlach, but I have not yet seen a Cuban specimen.

68. **Stenocrepis (Crossocrepis) sulcatus** Chev.

69. **Stenocrepis (s. s.) insulanus** (J.-Duv.)

70. **Stenocrepis (s. s.) duodecimstriata** (Chev.)
lecontei (Chd.).

71. **Stenocrepis (Stenous) tibialis** (Chev.)
femoralis (Chd.).
pallipes Gundlach, not Reiche.

Gundlach's short description evidently applies to this species rather than to the true *S. pallipes* (Reiche) of South America.

72. **Stenocrepis (Stenous) metallicus** (Dej.)

Stenocrepis (Stenous) subdepressus n. sp.

Of usual form for Stenous, but less convex; black, with greenish or bluish green lustre, head and margins of body scarcely brighter; legs entirely piceous or rufo-piceous, antennæ piceous with three basal joints rufescent. Head shining, nearly impunctate, but with exceedingly fine, rather sparse punctuation; mentum tooth long and acute. Prothorax moderately narrowed in front, slightly behind; sides scarcely sinuate before the right or slightly obtuse basal angles; disk rather strongly flattened basally, finely alutaceous. Elytra each with seven fine, slightly abbreviated, impunctate striæ, seventh finer than others; scutellar stria distinct; intervals flat, finely alutaceous but somewhat shining, third impunctate. Front tarsi of male rather widely dilated, about as in *S. metallicus* Dej. Length ±8½ mm.

Holotype ♂ (Museum of Comparative Zoölogy no. 19520) and 2 (♀ ♀) paratypes from Grande Rivière, Haiti, W. M. Mann.

In Chaudoir's monograph of Stenous (Ann. Soc. Ent. France (6) 2, 1882, pp. 497-) this species runs to *metallicus* Dej., which it resembles in most points of structure, but in addition to being a broader and flatter insect, *subdepressus* is differently colored and has the head practically impunctate, the prothorax slightly more narrowed posteriorly, and the third elytral interval without dorsal punctures The bluish green, almost uniform coloration and slightly depressed form are strongly suggestive of some Selenophorus.

Stenomorphus manni n. sp.

Elongate, parallel, moderately convex; shining rufo-testaceous to piceous brown, lower surface and appendages slightly more rufescent. Head with two rather small, abrupt foveae anteriorly; front smooth. Prothorax elongate in male (about five-eighths as long as elytra), less elongate in female; widest just behind middle; sides parallel (♀) or very slightly converging (♂) anteriorly, somewhat contracted and broadly but slightly sinuate before the rounded basal angles; disk with fine median line and oblique linear basal foveae, also with faint transverse undulate strigæ, surface not punctate. Elytra somewhat emarginate at base; striæ deep and impunctate; intervals convex, third with a series of punctures on inner edge, fifth with six or fewer irregular punctures either at middle or near edges. Sexual tarsal characters as usual in genus; male middle femora only minutely denticulate on lower edge near apex; middle tibiæ straight in both sexes; hind tarsi slender. Length ± 12 (♀)-15 (♂) mm.

Holotype ♂ (Museum of Comparative Zoölogy no. 19525) and 4 (♂ ♀ ♀ ♀) paratypes from Manneville, Haiti, W. M. Mann.

This, the first Stenomorphus to be found in the West Indies, is very close to *rufipes* Lec. of the United States but is slightly more slender, with the middle femora of the male more minutely denticulate and the male middle tibiæ not even slightly arcuate as they are in *rufipes*.

73. **Gynandropus subquadratus** Putz.

Key to West Indian Selenophorus

The following brief and rather artificial key includes chiefly species which I have seen myself. Three other species, marked with asterisks, are merely inserted in the proper places from description, without final distinguishing characters being given. Of species recorded from the West Indies I have been unable to place only *Selenophorus lucidus* Dej., described as *probably* from the Antilles, (near *discopunctatus*), and *subaeneus* Reiche, not known from north of Guadeloupe (probably also near *discopunctatus*). I have been aided in my identifications in this difficult genus by brief notes on some of Putzeys' types from Mr. A. d'Orchymont, and by comparison of specimens with the type of *S. integer* (Fab.) made for me by Dr. Joseph Bequaert.

1. Elytra with series of distinct punctures on second, fifth, and seventh striæ 2
   Elytra without seriate punctures .... *nonseriatus* n. sp.

2. Surface of elytra entirely pubescent; 7-8 mm. .... *pubifer* Putz.
   Most of elytral surface glabrous 3

3. Elytra dark, shining, with bluish, greenish, or cupreous iridescence 4
   Elytra without iridescence 9

4. Basal foveae of prothorax impunctate or nearly so 5
   Basal foveae of prothorax rather closely, though not coarsely, punctate 6

5. Seventh elytral interval near apex greatly swollen laterally, overhanging margin at sinuation; ± 10 mm. .... *carniger* Putz.
   Seventh interval not swollen; 7-8 mm. .... *flavilabris* Dej.

6. Length over 7 mm. 7
   Length under 7 mm. 8

7\. Sides of prothorax parallel, scarcely arcuate; elytral striæ punctulate... *integer* Fab.

Sides of prothorax more arcuate; striæ not punctulate. *chalybeus* Dej.
(and) *propinquus* Putz.
(and) *puertoricensis* Mutchler.

8\. Elytral striæ punctulate...............*striatopunctatus* Putz.

Elytral striæ not punctulate.................*puncticollis* Putz.

9\. Surface of elytra not alutaceous........(refer back to) 5

Surface of elytra alutaceous..10

10\. Color rufous with elytral intervals no. 2 to 5 or 6 blackish 11

Color above nearly uniform...12

11\. Male with basal angles of prothorax slightly prominent posteriorly...*thoracicus* Putz.

Male with posterior angles of prothorax obtusely rounded, like female ....*cinctus* Putz.
and (doubtfully Antillean) **dubius* Putz.

12\. Front shining, not alutaceous 13

Front finely but distinctly alutaceous..........................15

13\. Basal foveæ of prothorax not distinctly punctate; 4½ mm..*parvus* n. sp.

Basal foveæ of prothorax extensively punctate............14

14\. Form relatively broad, less convex; less shining; just over 5 mm.; Cuba ....*solitarius* n. sp.

Narrower and much more convex; head and pronotum highly shining; just under 5 mm.; Haiti.........................
haitianus n. sp.

15\. Basal angles of prothorax right; seriate punctures of elytra much larger than usual 16

Basal angles of prothorax broadly rounded; seriate punctures small 17

16\. Length ±8-9 mm..*pyritosus* Dej.

Length under 8 mm..................................*alternans* Dej.

17. Margins of elytra excised near apex; 4½-5½ mm............
sinuatus Gyll. (and) **mundus* Putz.
and (doubtfully Antillean) **parumpunctatus* Dej.
Elytra only slightly sinuate near apex; 6 mm. and over 18

18. Base of prothorax alutaceous and irregularly punctate; 6-8 mm..*discopunctatus* Dej.
Base of prothorax alutaceous but not punctate...........19

19. Color dull blue; ±11½ mm................*cyaneopacus* n. sp.
Greenish, cupreous, or æneous; not over 8 mm............20

20. Prothorax rather strongly narrowed posteriorly; 7-8 mm..*beauvoisi* Dej.
Prothorax not distinctly narrowed posteriorly; ±6 mm.
latior n. sp.

74. **Selenophorus pyritosus** Dej.

75. **Selenophorus alternans** Dej.

76. **Selenophorus cinctus** Putz.
Selenophorus thoracicus Putz. (♀)
excisus Putz. (♂)

I have seen twelve males and six females of this Haitian species and am convinced that the differences supposed by Putzeys to separate his two species are merely sexual.

77. **Selenophorus flavilabris** Dej.

78. **Selenophorus sinuatus** (Gyll.)
parumpunctatus Chev., & Gundlach, not Dej.

79. **Selenophorus discopunctatus** Dej.
cuprinus Dej.

80. **Selenophorus striatopunctatus** Putz.

Selenophorus parvus n. sp.

Form average, not especially convex; blackish, scarcely æneous; appendages testaceous. Head with front shining, not alutaceous; mandibular scrobes short. Prothorax about a half wider than long (by measurement), rather strongly narrowed posteriorly; basal angles obtuse, rather narrowly rounded; longitudinal impressed line fine but distinct, transverse lines obsolete; disk faintly alutaceous only in region of basal foveæ, which are impunctate. Elytra with humeri not strongly angulate; striæ moderate, impunctate except for small serial punctures on second, fifth, and seventh; scutellar stria practically absent; margin slightly sinuate near apex; intervals alutaceous, glabrous. Apex of prosternum not margined. Hind tarsi slender. Male with front and middle tarsi slightly dilated and biseriately squamulose below. Length 4½ mm.

Holotype ♂ (Museum of Comparative Zoölogy no. 19523) from Coamo Springs, Puerto Rico, Sept. 28, 1929, S. T. Danforth; unique.

This species somewhat resembles a small *S. sinuatus* (Gyll.), but has much less incised elytral apices, better defined angles of prothorax, and differs in other ways.

81. **Selenophorus solitarius** n. sp.

Moderately stout and convex; greenish or æneous black, nor iridescent; appendages testaceous. Head with front impunctate, not distinctly alutaceous (except faintly posteriorly); mandibular scrobes short. Prothorax about a half wider than long (by measurement), rather strongly narrowed behind; basal angles broadly rounded; median longitudinal line distinct, anterior transverse impression faint, posterior absent; disk moderately convex, rather shining; basal foveæ alutaceous and rather closely and coarsely punctate. Elytra with humeri angulate; striæ moderate, not punctate except for moderate serial punctures on usual striæ; scutellar stria present; margin broadly, moderately sinuate near apex; intervals alutaceous, glabrous. Apex of prosternum not margined. Posterior tarsi rather long. Male with front and middle tarsi slightly dilated and biseriately squamulose. Length ±5½ mm.

Holotype ♂ (American Museum) from Zaza del Medio, Cuba, Sept. 3, 1913; 1 ♀ paratype (United States National Museum) from Cayamas, Sta. Clara, Cuba, Jan. 14, E. A. Schwarz.

Superficially this species is rather like a small, stout *beauvoisi* Dej., but is easily separable as shown in the key.

Selenophorus haitianus n. sp.

Not especially broad, but very convex; piceous without distinct metallic or iridescent lustre; appendages testaceous. Head with front impunctate, very shining; mandibular scrobes short. Prothorax slightly less than a half wider than long (by measurement), rather strongly narrowed posteriorly; basal angles obtuse, narrowly rounded; median impressed line fine but distinct, transverse impressions obsolete; disk convex, very shining; base, especially basal foveæ, rather finely and closely punctate (punctures fainter at middle of base.) Elytra with humeri angulate; striæ moderately impressed, impunctate except for usual small serial punctures; scutellar stria present; margin moderately sinuate near apex; intervals alutaceous, glabrous. Apex of pronotum not margined. Hind tarsi long. Length ± 5 mm.

Holotype ♀ (Museum of Comparative Zoölogy no. 19524) from Manneville, Haiti, W. M. Mann; 1 ♀ paratype (American Museum) from Pont Beudet, Haiti, March 3-4, 1922, altitude about 100 ft.

As compared with its closest relatives, which seem to be *latior* and *parvus,* this species differs not only as shown in the key, but in its much more convex and more shining (though not metallic) anterior parts.

82. **Selenophorus chalybeus** Dej.

Selenophorus cyaneopacus n. sp.

Subdepressed; bluish or purplish black, dull, not shining; legs piceous; labrum, palpi, and antennæ rufo-piceous to rufous. Head: mandibular scrobe reaching about to apex of labrum; labrum very deeply emarginate in front; bottom of emargination would be acute if angle were not narrowly rounded; antennæ moderate, not quite reaching base of prothorax; front finely alutaceous. Prothorax large, just under a half wider than long, subquadrate, slightly narrowed behind; basal angles broadly rounded; margin rather strong at sides, less so basally; disk finely alutaceous, depressed near basal angles, base finely and inconspicuously wrinkled, not obviously punctate. Elytra finely striate, striæ not distinctly punctate except for minute serial punctures on second, fifth, and seventh; scutellar stria rather long; intervals flat, alutaceous, but without evident punctuation; humeri distinct; subapical sinuation of margin slight. Posterior tarsi long. Prosternum not margined at apex. Male with front tarsi rather narrow; first joint longer but not wider than second, spinulose but not squamulose beneath; joints two to four distinctly but narrowly squamulose; middle tarsi almost without sexual clothing; hind tibiæ straight; middle tibiæ nearly straight, only slightly arcuate. Length $11\frac{1}{2}$ mm.

Haiti: holotype ♂ (Museum of Comparative Zoölogy no. 19526) from Cap Haitien, W. M. Mann; 3 paratypes (♂ ♀ ♀) from Jean Rabel, Feb., E. C. & G. M. Leonard (United States National Museum); 1 ♀ paratype from Port-au-Prince, Aug., G. N. Wolcott (U. S. N. M.).

The outstanding structural characters of this Selenophorus are the deep emargination of the labrum, deeper than in any other species I have seen, and the reduced squamulation of the male tarsi. The emargination of the labrum is said by Putzeys (Ent. Zeit. Stettiner 1878, Vol. 39, p. 4) to be variable in this genus and to reach its greatest development in *S. batesi* Putz., which is otherwise quite different from the present species. Bates, in "Biologia" (p. 274), under *S. hepburni,* comments on the reduction of the squammules of the male tarsi in some Selenophorus. He found the character usually associated with arcuation of the male middle tibiæ, but in the present species the tibiæ are no more arcuate than in *S. chalybeus* Dej. The new species probably has a superficial resemblence to *anceps* Putz. and *opacus* Putz., of the Argentine and Brazil respectively, and to one or two other species, but differs, to judge from descriptions, not only in minor details but in having the labrum much more emarginate. It is a rather atypical Selenophorus, but cannot be referred to any other genus at present described.

Selenophorus latior n. sp.

Rather stout, not especially convex; brownish black, not iridescent and without evident metallic lustre; appendages rufo-testaceous, antennæ darker. Head with front impunctate but finely alutaceous; madibular scrobes short. Prothorax about a half wider than long (by measurement), scarcely narrowed posteriorly, so that it appears unusually wide; basal angles rounded but not especially broadly so; median line distinct, transverse impressions obsolete; disk alutaceous, more obviously so in basal foveæ, in which there are very indistinct traces of punctuation. Elytra with humeri angulate; striæ moderate, inpunctate except for rather small serial punctures on usual striæ; scutellar stria present; margin only slightly sinuate before apex; intervals alutaceous, glabrous. Apex of prosternum not margined. Hind tarsi rather long. Male with front and middle tarsi moderately dilated and biseriately squamulose below. Length ± 6 mm.

Holotype ♂ (American Museum) from Haina, Santo Domingo, G. N. Wolcott; 1 ♀ paratype (United States National Museum) from Pt. Congrejos, Puerto Rico, Feb. 8, 1920, G. N. Wolcott.

This species is easily recognized by the unusual width of the prothorax at base, as well as by other characters given in the key.

Selenophorus nonseriatus n. sp.

Convex, glabrous, shining; blackish, with more or less strong élytral iridescence; appendages, labrum, and tip of last ventral testaceous; mandibles, elytral suture and lateral margins (very narrowly) somewhat rufescent. Head shining, finely bi-impressed in front; antennæ rather stout; mandibular scrobes moderate. Prothorax subcordate, about a half wider than long; sides rounded anteriorly, broadly but slightly sinuate before the obtuse but distinct basal angles; lateral margin narrow; disk with transverse impressions and basal foveæ vague, median line distinct, surface impunctate. Elytra with striæ entire, moderately deep, faintly irregular but not distinctly punctate; humeri subangulate; margin near apex barely sinuate; serial punctures of second, fifth, and seventh striæ absent. Prosternum not margined. Male front and middle tarsi slightly dilated, biseriately squammulose; first joint of front tarsus not larger than second; hind tarsi short, joints three and four scarcely or not longer than wide. Last ventral narrowly emarginate at apex (♂) or not (♀), also sinuately emarginate each side (both sexes). Length $\pm 5\frac{1}{2}$ mm.

Holotype ♂ (United States National Museum) and 2 (♀♀) paratypes (1 in Museum of Comparative Zoölogy, no. 19528) from San Francisco Mts., Santo Domingo, Sept. 14 and "Sept.", A. Busck; 1 ♂ paratype from Claremont, Jamaica, March 14 (American Museum).

The genus to which this species should be referred is doubtful. However, it is a nearly typical Selenophorus except for the absence of the usual series of elytral punctures, and it seems better to place it in this genus temporarily rather than to describe a new genus in this difficult tribe without a complete generic revision. Superficially, except for its completely striate elytra, the new species rather resembles *Bradycellus obsoletus* Say of Mexico, but it differs greatly in microscopic structure.

83. **Bradycellus (Stenocellus) festinans** Csy.

84. **Bradycellus (Stenocellus) cubanus** n. sp.

Elongate, not very convex (about as in *Stenocellus rupestris* Say); irregular rufous to rufescent piceous, suture and outer margins of elytra paler; legs and mouth parts testaceous; antennæ brown with two basal joints paler. Head rather short and broad, eyes rather prominent; front normal for *rupestris* group, indistinctly bifoveate between anterior edges of eyes, with a short, oblique impressed line from inner edge of eye to fovea; front also with median puncture; mentum toothed. Prothorax about three tenths wider than long, narrowed behind, with basal angles very obtuse and not even minutely prominent, but not rounded; disk with strong median longitudinal and subobsolete transverse impressions; basal foveæ broad and shallow, finely alutaceous and with numerous rather coarse punctures. Elytra subparallel, evenly conjointly rounded at apex; striæ entire, moderately impressed, impunctate; no scutellar stria; intervals slightly convex, very shining, without trace of alutaceous microsculpture; one dorsal puncture on each third interval about a third from apex. Male tarsi slightly dilated, sparingly biseriately squamulose below. Length 3½-4½ mm.

Holotype ♂ (United States National Museum) from Cayamas, Sta. Clara, Cuba, Dec. 26, E. A. Schwarz; 1 ♀ paratype (Museum of Comparative Zoölogy no. 19529) from the same locality, Baker; 1 ♀ paratype from Cumanayagua, Cuba, June 13, F. de Zayas (collection Estación E. Agronómica, Cuba); 1 specimen in poor condition from Cuba, Poey Collection no. 569 (Philadelphia Academy of Sciences).

This species belongs to the difficult *rupestris* group of Stenocellus. It differs from *rupestris* and the latter's closest relatives in having the basal angles of the prothorax not minutely prominent; from *congener* Lec., *nubifer* Lec., *ventralis* Lec. (types of all three seen), and *flohri* Bates (series seen) in lacking the fine, transverse, alutaceous microsculpture of the elytra; and from *festinans* Csy. in being broader, less convex, with shallower elytral striæ and less rounded prothoracic angles.

The presence or absence of microsculpture on the elytra is apparently a constant specific character in this genus. For instance, it is uniformly present in a series of 26 specimens of *congener* Lec. from Brownsville, Tex., is uniformly present also in the 9 specimens of the following new species, and is uniformly undetectable in a series of 8 specimens of the Mexican *nigrellus* Bates which I have seen. I do not know of any species in which the sculpture varies in specimens from a single locality.

85. **Bradycellus (Stenocellus) velatus** n. sp.

Piceous, more rufescent below; suture and mouth always and base of elytra and humeri and (vaguely) prothorax sometimes rufescent; apex and side margins of elytra posteriorly and epipleuræ and side margins of prothorax below more or less testaceous; appendages pale testaceous. Head with a deep, oblique impressed line running forward from the inner margin of each eye; eyes rather prominent; front faintly alutaceous, with faint puncture at middle; mentum toothed. Prothorax rather subcordate, about a quarter wider than long; basal angles obtuse but distinct, preceded by a slight sinuation of the sides; basal foveæ broad and vague, distinctly but variably punctate; disk with median line distinct, transverse impressions sub-obsolete, surface with faint silky alutaceous lustre. Elytra parallel, evenly conjointly rounded at apex; scutellar stria absent, striation otherwise complete, regular, impunctate; intervals slightly convex, faintly alutaceous, third with a puncture near second stria behind middle. Male tarsi scarcely dilated, with scanty biseriate squamulation. Length ±3 mm.

Holotype ♂ (Museum of Comparative Zoölogy no. 19530) and 8 paratypes from Soledad (near Cienfuegos) Cuba, June, Oct. 25-Nov. 23, some taken in flood debris; 1 specimen in poor condition from Cuba, Poey Collection no. 597 (Philadelphia Academy of Sciences); 2 paratypes from Rio Piedras, Puerto Rico, Sept. 8 and July, coll. by Alsina (1 returned to S. T. Danforth).

This species is very similar to *Bradycellus tantillus* (Dej.) of the United States, but differs (as shown by comparison with specimens of *tantillus* in the Leconte Collection and with a series from Florida in my own collection) in being slightly broader, less shining, and with better defined posterior thoracic angles. It is even closer to *B. nigrellus* Bates of Mexico and Guatemala, of which there is a series of cotypes in the Museum of Comparative Zoölogy, but differs in its uniformly duller lustre.

86. **Acupalpus (Stenolophus) ochropezus** (Say).

87. **Acupalpus (Stenolophus) convexulus** n. sp.

Convex, moderately shining; nearly uniform piceous black; mouth parts, two basal joints of antennæ, and legs testaceous; outer joints of antennæ (last four missing) brown. Head short, broad, with moderately prominent eyes, frontal sulci subobsolete; front with distinct median puncture; mentum without tooth. Prothorax very convex, not depressed at sides, just over a third wider than long (by measurement); lateral margins narrow; basal angles strongly but somewhat obtusely rounded; disk with impressed lines faint; basal foveæ vague and shallow, impunctate. Elytra convex, rather short, subparallel, evenly conjointly rounded apically; striæ rather fine, impunctate; scutellar stria moderately long, slightly impressed; intervals faintly convex; one discal puncture nearly on second stria about a fourth from apex. Length 3½ mm.

Holotype ♀ (United States National Museum) from Baraguá, Camagüey, Cuba, June 5, 1932, at light, L. D. Christenson; unique.

Without the male it is impossible to be absolutely sure of the genus in which this species should be placed, but all nonsexual characters as well as the general appearance of the insect are as in Stenolophus. Among the North American species of the latter, the Cuban one is most like *conjunctus* (Say) but is much more convex, with a more transverse, differently shaped prothorax.

88. **Agonoderus infuscatus** Dej.

89. **Masoreus (Macracanthus) brevicillus** Chev.
brevicollis Leng & Mutchler (err.)

90. **Masoreus (Aephnidius) ciliatus** Mutchler (Pl. 5, fig. 9)

This species is described in a supplement (p. 130) following the present paper.

91. **Lebia bitæniata** Chev.

92. **Lebia cyanea** Dej.
pleurodera Chd.

93. **Lebia viridis** Say
cyanea Chd., not Dej.

94. **Lebia collaris** Dej.

95. **Lebia (Dianchomena) abdominalis** Chd.

96. **Lebia (Dianchomena) solea** Hentz

97. **Gallerucidia dimidiata** Chd.

This species, which was described from Cuba, is unknown to me.

98. **Phloeoxena plagiata** n. sp.

Form nearly as in following species (see fig.), very broad, depressed; head and thorax piceous black, moderately shining, but with surface finely reticulate; elytra very dull opaque blackish with narrow lateral margin and large, regular, transversely oval spot extending from near middle to near apex, and laterally to the sixth striæ, rufo-testaceous; lower surface piceous except metasterna and abdomen rufo-testaceous, latter with narrow black margin; appendages rufo-testaceous. Head bi-impressed anteriorly, front with a median longitudinal puncture. Prothorax between three and four tenths wider than long; side margins rather narrow anteriorly, slightly broader posteriorly; basal angles would be right except are narrowly rounded; foveæ in angles very broad and indistinct, more alutaceous than pronotal disk. Elytra with curiously broad, shallow striæ, much as in *P. signata* (Dej.) but even less distinct; intervals slightly convex, united and slightly more prominent at apex as usual in genus; sinuation of apex less pronounced than in *signata;* each elytron with an ocellate puncture at extreme base of second stria, also with three dorsal setigerous punctures, the first on the third stria about a sixth from base, second and third on second stria before apical third and near apex. Length just under 5 mm.

Holotype ♂ (American Museum) a unique from Guantánamo, Cuba, March 3, 1914, taken in a tree, C. T. Ramsden.

The simply plagiate color pattern of this species is unique in the genus, except for the following new species.

99. **Phloeoxena imitatrix** n. sp. (Pl. 5, fig. 10.)

Superficially almost exactly similar to *plagiata* (above), which it resembles in color except that the elytral macula is smaller and the ventral surface rufous to rufo-piceous.

Structurally, *imitatrix* differs in having the prothorax slightly narrower, about a fourth wider than long (by measurement), with sides of base more oblique and posterior angles more obtuse, though preceded by a slight sinuation of the sides; in having the humeri more evenly rounded; in having the elytral striæ practically obliterated, faintly indicated only in favorable light; and in lacking the anterior dorsal puncture of each elytron. The position of the puncture (about a fifth from base) is usually indicated by a faint, broad, indefinite, unpunctiform impression, without a seta. The extreme basal ocellate puncture and the two posterior pairs of setigerous punctures, about a fourth and a twelfth from apex, are present. Length $\pm 4\frac{1}{2}$-5 mm.

Holotype ♂ (United States National Museum) and 2 (♀ ♀) paratypes (1 in Museum of Comparative Zoölogy, no. 19531) from Cayamas, Sta. Clara, Cuba, March 3, E. A. Schwarz; 1 paratype from Cuba, Poey Collection no. 954 (Philadelphia Academy of Sciences).

The color pattern at once distinguishes this species from all previously known ones except the preceding.

100. **Phloeoxena schwarzi** n. sp.

Broad, but less so than the two preceding species; depressed; piceous black, head and prothorax slightly shining but with reticulate microsculpture; elytra duller, opaque; below piceous, rufescent medially; appendages testaceous. Head bi-impressed anteriorly, front with median impression or puncture. Prothorax subquadrate, a quarter to a third wider than long (by measurement), sides slightly sinuate before the posterior angles, which would be right except are narrowly rounded; side margins narrow anteriorly, broader posteriorly; basal foveæ broad but poorly defined. Elytra visibly but very shallowly striate; striæ formed as usual in genus by slight, broad undulations of the surface; each elytron with three dorsal punctures as in *plagiata*. Length $\pm 4\frac{1}{2}$-5 mm.

Holotype ♂ (United States National Museum) and 3 (♂ ♀ ♀) paratypes (pair in Museum of Comparative

Zoölogy, no. 19532) from Cayamas, Sta. Clara, Cuba, Jan. 17, Mar. 8 & 9., E. A. Schwarz.

The lack of plagiation and the narrower form distinguish this species from the two described above; the striation of the elytra is intermediate; the form of the prothorax and presence of anterior dorsal puncture of elytra are as in *plagiata*. Of other described species this is apparently close only to *unicolor* Chd. of Mexico, which is described as having the antennæ brown with pale bases and the legs brown with reddish articulations. Antennæ and legs are clear testaceous in the Cuban species.

101. **Coptodera festiva** Dej.

102. **Coptodera unicolor** Chd.

103. **Microlestes poeyi** (J.-Duv.)

104. **Apristus sericeus** n. sp.

Piceous, silvery æneous above, appendages piceous; upper surface very heavily alutaceous, lower surface less so. Prothorax about a third wider than long (by measurement), much narrowed behind; sides sinuate before the almost right but only slightly prominent basal angles. Elytra with striæ almost entire but very broad and shallow, faintly irregular but not punctate; third stria with two large and conspicuous impressions, just before middle and near apical fourth. Length $\pm 3\frac{1}{2}$ mm.

Holotype (Museum of Comparative Zoölogy no. 19533) and 7 paratypes from Soledad (near Cienfuegos) Cuba, Oct. 19, Dec. 3; all taken running on dry sand in the sun on the banks of the Arimao River.

This species may be distinguished from all other American Apristus by its shallow elytral striæ combined with very heavily alutaceous surface. The species is apparently unique also in the large size of the dorsal punctures of the elytra. The genus has not been known before from the West Indies.

105. **Callida rubricollis** Dej.
elegans Chd.

106. **Callida tinctula** n. sp.

Small, elytra unusually broad for genus; head and prothorax brownish rufous; elytra rufescent with dull green lustre, brighter laterally; appendages testaceous. Head with prominent eyes; front smooth, except slightly alutaceous anteriorly, with large median puncture, and with slight longitudinal strigulation at sides in front of eyes. Prothorax less than a fourth wider than long, subcordate; posterior angles right, very minutely rounded; lateral margins moderate; median impressed line strong, anterior transverse impression obsolete, posterior distinct but not strong; disk moderately transversely wrinkled, irregularly and sparsely punctate near base and apex and beside middle line. Elytra rather broad but subparallel; independently emarginate-truncate at apex, with outer angle rounded; striæ moderate, punctulate; intervals barely convex, dull and alutaceous; third interval tripunctate. Inner wings fully developed. Mesosternum not tuberculate between coxæ. Lobes of fourth tarsal joints oval, slightly narrowed at base. Last ventral of female quadripunctate each side, broadly truncate apically, slightly sinuate each side. Length 5½ mm.

Holotype ♀ (United States National Museum) from Cayamas, Sta. Clara, Cuba, Feb. 2, E. A. Schwarz; unique.

This species is generally similar to *Callida decolor* Chd., described from Martinique and seen by me from Haiti, and will probably prove to have similar male tarsal squammulation, with small squammules on the first three joints of the middle tarsi. It differs from *decolor* in being smaller, with elytra submetallic, and with the prothorax narrow and with relatively narrower margins. It is apparently not at all close to anything known from Central America.

107. **Plochionus (s. s.) pallens** (Fab.)

108. **Plochionus (Menidius) bicolor** Notman

109. **Andrewesella (Euproctus) trivittata** (Lec.)

110. **Apenes coriacea** (Chev.)

111. **Apenes sulcicollis** (J.-Duv.)

112. **Apenes parallela** (Dej.)

113. **Apenes (s. s.) delicata** n. sp.

Form as usual in *sinuata* group; rather broad, depressed; æneous black with more or less piceous tinge; elytra each with humeral spot (extending inward to about fifth stria, back about a fifth of elytral length) and together with a rather broad, undulate transverse supapical fascia yellow; appendages brownish yellow. Head with front not distinctly alutaceous, very finely and sparsely punctate, not strigulose; antennæ short, middle joints scarcely longer than wide. Prothorax about a third wider than long (by measurement) subcordate; sides briefly sinuate before the basal angles, which are minutely almost right; disk alutaceous and with very fine sparse punctuation and indistinct transverse strigulation. Elytra with striæ moderate, not punctate; scutellar stria long; intervals flat or (externally) slightly convex, heavily alutaceous; third interval with two rather broadly but shallowly impressed setigerous punctures about a fourth from base and near middle. Length $\pm$5-5½ mm.

Holotype ♂ (Museum of Comparative Zoölogy no. 19534) and 3 paratypes from Soledad (near Cienfuegos) Cuba, June 27 (G. Salt), Oct. 18-Nov. 7; 3 paratypes (United States National Museum) from Cayamas, Sta. Clara, Cuba, Mar. 15, May 20, and Dec. 26, E. A. Schwarz; 1 paratype from Cuba, Poey Collection no. 822 (Philadelphia Academy of Sciences). One of my specimens was taken by sifting in woodland, another in a flooded plowed field.

This species is near *sinuata* Say of the United States, but is smaller, with head much less punctate. It answers rather well to the description of *lunulata* Chd. of Yucatan, but M. René Oberthür, who has been kind enough to compare a specimen of the Cuban species with Chaudoir's type, writes that the latter is considerably larger, with a broader thorax and more elongate humeral mark.

114. **Apenes lata** n. sp.

Also of the *sinuata* group, and so similar to the preceding (*delicata*) that a brief comparison will be sufficient for description. The form of *lata* is relatively broader; color, sculpture, and marking similar. Prothorax much broader, a half or more wider than long (by measurement). Size larger, ±7-8 mm.

Holotype ♂ (American Museum) and 2 paratypes (1 in Museum of Comparative Zoölogy, no. 19535) from Mangrove Cay, Andros Island, Bahamas, May-June, 1917, W. M. Mann. I have also seen a specimen from Soledad (near Cienfuegos) Cuba, July 1, B. B. Leavitt, but the specimen is not at present available for description.

A specimen of this species also has been sent to M. Oberthür, who finds it different from anything in his collection. I had thought from Chaudoir's description that it might be *fasciata*, described without locality, but M. Oberthür writes that the type of *fasciata* has a more cordiform prothorax, and that the West Indian species is perfectly distinct.

Apenes lævicincta n. sp.

Form of *sinuata* group; head and prothorax æneous rufopiceous, ground color of elytra nearly same; elytra each with humerus, a fragmentary oblique fascia at basal third, narrow lateral margin, and common subapical transverse fascia testaceous, also with a slightly oblique transverse shining black fascia common to both elytra just in front of subapical testaceous mark, also with faint dark spotting around anterior oblique fascia and on the ninth interval; lower surface mostly piceous, appendages and middle of abdomen rufous or testaceous, base of femora slightly infuscate. Head alutaceous and finely and sparsely punctate, not strigulose; antennæ short, middle joints about as wide as long. Prothorax transverse, nearly a half wider than long (by measurement), subcordate; sides briefly sinuate before basal angles, which are minutely almost right; disk alutaceous and with fine sparse punctuation and indistinct transverse strigulation. Elytra finely striate, striæ finely punctulate, scutellar stria long; intervals nearly flat, alutaceous except in transverse black fascia which is smooth and shining, third interval with two broadly impressed punctures almost on second stria (relation to striæ probably variable) about a fourth from base and near middle. Length just over 5 mm.

Holotype ♂ (American Museum) unique, from Port-au-Prince, Haiti, about 300 ft. altitude, Apr. 8-11, 1922.

This species is at once distinguishable from all others of the *sinuata* group, including the two described above, and I think from all other Apenes too, by the black, shining fascia just preceding the subapical testaceous one. The alutaceous head and punctulate elytral striæ further differentiate this species from the two preceding.

115. **Eucærus insularis** n. sp.

Stout, convex; piceous, elytra with iridescent lustre; antennæ with first six joints brown, seventh vaguely bicolored, outer joints whitish; palpi and legs irregular brownish yellow, posterior femora darker. Head alutaceous, antennæ relatively stout, middle joints about three times as long as wide. Prothorax cordate, about four tenths wider than long (by measurement), sides sinuate before the obtuse but distinct posterior angles; disk alutaceous. Elytra shining, striæ rather fine, entire, not punctate; intervals barely convex; third stria with inconspicuous setigerous puncture about a fourth from base, second stria with similar punctures near middle and about a fifth from apex. Inner wings vestigial. Male with one, female with two setæ each side last ventral. Length $\pm 3\frac{1}{2}$ mm.

Holotype ♀ (Museum of Comparative Zoölogy no. 19536) from Soledad (near Cienfuegos) Cuba, June, probably taken in flood debris; 3 paratypes (United States National Museum) (♂ ♀ ♀) from Cayamas, Sta. Clara, Cuba, Jan. 17 and Mar. 11, E. A. Schwarz.

This species is very close to *Eucærus varicornis* Lec., of which I have seen nine specimens, including the type, from South Carolina, Georgia, Florida, Alabama, and Louisiana, but differs in having the antennæ slightly stouter, the posterior angles of the prothorax more distinct, and the color darker. The genus has not been known before from the West Indies.

116. **Pentagonica flavipes** (Lec.)

117. **Pentagonica nigricornis** n. sp.

bicolor (Gundlach) (Rhombodera), not Lec.

Form as usual in Pentagonica; surface alutaceous, slightly shining; black; entire prothorax, narrow reflexed margins of elytra, and legs yellow; palpi brown; antennæ entirely black. Prothorax slightly wider than in *flavipes*, eight or nine tenths wider than long. Elytra moderately striate, striæ irregularly subpunctate; intervals slightly convex. Length ±4-5 mm.

Holotype (Museum of Comparative Zoölogy no. 19537) and 2 paratypes from Soledad (near Cienfuegos) Cuba, Nov. 1 & 2; all from flood debris.

This differs from all previously described New World Pentagonica in type of coloration combined with uniformly black antennæ. It resembles *picticornis* Bates of Guatemala except that the antennæ (of *nigricornis*) are not bicolored and there is less yellow on the lateral margins of the elytra. Gundlach's notes under "Rhombodera bicolor" show that he really had this species before him.

Pentagonica divisa n. sp.

atrorufa (Gundlach) (1893, An. Soc. Espanola H. N. 22, p. 292; Rhombodera), not Reiche.

bicolor (Leng & Mutch.) (1917, Bull. American Mus. N. H. 37, p. 195), not Lec

Form as usual in genus; head and prothorax above and below yellow testaceous, prothorax above with sides (but not margins) anteriorly faintly dusky to more or less strongly infuscate; elytra dull black with narrow pale outer margins; hind body piceous below; antennæ testaceous with first joint commonly and next three rarely slightly darker; legs testaceous. Head and prothorax as usual in genus; alutaceous; prothorax seven or eight tenths wider than long. Elytra unusually deeply striate. Length ±4-4½ mm.

Puerto Rico: holotype (Museum of Comparative Zoölogy no. 19538) from Yauco, F. Delgado: paratypes from Mayagüez, S. Vicks; Jayuya, C. Gonzales; Aguada, G. Lopez; and Boquerón, F. Mora; all December (collection of S. T. Danforth and M. C. Z.); Bayamon, May 14, at light (United States National Museum).

This species resembles *atrorufa* Reiche (Brazil), *bicolor* Lec. (United States), and *semifulva* Bates (Central America) in color, but differs from all of them in having testaceous, not dusky, antennæ, and from the last two at least, in having deeper elytral striæ.

118. **Colliuris (Odacanthella) picta extrema** Liebke
picta (Gundlach), not Chd.

118-a. **C. (O.) p. suturalis** (Chd.)
concluda Liebke.

The American Museum possesses one specimen each of *suturalis* Chd. and *concluda* Liebke, the latter differing from the former only in that the subapical red spots of the elytra are connected across the suture. These specimens were evidently taken together, "at the foot of a *Jatia* fence post," between Manati and Los Canos, Guantánamo, Cuba, July 27, C. T. Ramsden. It does not seem to me worth while to recognize and name color forms of species of beetles when, as in this case, color has no geographical significance, so I suggest that *concluda* be reduced to synonymy. The entirely unspotted form (*extrema* Liebke) may possibly have geographical standing in Cuba, so it may stand for the present.

119. **Colliuris (Odacanthella) gundlachi** n. sp.

Elongate; piceous, elytra translucent apically, each with a conspicuous subapical red spot and rarely a rather small reddish mark about a third from base near outer margin; antennæ brownish, joints two and three vaguely more rufescent; middle and hind tibiæ more or less spotted or banded with whitish beyond the middle; femora pale basally, brown apically. Head: front smooth. Prothorax about two and four tenths as long as greatest width, with usual median line, with faint traces of transverse rugæ only basally, otherwise smooth; anterior angles not at all produced. Elytra with striæ almost obliterated even in basal third, where only indistinct traces of punctate striation are visible; outer apical angles approximately right; apex sinuato-truncate. Length 6½-8 mm.

Holotype (Museum of Comparative Zoölogy no. 19539) and 34 paratypes from Soledad (near Cienfuegos) Cuba, June, Oct. 19-Nov. 7; taken in a variety of damp places.

In Liebke's recent key of Odacanthella (1930, Mitt. Zool. Mus. Berlin 15, pp. 658 -) this species runs to *portoricensis* Liebke, differing from *tetrastigma* Chd. and *lioptera* Bates in its nearly uniformly colored antennæ. From *portoricensis*, which I have seen from Puerto Rico and Haiti, *gundlachi* differs in its maculate tibiæ, slightly smaller size, and more nearly complete obliteration of the rugæ of the prothorax and the striæ of the elytra.

120. **Colliuris (Pseudocasnonia) noah** n. sp. (Pl. 5, fig. 11.)

Small, slender, convex; shining piceous, elytra sometimes speckled with black in strong light; appendages and narrow elytral margin pale testaceous. Head short; sharply, obliquely constricted behind the eyes; front smooth and shining. Prothorax rather short, slightly less than twice as long as wide, truncate anteriorly, anterior angles not at all produced; disk faintly, transversely rugose, shining and impunctate except in basal and apical transverse impressions, with distinct median longitudinal impressed line; side margins each with a single setigerous puncture just before middle. Elytra narrow, only slightly dilated behind the middle, lateral margins narrow; apices sinuato-truncate, outer apical angles obtuse, narrowly rounded; elytral surface entirely shining, not alutaceous; marginal stria deep, inner impressed striæ nearly or entirely absent, but several striæ indicated by rows of widely spaced punctures in basal third of elytron; third interval with about five, fifth and seventh with fewer, setigerous punctures. Length ±5 mm.

Holotype (Museum of Comparative Zoölogy no. 19540) and 2 paratypes from Soledad (near Cienfuegos) Cuba, Oct. 21; all taken in floating debris during a very heavy flood.

In Liebke's table of Pseudocasnonia (*l. c.*, 664 -) this species runs to *signata* Chd. which, however, has the elytra strongly ridged, not smooth as in *noah*. So far as I can find, the latter has no really close relatives.

121. **Leptotrachelus dorsalis** (Fab.)

I have seen no Cuban specimen of this species, which is recorded by Gundlach, however.

122. **Galerita tenebricosa** Klug.
vetula Chev.

123. **Galerita ruficollis** Dej.
erythrodera Brullé
insularis Cast.
thoracica Chev.

Galerita microcostata n. sp.

Moderately stout for genus; black, head with two small red spots between eyes, tibiæ and tarsi piceous, antennæ brownish rufous. Head rather large, with sides angulate, not directly narrowed, behind eyes; front coarsely punctate. Prothorax subquadrate, very slightly wider than long (by measurement); sides broadly sinuate before basal angles, which would be right except are narrowly rounded; disk closely punctate, median line very fine, transverse impressions sub-obsolete. Elytra very slightly narrowed basally, humeri rather distinct; each elytron with nine pairs of fine longitudinal costæ, with unpaired intermediate costæ developed externally but obsolete near suture. Inner wings present. Length 15½ mm.

Holotype ♂ (Museum of Comparative Zoölogy no. 19541) from Mayagüez, Puerto Rico, May 12, 1932, E. Figarella, received from S. T. Danforth; unique.

This species is a close relative of *Galerita americana* (L.) of South America and the Lesser Antilles (I have seen nine specimens from Guadeloupe), but has the prothorax and appendages dark and the inner unpaired costæ of the elytra obsolete, not conspicuous as in *americana.* The two species are very similar in form.

Key to the West Indian Species of Pseudaptinus

Since I am describing several new species of Pseudaptinus and recording others from the West Indies for the first time, it seems best to publish the following key:

1. Posterior angles of prothorax basal, not prominent .... (Pseudaptinus *s. s.*) 2
   Posterior angles of prothorax before base, minutely prominent (subgenus Thalpius) 4
2. Body irregular testaceous and brown, head black; antennæ not sharply bicolored; length just under 5 mm........ *apicalis* n. sp.
   Uniform piceous or black; antennæ sharply bicolored; length 5-6 mm........ 3
3. Side margins of prothorax distinct....*marginicollis* n. sp.
   Side margins of prothorax obsolete ....*thaxteri* n. sp.
4. Body bicolored, black or brown with rufous prothorax; punctuation rather fine and close; ± 5 mm........ *insularis* Mutchler
   Not bicolored; punctuation variable........ 5
5. Pinkish brown, upper surface opaque, finely and very closely punctate; $\pm 5\frac{1}{2}$ mm........ *cubanus* Chd.
   Rufous, plain brown, or black; rather closely but more coarsely punctate, surface of head and thorax rather shining between punctures 6
6. Antennæ slender, middle joints about twice as long as wide; elytra usually with a vague post-median dark area........ *dorsalis* Brullé
   Antennæ stout, middle joints scarcely longer than wide. 7

7. Elytral striæ rather irregularly but seriately punctate except apically, the punctures much coarser than those minutely prominent.................................*pygmæus* Dej. of the intervals; prothorax narrower, basal angles more Elytral striæ not evidently seriately punctate, not more coarsely punctate than intervals; prothorax broader, basal angles more broadly prominent........*deceptor* n. sp.

124. **Pseudaptinus (s. s.) apicalis** n. sp.

Convex, rather elongate, finely pubescent; head piceous black; prothorax rufo-testaceous; elytra brown, vaguely paler near suture anteriorly, with about apical fifth testaceous. Head: antennæ stout; eyes rather large and prominent; front finely alutaceous; moderately punctate. Prothorax convex, comparatively little dilated apically; side margins indistinct; disk rather shining, rather closely punctate, with distinct median line, without transverse rugæ. Elytra convex, deeply striate, striæ not punctate; intervals finely alutaceous; apices obliquely subtruncate, with outer angles broadly rounded. Length just under 5 mm.

Holotype (Museum of Comparative Zoölogy no. 19542) unique, from Soledad (near Cienfuegos) Cuba, Nov. 13.

Among described species this is close apparently only to *Pseudaptinus subfasciatus* Chd. of Brazil, which, however, has the elytra much more extensively pale. M. Oberthür has compared the Cuban specimen with Chaudoir's type and states that they are different species. From *S. leprieuri* (Buquet) of Cayenne, which must be superficially similar, *apicalis* differs in its non-rugose prothorax and in other ways.

125. **Pseudaptinus (s. s.) marginicollis** n. sp.

Elongate, rather convex, finely pubescent; dull piceous black, rufescent below; antennæ with three basal joints mostly black, fourth and fifth bicolored, outer joints whitish; palpi dark, tipped with whitish; legs testaceous. Head with eyes rather large and prominent; antennæ rather slender; front alutaceous, moderately punctate. Prothorax narrow, about a fifth longer than wide (by measurement), but appearing longer, widest near the front; posterior angles not prominent; lateral margins distinct, narrowly raised; disk alutaceous, punctate like head, with distinct median impressed line abbreviated at base and apex. Elytra deeply, nearly evenly striate; striæ impunctate; intervals convex, alutaceous. Length 5-6 mm.

Holotype (Museum of Comparative Zoölogy no. 19543) and 9 paratypes from Soledad (near Cienfuegos) Cuba, Sept. 2 (B. B. Leavitt), June, Oct. 21, Nov. 7 & 9, most of the specimens from flood debris; 1 paratype from Baraguá, Cuba, Oct. 28, at light, L. C. Scaramuzza (United States National Museum).

This and the following species must be near *Pseudaptinus elegans* (Chd.) of Brazil, but are said by M. Oberthür, to whom I am indebted for comparisons of West Indian specimens with Chaudoir's type, to be distinct. I hope in my next paper to be able to publish the distinguishing characters. Both West Indian species, especially the one from Grenada (below) are near *Ps. lecontei* Dej. of the United States, too, but *lecontei,* of which I have seen several specimens, has the prothorax more dilated anteriorly and is more shining.

Pseudaptinus (s. s.) thaxteri n. sp.

Exceedingly similar to *marginicollis.* The preceding description may stand for the present species except that the side margins of the prothorax are obsolete and the color less contrasting. Length about 5 mm.

Holotype (Museum of Comparative Zoölogy no. 19544) and 1 paratype from Grand Etang, Grenada, R. Thaxter.

This species is, of course, named in honor of the collector, the late Professor Roland Thaxter.

126. **Pseudaptinus (Thalpius) cubanus** (Chd.)

127. **Pseudaptinus (Thalpius) insularis** Mutchler.

This species is described in the *American Museum* (New York) *Novitates* no. 686, 1934, p. 4.

128. **Pseudaptinus (Thalpius) pygmaeus** (Dej.)

129. **Pseudaptinus (Thalpius) dorsalis** Brullé.

130. **Pseudaptinus (Thalpius) deceptor** n. sp. (Pl. 5, fig. 12.)

Of average form for group; rufescent to piceous brown, appendages testaceous; entire dorsal surface finely pubescent, moderately punctate with punctures of average size; surface between punctures rather shining. Head with eyes large; antennæ short, middle joints scarcely longer than wide. Prothorax almost exactly as long as wide (by measurement), subcordate but broader at base than usual; subbasal denticles (basal angles) rather broad and conspicuous, but acute; lateral margins rather broad; disk not very convex, middle line distinct except near base and apex. Elytra rather shallowly striate, striæ not regularly punctate but with irregular punctuation like that of intervals; latter slightly convex, not rugulose. Length $\pm$5-6 mm.

Holotype (Museum of Comparative Zoölogy no. 19545) and 55 paratypes from Soledad (near Cienfuegos) Cuba, June, Oct. 21-Nov. 7, mostly taken in flood debris.

The largest specimens of the series have the punctuation of the prothoracic episterna less developed than in smaller ones, but the variation is probably only individual. The distinguishing characters of the species are sufficiently given in the key.

131. **Zuphium cubanum** Liebke.

Described in *Revista Ent.*, 1933, Vol. 3, p. 470.

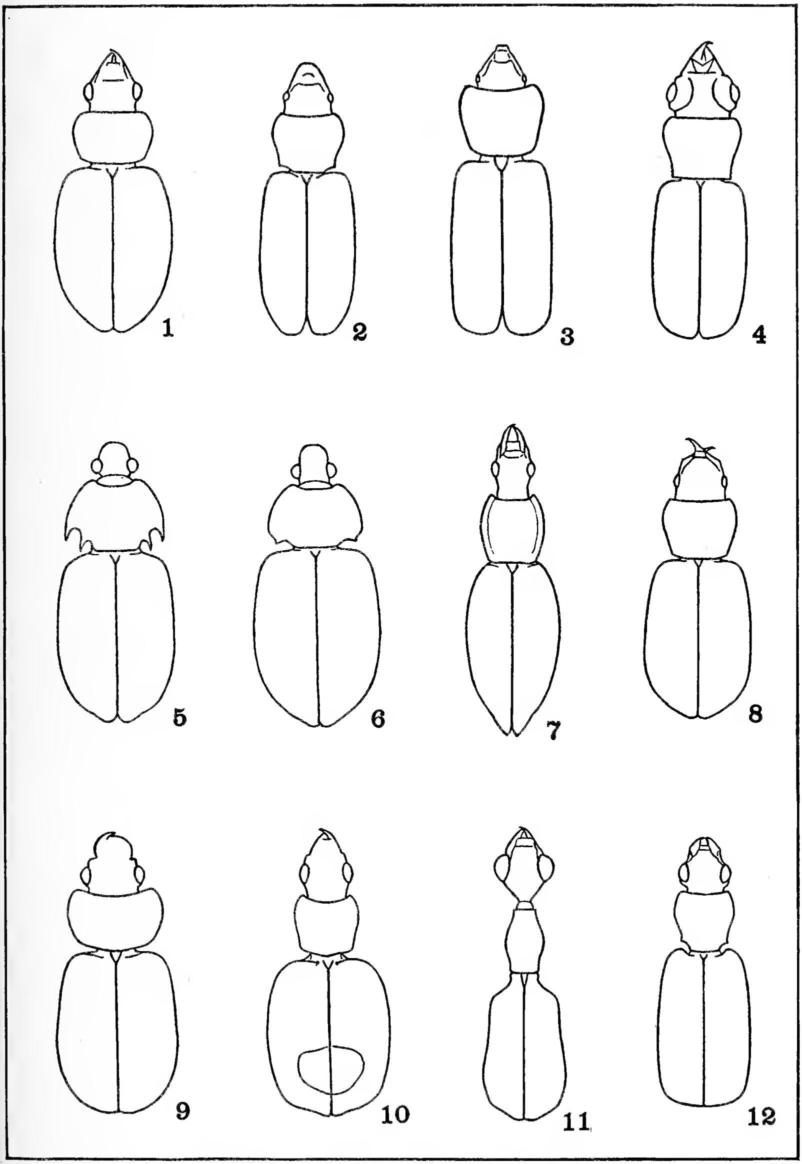
132. **Zuphium bierigi** Liebke.

Described in the same paper as the preceding, p. 467. I have not seen this species; all my Cuban Zuphium are certainly *cubanum*.

133. **Brachynus lateralis** Dej.

134. **Brachynus brunneus** Cast.

Psyche, 1934 Vol. 41, Plate 5



Darlington—West Indian Carabidæ

EXPLANATION OF PLATE

Outlines (from camera-lucida drawings) of head, prothorax, and elytra of

Fig. 1.—Tachys (s. s.) dominicanus n. sp.
Fig. 2.—Limnastis americanus n. sp.
Fig. 3.—Micratopus parviceps n. sp.
Fig. 4.—Perileptus columbus n. sp.
Fig. 5.—Coptia sauricollis n. sp.
Fig. 6.—Coptia effeminata n. sp.
Fig. 7.—Colpodes macer n. sp.
Fig. 8.—Perigona microps n. sp.
Fig. 9.—Masoreus (Aephnidius) ciliatus n. sp. (Mutchler.)
Fig. 10.—Phloeoxena imitatrix n. sp.
Fig. 11.—Colliuris (Pseudocasnonia) noah n. sp.
Fig. 12.—Pseudaptinus (Thalpius) deceptor n. sp.

SUPPLEMENT:

Masoreus (Aephnidius) ciliatus new species (Mutchler)
(Pl. 5, fig. 9)

Oblong oval, black, legs, antennæ and mouth parts testaceous. Head subquadrate, finely closely punctate; mandibles without setigerous punctures in the scrobes, sides elevated; basal joint of antennæ with a long bristle at apex; front of labrum slightly curved inwardly (almost straight) margin with setigerous punctures; clypeus with a puncture on each side. Pronotum subquadrate, one-third wider than long, wider than the head, widest at about the middle, apical angles narrowly rounded and slightly produced, lateral margin with a setigerous puncture on the apical third and another at the basal fifth, basal angles broadly rounded, marginal bead extending from the side of the insertion of the head to the scutellar area, a median longitudinal impressed line, somewhat well marked, extending from the apex to near the base, with indistinct oblique lines, extending backwards from this median line. Scutellum triangular, apex narrowly rounded. Elytra with humeral angles rounded margins not interrupted, surface (under high power magnification) with indications of faint striæ and appearing as if covered with fine scales giving them a silky appearance, possibly granulate punctate, submargin with setigerous punctures, apical angles rounded. Front tibiæ with two elongate spines at upper end of the emargination (the outer one apparently bifid for about two-thirds its length), apical spine somewhat long; joints of the front tarsi shorter than those on the other legs, first joint slightly longer than the next two taken together and about as long as the apical joint, joints two, three and four gradually shorter, hind tarsi with the first joint slightly longer than the apical joint, other joints shorter, claws distinctly but shortly pectinate; hind tibiæ, with spines similar to those on the middle tibiæ, on the outer side. Length 4.5 mm.

Type. Ensenada, Puerto Rico, June 17 to 19, collected by Dr. F. E. Lutz, on the side hill back of Canary Cottage, under stones, in a field containing numerous cacti. In American Museum of Natural History. One paratype.—Soledad, Cienfuegos, Cuba, October 26, collected by P. J. Darlington. In Museum of Comparative Zoölogy. Two paratypes.—Cayamas, Cuba, June 6, collected by E. A. Schwarz and Porto Rico, with no definite locality, collected by George N. Wolcott. In United States National Museum.

Remarks. This new species resembles *Aephnidius* (= *Masoreus*) *piceolus* Chaudoir, and believing that it might possibly be that species I failed to describe it in the recent paper on "New Species of Carabidæ from Puerto Rico" Amer. Mus. Novitates. No. 686. Since these descriptions appeared a specimen of this species from Cuba was submitted by Dr. P. J. Darlington to Mr. René Oberthür for comparison with the Chaudoir type.

The reply from Mr. Oberthür stated the Cuban specimen was not Chaudoir's species. The West Indian species differs in having the antennæ and legs stouter than the true *piceolus* (although still slender) and probably differs in other ways.

The paratype from Cayamas, Cuba, is somewhat brownish black in color, possibly due to being collected before the coloring had fully developed.

PSYCHE

VOL. XLI SEPTEMBER 1934 No. 3

JOHN MERTON ALDRICH

By A. L. Melander

On May 27, 1934, with the passing of John Merton Aldrich, the nation's greatest accumulation of dipterological information has ceased to be. Easily the leader in this branch of zoölogy, Aldrich will be missed, and there is no one in line who is prepared to continue where he left off.

At the age of sixty-eight, Aldrich still counted on several more years of productive work. His mind was as keen as ever, and physically he had no intimation until two weeks before the end that an abrupt catabolic derangement was to close his life. He had even completed plans to start early in June on another of his biennial collecting trips to the Pacific Coast.

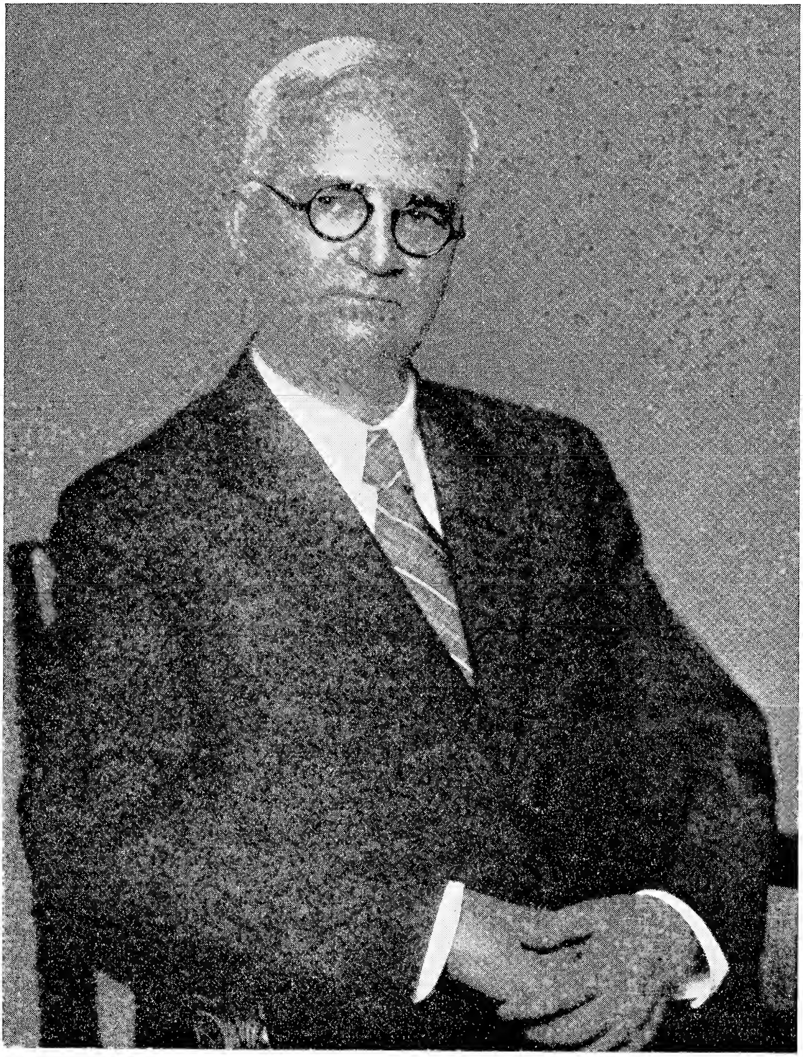
Aldrich was born on January 28, 1866, in Olmstead County, Minnesota. He attended school at Rochester, near by, and in 1888 completed the course for the B. A. degree at South Dakota State College. In 1889-1890, he studied under Professor A. J. Cook at the Michigan State College, and in 1891 received the degree of M. S. from South Dakota State College. Leaving an assistantship at South Dakota in 1892, he went to the University of Kansas in order to study with Professor S. W. Williston, and was awarded another degree of M. S. in 1893.

In 1893 the new University of Idaho opened, and Aldrich was selected to found its Department of Zoölogy. He married Ellen Roe of Brookings, South Dakota, and moved to Moscow. The loss of his wife and infant son four years later caused him to plunge most deeply into his dipterological work, and he began his card catalogue of the literature on Diptera, a project to which he contributed almost daily until his last illness. By 1905, when this catalogue had reached publication size and was about ready for submission to the Smithsonian Institution, Aldrich married Della Smith of Moscow, Idaho, and securing sabbatical leave of absence from Idaho went to Stanford University for a year. His Ph. D. degree was awarded by Stanford in 1906. Fortunately Aldrich had moved his library and collection of Diptera to his father's house because during his absence the University of Idaho burned to the ground.

Aldrich always regarded Moscow, Idaho, as home. He had built a beautiful house at the edge of the University campus facing Moscow Mountain, his best beloved collecting ground, and there had established his library and collection. He had every prospect of continuing his useful work at Idaho, when suddenly after twenty years of service as its most eminent professor his connection with the University of Idaho was terminated. It is unnecessary now to reopen the sorry case and discuss the vagaries of an incompetent administration other than to recall that those of us who knew the situation well regarded the dismissal as an outrageous and unwarranted interference. Aldrich's ashes have been returned to Moscow, Idaho, and placed beside his first wife and his only child.

Idaho's self-inflicted loss proved to be the nation's gain. Dr. Howard immediately appointed Aldrich to the Bureau of Entomology, and for the next five years he was stationed at Lafayette, Indiana, to investigate life-histories of Oscinidæ and other Diptera affecting cereal crops. The death of Frederick Knab in 1918 made it necessary to transfer Aldrich to the National Museum, where he was appointed Custodian of Diptera and Associate Curator.

In 1928 Aldrich presented to the National Museum his personal collection of Diptera, numbering 45,000 specimens and 4,000 named species. With this he donated the unique and extensive card catalogue of Diptera. This index is the only source of information on all the literature of all the American Diptera, and with its cross references to synonymy is invaluable to all workers. It brings the Aldrich catalogue of 1905 to date. His library is the most complete assemblage of books and articles on Diptera, and de-



JOHN MERTON ALDRICH
1866—1934

servedly should be acquired by the National Museum to complement the collection and index.

Aldrich always generously shared his library, records, specimens, and information. Most present day dipterists owe more to him than their printed words of thanks can imply. Beyond the tremendous wealth of specialized information he held regarding the Diptera he was versatile in many lines. He was devotedly interested in the All Souls' Unitarian Church in Washington, of which he was a trustee, and conducted classes in religious history and education. He was keenly interested in politics and daily followed the doings of Congress. He was one of the organizers of the Thomas Say Foundation and served as editor from 1916 to 1931. He was secretary-treasurer of the Entomological Socity of America from 1915 to 1920, and President in 1921. In 1926 he was President of the Washington Entomological Society.

Aldrich had a remarkable gift of locating rare species on his collecting trips. His more extensive journeys included Utah and California, 1911; Alaska, 1921; Guatemala, 1926, and Sweden, 1930. He was meticulously careful in mounting specimens, in arranging the Museum collection, and in entering the records in his great index. His diary has daily entries for some fifty years, not merely a line or two, but a careful description of the happenings that befall an eminent man.

The accompanying bibliography, transcribed from the card index by his secretary, Mrs. Willis, gives his publications in chronological order. Outstanding in the list is the catalogue. This monumental work stimulated so many publications on the Diptera that its very importance in the progress of American entomology led to its rapid obsolescence. Would that its author could have been spared a few more years to give to all the codified information that he alone possessed. We regret his passing, but are thankful that such a man has lived and has been enabled to leave a permanent impress on science.

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BIOLOGICAL NOTES ON *SPHEX WRIGHTII* (CRESSON)

By Charles H. Hicks
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The digger wasp, *Sphex wrightii* (Cresson), is one of the smallest Sphecids I have yet had an opportunity to study. It was placed in the genus *Coloptera* by Cresson in 1868. Professor H. T. Fernald has kindly determined this species[1] for me and gives an account of it in his recent monograph of wasps of the genus *Sphex*.[2] My study is based on observations made on the habits and nesting of the female since the male was not taken at all. The wasp was found only rarely at Owens Lake, near Boulder, in August, 1933, although its small size and somewhat concealed hunting habits may have caused this scarcity to appear more evident than actual numbers would warrant. Specimens were seen on different days, hunting among the tumble weeds. Two nests were taken: one, on August 4th; the other, a week later.

The nest of August 11th and the wasp's activity at the time appear more complete and possibly more typical than the earlier record and are given, in part, below. The presence of the nesting wasp was noted by means of a rather loud buzzing the digger made while she was excavating along a road in a field near the lake. She was found at 1:37 P. M. and observed continuously until the nest was finished and the wasp captured at 2:19. When first found, she had barely begun her vertical tunnel, but was already carrying

[1]Dr. T. D. A. Cockerell examined one specimen and likewise ascribed it to this same species. The writer is pleased to acknowledge this favor.

[2]For a consideration of this species and other Digger wasps of the genus *Sphex*, see the paper by Professor Fernald entitled "The North American and West Indian Digger Wasps of the Genus Sphex (*Ammophila* auct.)." E. O. Painter Printing Co., Deland, Florida. pp. 1-167. Plates I & II. Figs. 1-39. 1934.

soil on foot to a definite place some three inches away. This spot continued to be used for soil deposition until the end of the digging. The wasp backed out of the shaft with soil, turned and walked with it in her jaws and fore legs to this spot, released the load, walked back and down the tunnel for more.

This process and sequence continued 91 times between 1:37 and 1:58 P. M., during which time the wasp was not at all distracted from her work. Then, either feeling a need for a brief rest or change of activity, or more probably a solicitude for the safety and welfare of her already captured and suspended prey, she spent some time walking among the branches of one of the several tumble weeds which surrounded her nest and in visiting the moth larva. But the delay lasted only one minute, after which she was back again and digging. The period of excavation ended at 2:03 and the total number of observed loads removed up to this time was 109. Since she was well started when I arrived, the grand total doubtless was more, but probably not in excess of 125, or 130 at the most.

This small wasp spent from 2:03 to 2:06 in finding her hidden prey and in bringing it to the nest. She walked over and among the thistle stems, seemingly meeting with some difficulty in locating the larva. This is not surprising, for the branches in this area were exceedingly thick. Reaching the larva resting in the fork of a stem, she grasped it with her jaws on the ventral side back of the true legs, wrapped her fore legs about it and started. It was a green geometrid, long and slender, but larger and heavier than the wasp and bulky in comparison.

The trip to the tunnel was over stems, through and among branches, and the wasp met with minor difficulties on the way. She had to change her hold on the prey a number of times, and on five occasions was forced to turn back and bite or pinch with her jaws the posterior end of the abdomen of the prey. This was due to the fact that it was able to hold onto a stem with its anal legs and with sufficient force, when in a tight place, to momentarily stop the progress of the wasp. Once, after she had been thus hindered, she stung it twice on the ventral side of different abdominal segments.

Arriving at the tunnel, she at first walked too swiftly, and moved farther than was necessary so that the head of the larva extended over the tunnel rather than just to or almost to it, as it normally does or should. But she quickly backed up a few millimeters, released the prey, walked down the hole in a journey of inspection, and out. Now she was ready for the provisioning of the cell. She did this by backing into the tunnel, seizing the prey and dragging it slowly out of sight. It took her exactly one minute to arrange the prey and fix her egg to its side.

She spent 12 minutes and 3 seconds, or from 2:07 to 2:19:03, in filling in the tunnel and at other activity about the nest site. Her first act upon emerging from the nest was to find and select a large pebble which was forced well down the shaft. Then she filled in the tunnel with loose soil which she kicked back into it and later tamped. This process continued, although some material was bitten loose nearby. This latter work was necessitated because the soil from earlier digging was not readily available. It had been carried over some stems and had formed a mound, but the stems and debris between it and the tunnel hindered its later use. The digger came several times to heavy pieces of material, such as sticks, clods, small pebbles and the like. These were carried away in her jaws on foot from the nest site and discarded, hence nearly all the material used was fine soil.

When the tunnel was nearly full, she searched long and tirelessly for a large object to finish filling the tunnel and as a blockade to the entrance. She tested many things, but all were rejected, until one finally met her needs. She laboriously carried this in her jaws and forced it well into the nearly filled tunnel. It was not flush with the surface but extended above. Time and again the wasp seized this with her mandibles, and for many seconds at a time pushed and vibrated it. At last, all seemed well to her. This was after she had scraped the surface around the nest site and had left objects scattered about. This was in contrast to her earlier careful removal of such material, and resulted in the formation of a camouflage. She next made a few trips out and back (manner of a locality study although no apparent need for it, nor probability of a later return, was seen), then started away and was caught some distance from the nest.

The tunnel was nearly vertical and some 16 mm. long. The cell, at the end and at nearly right angles to the tunnel, contained the prey resting on one side, doubled up so that the posterior and anterior ends nearly met. A small, slender, clear egg about 2 mm. in length was attached to the upper side on the 2nd abdominal segment and near to a spiracle. The prey was able to kick about when stimulated. It was brought home and kept in a test tube, plugged with loose cotton, where further facts were obtained. The digestive tract was cleared of excrement before the egg hatched, and thus better food conditions provided for the wasp larva.

The egg hatched early on August 13, and by the evening of August 17 all the food provided for the larva had been eaten. A day later, its cocoon was well started, and by the evening of the next day it was, from outward appearances, complete. The larva while feeding, and especially at first, fed at the point where the egg had been fastened. It was greenish-yellow in color. The cocoon was photographed, when completed, but the larva within, upon removal from its protective covering and consequent exposure, was too active for picture-taking. It later was less active in its movements and more completely yellow in color. The drawing which accompanies this article was made some five months after the cocoon had been completed and at a time apparently when the insect was hibernating.

Another observation, at the same general location at Owens Lake, affords additional and supplementary facts of behavior. This female dug her vertical tunnel on a flat surface between plants in a soil in which there was some gravel. She produced an audible noise or buzzing as she used her jaws in digging. The loosened soil, held with the inner surface of her head and jaws, front of the thorax and legs, was carried up and out of the tunnel as earlier described but, at this nest, only to a distance of 1¼ inches. She carried it out, at a time when the nest was nearly completely dug, at an average rate of five loads each minute.

An intruder, an ant in reality as well as in appearance, came upon the scene soon after observations began on the wasp. The wasp quickly retreated to a distance while the ant entered her nest, moved in and out, in impish fashion. But the wasp did not desert her nest very long. Soon back, she continued the work as before, only perhaps more hurriedly. It seemed that the ant had irritated her, and this later caused her to proceed in a more nervous manner. Her nest, when first found, must have been very nearly complete, for she soon provisioned it.

Her prey was a small greenish larva, which she had left suspended on a plant 18 inches away, hanging over a stem while she was working on the tunnel and cell. She now brought it to the nest, released it with its head to the entrance, backed within and pulled it in after her. This took place in good orthodox fashion, as did also the laying of eggs or the depositing of larvæ by a small tachinid fly just as the prey was disappearing from sight.

She remained in the cell but a few seconds, and upon emerging sought a large pebble to place in the tunnel below the orifice. The first one tried was too small, so she quickly removed it and continued searching for another. She conducted this activity on foot, searching on the ground among the plants near the nest. She soon tried another stone, which again was rejected for like reason as the first.

There followed at this point an interesting fight with a dark ant which was again intruding. The ant literally jumped at the wasp, the latter this time holding her ground and darting back at her foe. The contest continued for a few seconds with little advantage to either. Then each quit voluntarily, or possibly, the wasp was the victor. At any rate, she resumed her work and the ant, as it was scurrying away, was taken for identification.

A suitable pebble was secured, which fitted the upper part of the tunnel, fine soil was kicked in from the surface and more was chewed loose from the sides of the opening. The loose soil filler was not great in quantity, and during her activity in securing it, small pebbles found in it were carried away and rejected.

The last phase of tunnel filling and protection consisted first in a diligent search for a large pebble. That she had an object of large size in mind was strongly suggested by the fact that she appeared interested only in the big ones. Too, she brought pebbles three different times and attempted to use larger ones than would fit, before one was

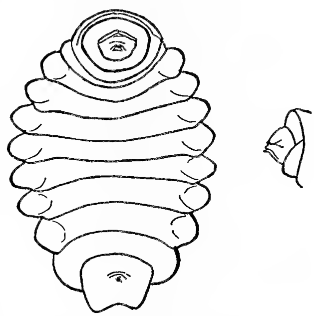

FIG. 1. Ventral view of hibernating larva of *Sphex wrightii* (Cresson). The head of the entire larva is above. Sketch of side view of head and anterior segment to the right. X6.

finally approved. It was a large and heavy object, but it fitted into the orifice and to spare, with a portion extending above the surface. She twisted this about in place, and vibrated it vigorously.

At this time another ant, a smaller species this time, bothered her not a little. She soon drove it away, however, and continued with the loose soil or in pushing and vibrating the pebble. A small stem unearthed in obtaining filler was seized in her jaws, carried away and left with the other rubbish of the surrounding area.

The nest filling was quickly finished, and the wasp flew away in and among the branches of tumble weeds where from subsequent observation it was thought she finds her prey. She gave evidence at this time of searching for larvæ on the stems. If this be true, she must indeed be a good worker not even to spend some time at rest between one

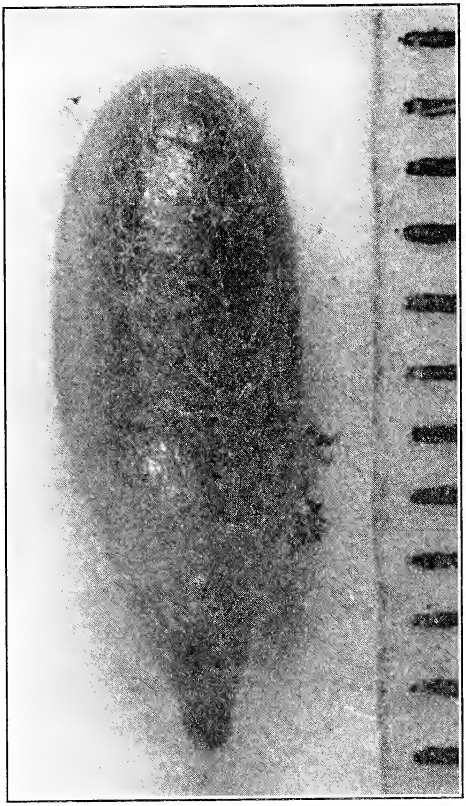

Fig. 2. Cocoon of *Sphex wrightii* (Cresson). Millimeter rule marks to the right.

nest provisioning and the hunt and capture of a prey for another. Her capture at this time allowed for no further observations.

The nest was dug out and the prey with an egg attached on the lateral surface of an abdominal segment found in a shallow cell not far below the surface. Before the egg had the opportunity or time to hatch in my office at the University, it was found that fly larvæ had taken their toll. Internally, they had eaten the food to the extent that the body walls of the moth larva collapsed and the wasp's egg perished. The identity of the three larvæ, which each formed a puparium, was not learned. In later emerging from the puparia, they crawled into the cotton about them before the body parts were normally expanded and fully developed, thus preventing accurate comparison with normal flies and correct identity.

This wasp species did not use a tool at any time as the tool-users do, although it worked on the large pebble, trying again and again to force it farther into the tunnel and repeatedly vibrating it. This last record, however, is probably not typical and complete, since the ants disturbed the nesting wasp and probably abbreviated many, if not all of her activities.

The larger ant, which troubled the wasp, was taken, and has been compared with determined specimens in the collection of the University of Colorado. It is possibly a variety of *Formica fusca* L. It was very pugnacious, actually throwing itself at the wasp, which it may have "thought" to be an oversized ant and may have resented its intrusion in this territory. It is possible, too, that the ant was trying to obtain the prey of the wasp as food for its own nest.

The writer is indebted to Charles R. Bitter for the photograph of the cocoon of this wasp and to Louise Ireland for the drawing of the larva. He is pleased to express his thanks for this help, as also to Professor Fernald for the determination of this wasp and references to this and other digger wasps.

THE INSECT COLLECTIONS OF A PUBLIC MUSEUM[1]

BY ALBERT P. MORSE

The aims of a public museum may be said to be primarily recreational and educational. Sometimes a museum is maintained also partly for purposes of preservation of material collected for or presented to a State, or other political, scientific, or educational institution. In-so-far as its collections arouse interest in and impart information about man and his environment or activities it belongs in one or both of the first two fields; if it conserves specimens for future examination by students it may claim to belong in the last also. Formerly, in most cases, all three fields were cultivated by the same institution. Of late, with the development of children's museums, there is an increasing tendency to relegate the duty of preservation to the larger, better endowed, and perhaps more scientific institutions, leaving the fields of recreation and education to be cultivated largely by the smaller museums. These are, perhaps (sometimes, at least) more closely in touch with the people of the district in which the museum is located.

Probably all of the older museums, founded in a more serious age by serious-minded people, still retain or have passed through all the phases mentioned. My statements are based upon the experience of the Peabody Museum of Salem and may need to be modified by that of others. This institution was founded as the museum of the East India Marine Society of Salem, in 1799. Its purpose was to contain such objects as the sea-captains of Salem and vicinity brought back from beyond the seas for the enlightenment and delectation of themselves and their fellow-members. It has always been open to the members of the society and their friends,—and even to the general public, by free admission tickets,—since the day of its founding, and it is thus one of the oldest public museums in the country.

[1]Address of the retiring President of the Cambridge Entomological Club, May 8, 1934.

In 1867, on receipt of the (for the time) munificent gift of $140,000 from George Peabody, a banker of London (born in South Danvers, Mass., since named Peabody in his honor), it took the name "Peabody Academy of Science," and embarked upon a career more particularly devoted to education. The natural history collections of the Essex Institute of Salem (founded in 1848) were added to its own, and in its early days, as the Peabody Academy of Science, its destinies were presided over by several men whose names were to become known later through their labors in scientific fields. I refer to such men as Frederick W. Putnam, Edward S. Morse, Alpheus Spring Packard, etc. Shortly thereafter, it met with financial reverses, and certain of its collections, notably those of the insects described by Packard, which faced almost certain destruction by pests, were turned over to the Museum of Comparative Zoölogy at Cambridge, Mass., in order to assure their preservation. A large number, it is true, remained, but, being almost continually exposed to white light, their deterioration was rapid.

In addition to the insect collections named above, material naturally accumulated in those groups which were the special study of officers of the museum; and, as the publisher of the "American Naturalist," the Museum was the recipient of more or less material sent in as payment for subscriptions to that journal. These specimens, together with those received from persons seeking information about local insects, accumulated rapidly, resulting in the formation of a collection of varied character and provenance. In addition, specimens of the local butterflies in Denton tablets, and of the commoner local moths, made by interested amateurs, had found a place in the museum collections at the beginning of the twentieth century.

With the exception of the local butterflies, these specimens were practically all pinned, and were contained in trays about 10 x 12 inches in size, painted white, and lined with white paper stretched on both sides of a wooden frame in an ingenious fashion devised by Prof. E. S. Morse (see Amer. Nat., vol. 1, p. 156, or Riley, C. V.—Directions for Coll. & Pres. Insects, Bull. U. S. N. M., no. 39, p. 105).

They were displayed in a glass-covered rail-case in the gallery of the Museum where they were for the most part continuously exposed to the damaging effects of white light. That some of the specimens became, with the lapse of years, nearly unrecognizable, is not to be wondered at.

Such was the state of things when I was placed in charge, for a period, at first, of one day per week, except during the summer. Later, the care of all the natural history collections,—geological, botanical, and zoölogical, was added to that of the insects, and the time allotted gradually increased, until all the time that I can now give has been taken.

Mr. John Robinson (a very good old-time botanist, by the way), who acted as Director during Prof. Morse's absences in Japan and on his lecture-tours, used to say that his personal knowledge of insects was limited to an acquaintance with those species most frequently brought in by children, or more or less conspicuous in themselves,—such as the house centipede, *Scutigera forceps*, formerly a common denizen of the city,—and the larger moths and butterflies. In time, these were supplemented by the gipsy and brown-tail moths, and by pests responsible for local outbreaks.

The persons visiting a museum who show an interest in insects comprise: 1st, the children of the vicinity, to whom the world and its wonders are new, and who do not customarily think, in the manner of their elders, of insects as small fry, unworthy of attention; 2nd, people of inquiring minds who have observed something new to them (it may be very old to an entomologist) ; 3rd, people to whom an insect has suddenly revealed itself as a possible pest, who seek information regarding it and how to control it; and 4th, persons, old or young, who judge everything by its commercial value and hope to acquire dollars or cents by selling their captures to the Museum. (It may even be an almost totally denuded moth or butterfly or some similar worthless specimen.) These must all be treated with the utmost courtesy if one would make friends for the Museum; information and advice must be freely imparted; gifts of much-rubbed butterfly or legless grasshopper must be gratefully accepted or declined with thanks,—if you would have them continue to bring to you their treasures (or what they regard as such). Our only local specimen of *Mantispa brunnea* was captured by a resident clergyman, who had no idea of its rarity or interest, and who had previously brought in some execrable material.

What Collections of Insects Do Public Museums Need?

FIRST,—exhibition collections, of large-sized specimens, to illustrate systematic groups and the most striking facts of life history and of damage done. These should contain inflated larvæ, and sometimes pupæ and cocoons, as well as adults. No rarities! Only common and readily replaceable specimens. (Do not submit rare specimens to destruction by white light! Use boxes with covers, or curtains for their protection). Probably enlarged models, showing the anatomy in detail, especially of the mouth-parts, would be valuable. I have not had an opportunity to try them, but I have heard that the enlarged model of a mosquito at the American Museum of Natural History in New York is a very popular exhibit. These enlarged models should show at least two or three types of mouth-parts and of life-histories.

I remember what a pleasure it used to be to study the New England collection of insects on exhibition in the Boston Society of Natural History, faded and discolored though they were. Probably in no way is it possible to convey to the mind of a novice such a good idea of the fauna of a particular region as by the exhibition of its component species.

Especially do I remember being seated at my table in the old entomological laboratory at Cornell University one morning when in breezed Prof. Comstock with a box in his hand and a small boy with a net in tow. "Give me your chloroform bottle, Mr. Morse, and I'll show you something," was his salutation. The bottle was promptly produced, its contents applied, and presently he exclaimed, "There, what do you think of that for central New York?" "Hallo", said I, as the great moth was revealed, "*Erebus odora!*" "Where in the world did you make the acquaintance of that creature?" said Prof. Comstock, with an expression of astonishment on his face. "Oh," said I, "the Boston Society of Natural History has a series of New England insects on view and among them is an example of this species." "There," said he, "I've always claimed that there was danger that the boys would use such a collection as a pony if we had one here, but what you say has nearly convinced me that such an exhibition series would be a good thing." This happened to be the first specimen of this species to be secured for the entomological collection of Cornell University.

An exhibition collection is undoubtedly a good thing if it inspires interest in the visitors to a museum, and if it can be properly protected from light. This can be done by the use of opaque curtains or by keeping it in drawers to be pulled out from a cabinet when it is desired to consult it. At the Peabody Museum, we have a considerable series of insect exhibits arranged in flat, glass-covered rail-cases protected by covers of opaque brown cloth attached along one side and removable by the inquiring visitor. Hitherto, it has rarely been necessary to cover up the specimens after inspection, persons removing the covers being unbelievably careful to replace them.

SECOND,—There should be at hand in every public museum, a reference or study collection for the benefit of the curator in charge of insects and the serious-minded public seeking information. This should contain, so far as possible, examples of every local species and its life-history, their modes of attack and specimens of their work,—all to serve as an aid in identification and for the enlightenment of the serious student. Determinations of species should be by some recognized authority, if possible. This is the place for the rarities. Specimens should bear complete data as to locality and date of capture; ecological conditions should be stated, if possible; and taxonomic groups other than genus and species may well be indicated.

THIRD,—There should be topical or ecological collections, either illustrating the insects associated with certain plants, as visitors, pests or pollinators, or with a definite kind of environment,—insects of sandhills, ponds, streams, etc. These groups may be limited in number and should be of readily replaceable material. Those of pests should contain numerous specimens in order to convey subconsciously the idea of abundance.

FOURTH,—The geographical or zonal distribution of the insects of a large area can perhaps be fully as well shown by charts (preferably in conjunction with specimens) as by insects alone, and the topic is generally one of interest even to the transient visitor.

There are also to be considered the needs of the genuine scientific student resident in the vicinity, and of the school-teacher trying to awaken an interest in the natural world in the minds of her pupils through this medium. Give them all the aid possible! "Cast your bread upon the waters and after many days it shall return unto you." Very likely you can give them specimens also.

Mr. Charles W. Johnson, formerly in charge of insects and mollusca at the Boston Society of Natural History, after a long and valuable experience wrote an article on this subject which should be read by everyone interested (see Museum Work, vol. 1, no. 5, Feb. 1919).

In closing, I wish to give a word of warning (and this advice will apply as well to other things as to insects) :—Accept no collections for an unlimited period of time or that must be kept separate from others! One is liable to find oneself handicapped ultimately by such a procedure, even if it seems wise at first. Twenty years ago we accepted at the Peabody Museum for temporary storage a very good collection of butterflies and moths in tablets. This is still useful as an exhibit: but it was accompanied by a space-consuming collection of mounted birds (some of which were useful at the time, it is true, but which no longer are), for which storage must be provided. To our disappointment, the owners have as yet shown no tendency to regard the Museum as other than a place of temporary storage of the collections, intead of, as hoped and as would naturally be expected, after a reasonable number of years, a more or less willing recipient, the collections to be made use of as seemed wisest to experienced persons.

POSSIBLE POLYPLOIDY IN THE HYMENOPTERA

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The Bresslau-Harnisch lists of animal chromosome numbers (Tab. Biol. 4) include data for the twenty species of Hymenoptera whose chromosome numbers were known at that time. Records subsequently published give the numbers in two additional species, *Habrobracon juglandis* and *Pteronidea ribesii.* The total may be summarized in this fashion:

1	species,	haploid	number	*4*
8	"	"	"	*8*
1	"	"	"	9
3	"	"	"	10
5	"	"	"	*12*
3	"	"	"	*16*
1	"	"	"	*24*

Eighteen of the twenty-two species have chromosome numbers of 4 or a multiple of 4; whereas only four species have different chromosome numbers (9 or 10). These numbers are representative of seven families out of more than one hundred in the Hymenoptera and seem to be a random sample of what may be expected to be the situation in the other species whose chromosome numbers are yet unknown. Though the number of species which have been investigated is very small, the idea suggests itself that these chromosome numbers may be a result of polyploidy such as is known to occur in plants.

There is very good evidence that about half of the Angiosperms are polyploids. From such studies as those reviewed by Darlington (Darlington's Cytology, p. 212) we see that in polyploid series one finds many species with double the basic chromosome number, fewer with the number obtained by a second doubling and still fewer resulting from further doublings of the basic number. Such would seem to be the case even in this small sample from the Hymenoptera. A second point also demonstrated by the abundant plant material is that in polyploid series there are few species with *prime* numbers as their haploid count. In the Hymenoptera there are no species with prime numbers. If the chromosome numbers in the order were entirely fortuitous, one should expect several species to show prime numbers as their haploid count.

The rareness of polyploidy in the animal kingdom and particularly in diœcious species has been considered to be due, at least in part, to the fact that such species are in one sex heterozygous for the sex chromosomes. Multiples of the chromosomes in the vast majority of animals would thus cause an upset of the balance between sex chromosomes and the autosomes as was suggested by Muller (Am. Nat. 59) in regard to polyploidy. He suggests, however, that polyploidy might occur in the Hymenoptera.

In the Hymenoptera it may have been possible to avoid this difficulty since they are almost unique among insects in that their *males are haploid.* Thus if there is *any* order of insects in which polyploidy is possible it would seem to be the Hymenoptera.

The suggestion that the series of chromosome numbers in the Hymenoptera may have arisen by polyploidy rests, then, on these considerations: 1, all but four of the species have chromosome numbers which are 4 or a multiple of four; 2, the existence of haploid males may have allowed polyploidy to occur.

ENTOMOLOGICAL INVESTIGATIONS IN THE CHIRIQUI REGION OF PANAMA

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The notes presented in this paper are based largely upon observations made and specimens collected during a visit to the Province of Chiriqui, in the south-western corner of the Republic of Panama, in July, 1929. This expedition was organized by Dr. H. C. Clark, Director of the Gorgas Memorial Laboratory and included also Dr. G. B. Wislocki and Dr. A. H. Schultz, from the Johns Hopkins University, and the writer. The purposes of this visit included medical, embryological, anthropological and entomological studies on the wild monkeys of that region. This report deals with the entomological results. The writer took advantage of the opportunity offered to secure and examine a number of birds and other animals in addition to the monkeys in order to gain some general knowledge of the ectoparasites of the wild animal life of the areas visited. Specimens of the prevalent blood-sucking diptera were collected whenever possible and a few observations on the mosquito breeding occurring in the vicinity of our camp were also carried out. These investigations were conducted at Camp Pital and Puerto Armuelles and covered the period from July 11 to July 29, 1929, sixteen days at the camp and three days at the port.

Dr. Clark made two later visits to Chiriqui, in February, 1930 and August, 1931. On his 1930 trip he spent several days (in camp) at La Vaca, in a more virgin part of the same general area as Camp Pital. In 1931, he made a brief visit to the large banana plantations of the Chiriqui Land Company at Puerto Armuelles and Progreso. The latter station is situated a few miles inland from the coast, on the

Puerto Armuelles-David Railway. Mr. W. H. W. Komp, of the U. S. Public Health Service, accompanied Dr. Clark on his 1930 trip and Dr. Theodore Trimble, of the Rochester University, Rochester, N. Y., was his companion in 1931. On both these occasions a number of ectoparasites were obtained from the various animals examined as well as of the blood-sucking diptera most commonly encountered.

Since the specimens obtained during the three expeditions to Chiriqui represent many of the common species of insects and other arthropods affecting man and animals in that region, they are listed with annotations in the following pages.

Camp Pital was located in the humid lower tropical zone of the fairly level coastal plain of the south-western part of Chiriqui. It was very close to the Costa Rican border, probably not more than eight miles by direct line from the Pacific coast. Here a square area of about twenty acres had been cleared for banana culture. All trees had been felled, larger ones being left to rot and banana sets had been planted in the open spaces between the logs. The area surrounding this clearing was heavily forested, with trees of large size and an undergrowth of luxuriant vegetation. The pita plant, *Ananas magdalense*, was abundant in this locality and it was from this plant that the name of the camp was derived. The undergrowth was not of sufficient density to necessitate the use of a machete when walking in the forest, and since there were several narrow trails leading in different directions, a considerable freedom of movement was possible in the forest nearby.

The animal and bird life in this region was abundant and varied and the easy passage in the forest made good hunting conditions. It was also a nearly ideal location for collecting blood-sucking diptera, since the abrupt change from the deep shade of the forest to the open sunlight of the clearing provided conditions favorable for both shade and sun loving species.

Two native hunters and one of the members of our party were usually out after specimens of animals and birds during the early part of each day. A number of muslin bags of various sizes were carried by the hunters and each animal or bird shot was immediately placed in one of the bags which was then closed and tied with twine.

At the camp each bag was carefully opened on a large piece of Canton flannel spread out on an improvised table. The bag was slowly turned back until the animal was left lying in the center of the flannel. Any ectoparasites present were usually collected first from the animal and then from the bag, if any adhered to the inner side of it. A comb was sometimes used in examining animals with long hair. With birds it was found advisable to pluck out most of the feathers. Some of the birds were infested with parasitic flies that were quite active and difficult to capture. When such birds were brought in, they were placed, while still in the bags, in a wooden box and sprinkled with chloroform. The vapor of this penetrated the bags and stupefied or killed all the flies that were on the birds, which were then easily collected. The nap of the Canton flannel on which the examinations were made impeded any of the fleas, lice, etc., that attempted to hop or walk on it and facilitated their capture.

Engorged ticks in larval or nymphal forms were placed in pill boxes or glass tubes in order that they might develop to later stages. Dipterous larvæ producing Myiasis were removed from animals and, if nearly mature, placed in wide mouth bottles containing about an inch of damp earth to allow them to pupate and emerge as adults.

Since the study of monkeys was the principal purpose of our expedition to Chiriqui, a few words about the examination of these animals are appropriate. A total of 107 monkeys killed or captured at Camp Pital were examined for ectoparasites. This included 53 Orsted's titi monkeys, *Saimiri orstedii orstedii;* 29 Panama white-throated monkeys, *Cebus capucinus imitator,* and 25 Geoffroy's spider monkeys, *Ateles geoffroyi.* Although the examination of these monkeys occupied a considerable part of my time while at the camp, they were not productive of ectoparasites.

One female tick was found walking about on a freshly killed titi monkey, but since it was not attached and contained no blood it was not credited with being a parasite of the animal.

The howling monkeys, *Alouatta palliata inconsonans*, at Puerto Armuelles were found to suffer from Myiasis due to dipterous larvæ but no howlers were taken during our stay at the camp and no myiasis was noted in any of the monkeys examined there.

No lice-infested monkeys were found. The freedom of these monkeys from ectoparasites causes me to wonder if the species examined at the camp are habitually free from infestation of parasitic arthropods in this region or if it may have been due to the climate conditions prevailing at the time.

A very large number of blood-sucking and parasitic diptera were collected, various genera in several families being represented.

It was somewhat surprising to find that comparatively few adult mosquitoes were in evidence at the camp. There were a number of streams and pools exposed to sunlight in the cleared area, while in the surrounding forest there were numerous streams, pools and small swamps in dense shade. Thus the conditions in the immediate vicinity of the camp were suitable for mosquito larvæ that preferred either sunlight or shaded environments. There were also many natural depressions present in the large tree trunks lying about the clearing which contained varying amounts of water adapted to certain species. The so-called tin can invasion had preceded us at this camp and a considerable number of tin cans that had previously contained fruits or vegetables had been thrown in a pile near the camp by former occupants. In some of these cans a small amount of the contents had been left and as the cans filled with water from rains this vegetable matter, and also leaves that had fallen into the cans from nearby trees, became decomposed and caused the water to become very foul. Mosquito larvæ were found in a number of these cans. Enamelware soup bowls were used for breeding out the larvæ investigated. It is to be regretted that the opportunity did not permit a more extensive study of the mosquitoes breeding in this region, since in my opinion such observations would very probably be repaid by finding many interesting species.

Anopheles albimanus Wiedemann. From one to four adults of this species were collected each morning on the inside of the wall netting and cloth ceiling of the camp. They probably gained entry through numerous small holes and rips in the netting. Cursory examinations of several of the nearby pools and streams were made but no larvæ of this or other species of Anopheles were found.

Anopheles punctimacula Dyar and Knab. Two females of this species were captured on the ceiling inside the camp.

Culex bonneæ Dyar and Knab. Adults of this species were bred from the larvæ present in considerable numbers in a ground pool (in which the end of a tree trunk was lying). The finding of this species in Panama increases our knowledge of its distribution since it previously has been reported only from Dutch Guiana where it is a common species and breeds in artificial receptacles, tree holes and ground pools.

Culex corniger Theobald. Larvæ of this species were numerous in several small ground pools.

Culex coronator Dyar and Knab. Numerous larvæ were present in a ground pool surrounding the base of a large stump in the cleared area.

Culex declarator Dyar and Knab. This species was breeding in profusion in water in a natural hollow in a log in the clearing.

Culex inflictus Theobald. Breeding in old tin cans where it occurred both alone and in association with *Joblotia digitata*. The larvæ were also found in a hollow in a log in company with *Hæmagogus lucifer*.

Aëdes angustivittatus Dyar and Knab. Represented by three females that were captured while biting man at the edge of the forest.

Aëdes quadrivittatus (Coquillett). Several females were captured near the camp while in the act of biting man. They were taken in late afternoon and on cloudy days. Finding this species at Camp Pital indicates that it has a rather unusual altitudinal range since it previously has been reported only from higher elevations, having been taken up to 9,000 feet, and was considered as an *Aedes* of high altitudes only.

Mansonia titillans (Walker). Two females of this species were taken within our camp and a third was captured outside while biting man. It was remarkable that this mosquito was not more in evidence since masses of the floating water plant, *Pistia stratiotes,* to the roots of which the larvæ of this species remain attached, were present in the Madre Viejo River about two miles from Pital.

Hæmagogus lucifer Howard, Dyar and Knab. Many adults reared from larvæ collected from water in a hollow in a log. *Culex inflictus* larvæ were also present in this water.

The entomological fauna of Camp Pital was found to be rich in blood sucking flies of the family Tabanidæ. The door of the camp had evidently been open for some time previous to our arrival and many flies of various families had entered and were grouped about on the inside of the screens when we moved in. A number of these were captured and thirty-eight proved to be Tabanidæ, with four genera and seven species represented.

A mule used for transporting supplies was kept at the camp and during the greater part of the day it was tied at the edge of the forest to graze. This animal proved to be good bait for attracting Tabanidæ and numerous specimens were collected from it. It also gave me an opportunity for making a few observations concerning the biting habits of some of the species.

Pangonia prasiniventris Macquart. Flies of this species were quite numerous and caused much annoyance to the pack animals at Camp La Vaca in February, 1930. Dr. Clark collected ten specimens at this time.

Stibosoma flavistigma Hine. Only one specimen of this large fly was captured on the mule at Camp Pital. It was noted approaching with a swift circling flight and a loud buzzing sound. It made several attempts to alight on the belly of the mule but each time it struck with so much force and noise that the animal flinched and twitched its skin to prevent it. After a number of trials it succeeded in alighting on the inside of the upper part of the hind leg and began to feed. This gave me a chance to capture it. A second specimen was also seen making several efforts to alight on the mule but, like the first one, it struck so forcibly and noisily that it startled the animal each time and caused it to flinch and stamp its feet. The fly finally ceased its attempt to alight and flew away. It did not return while I was observing the mule.

Lepidoselaga lepidota Wiedemann. Three of these flies were captured inside the camp at Camp Pital. They were taken some days after our arrival and apparently had gained entrance through holes in the screening or while the doors were open. A fourth specimen was captured as it was feeding upon an ox in a pasture near Esperanza Station. Since this species appears to pass its larval and pupal stages at the base of the crown of leaves of the water lettuce, *Pistia stratiotes*, it is quite probable that these flies were much more numerous in closer proximity to rivers, streams, pools, etc., in which these plants were present.

Chrysops melænus Hine. Twenty-four flies of this species were captured while they were feeding upon the mule at Camp Pital. They seemed to confine thier attacks mainly to the region about the animal's ears.

Chrysops calogaster Schiner. One of the small flies of this species was found inside the camp at Camp Pital upon our arrival.

Dichelacera analis Hine. Flies of this species were found to be much more numerous than any other of the Tabanidæ and were the most persistent in their attacks on man and animals. A total of 165 specimens were collected at Camp Pital and Puerto Armuelles. Twenty-two of these were found inside the camp upon our arrival, where they had entered apparently for shade. The remainder were taken while biting either man or the mule. They were present throughout the day and until late in the evening, seeming to become more active at twilight. They were vicious biters and very persistent in their attempts to obtain blood. They apparently were attracted by motion and when one was moving in the forest they followed to circle about with a vicious hum and dart at one's face, hands or any exposed part of the body and immediately begin biting. If one stood or sat quietly for a few minutes most of these flies gradually disappeared, although a few invariably remained and continued their efforts to feed. They were to be found by the hundreds attacking the mule at nearly all times. Some preference seemed to be shown for the neck and head but they were found on nearly all parts of the animal's body at times. They were rather slow in filling with blood and when gorged became quite sluggish. The wings were held partly extended while feeding. Although this species was much more common along the edge of the forest, they frequently appeared in bright sunlight as well.

Dichelacera submarginata Lutz. This was nearly as abundant as *D. analis* and 94 specimens were collected, fifteen found inside the camp resting on the screens. They seemed to center their attacks upon the mule and apparently were not much attracted by humans, only one being taken while biting man. They attacked the mule all during the day and early evening and, strangely enough, never attempted to feed on any part of the animal except the lower legs. From 20 to 50 were usually present on each leg and it was very seldom that a single individual was noticed biting above the knees. They gathered in masses at the fetlocks and around the coronary region at the top of the hoofs. They are slow feeders and required some little time to engorge. The mule did not seem to experience much annoyance from their attacks and seldom stamped its feet to prevent their bites. When brushed from the animal's legs these flies flew only a few inches and immediately returned to resume their feeding. They seemed to be noiseless in flight when approaching or leaving the mule.

Tabanus albocirculus Hine. Flies of this species were quite common at Camp Pital and were present in considerable numbers on the mule. It was noted that most of those on the animal at any one time were located about the head and neck.

Tabanus calignosus Bellardi. This species was represented in our collections by only two specimens. One of these was taken inside the camp and the other was captured while feeding upon the mule.

Tabanus festivus Hine. Five of these flies were collected at Camp Pital, three on July 13th and two on July 20th. They were not in evidence except while feeding, or about to feed, on the mule. They approached with a swift flight and after a short circling about darted at the animal and settled on the lower frontal area of its head. All five seemed to attempt to bite at almost the same spot. The first three captured were taken within an hour and although they came only one at a time the sites of the three bites could have been covered with a silver dollar. These flies were very wary and it was almost impossible to capture them until after they had begun to take blood.

Tabanus fumomarginatus Hine. Five specimens were taken at Camp Pital, two in the camp on the evening of our arrival and three others later on the mule.

Tabanus inanis Fabricius. Two flies of this species were collected by Dr. Clark as they were attacking the pack mules at Camp La Vaca in February, 1930.

Tabanus leucaspis Wiedemann. Two of these flies were collected from the mule at Camp Pital.

Tabanus occidentalis Linnæus. This species was present in abundance and attacked the horses and mules at Progreso in August, 1931. Two specimens were collected by Dr. Clark at this time.

Tabanus stenocephalus Hine. This species was quite common at Camp Pital and a number of specimens were captured as they fed upon the mule. They did not appear to favor any particular part of the animal.

Tabanus unistriatus Hine. Many flies of this species were present at Camp Pital and Puerto Armuelles. They bit man and animals with equal readiness.

Lynchia augustifrons (Van der Wulp). A male and female of this species were collected from a Swainson's toucan, *Rhamphastos swainsonii* Gould, at Camp Pital.

Stilbometopa ramphastonis Ferris. Two females of this species were found on a Swainson's toucan, *Rhamphastos swainsonii* Gould, at Camp Pital. These proved to be a new species and were named and described by Ferris.

Ornithoica confluenta (Say). Three specimens of these flies were collected from two Swainson's toucans, *Rhamphastos swainsonii* Gould, at Camp Pital.

Olfersia vulturis Pan der Wulp. Flies of this species were collected from four black vultures, *Catharista urubu* (Viellot), that were examined at Camp Pital. Three of these birds yielded three flies each, and five were taken from the fourth.

Olfersia spinifera (Leach). Several of these flies were taken from a king vulture, *Gypagus papa* Linnæus, by Dr. Clark at Camp La Vaca. There were many of these flies present on the bird but they were very difficult to capture. So many escaped that a bed net was hung from a limb of a tree and the dead bird placed in it in order to secure the flies. Four specimens were collected inside the net. The following day one of these flies was captured as it alighted upon the head of the native cook and attempted to crawl into his hair. The second day another fly of this species was found on the outside of the bed net, in which the bird had been placed. (It had been left suspended in order that it could be used if others with parasitic flies were taken.) Probably these two flies were among those that had left the bird to escape capture (one or two days previously and had later returned to seek their host again.)

Lipoptena mazamæ Rondani. Twelve of these small parasitic flies were found on a brocket deer, *Mazama sartorii reperticia* Goldman, that was killed in the forest near Camp Pital.

Cuterebra bæri Shannon & Green. Four large, mature larvæ of this species were collected by Dr. Wislocki from a young, black howling monkey, *Alouatta palliata inconsonans* Goldman, that was killed at Puerto Armuelles on July 27, 1929. These four larvæ were located in the skin in the region of the neck and an empty nodular pocket from which a fifth larva apparently had emerged was nearby. Three other young howling monkeys were shot at the same time. One of these was infested with a small, immature larva of this species. The other two each bore a number of empty nodular pockets from which it is more than likely that larvæ of this species had emerged a short time previously. Specimens of the larvæ were reared to adult flies in order to confirm the identifications. Larvæ of this species were collected in the Darien region by J. L. Baer, in 1924, and have been reported upon by Shannon and Green (1). Since there seems to be no record of this species having been taken in Chiriqui this is probably the first report of its presence in Western Panama.

Dermatobia hominis Linnæus. A larva of this species located itself on the inner side of Dr. Clark's elbow at Camp La Vaca in February, 1930. Two coatis, *Nasua narica panamensis* Allen, killed at Camp Pital, were found to be infested with larvæ of this species. A mature larva, about 21 mm. in length, was located in the right femoral region of one of the animals. The second coati was infested with two of the larvæ. They were approximately two-thirds mature and were situated at about the middle of the animal's tail, but little more than an inch apart. The tail was badly swollen, crooked at an obtuse angle and looked as though it were broken. From the appearance of the lesions one would assume that both these animals had suffered a considerable amount of pain and discomfort from the presence of these larvæ.

Gastrophilus nasalis Linnæus. A total of 58 of the larvæ, or "bots," of this species was found in a horse that was autopsied at Progreso, Chiriqui, on August 25, 1931. Fifty-six of these larvæ were clustered to form a rosette near the pyloric orifice of the stomach while two were found unattached in the stomach contents. These larvæ were large and apparently nearly mature. This seems to be the first record of this species in Panama and since it was found in an animal that had always been on the Isthmus there is no doubt regarding it being established in Chiriqui, at least.

Stomoxys calcitrans Linnæus. These flies were very common in the vicinity of Camp Pital and great numbers of them could be found feeding upon the pack mule all during the daylight hours. They apparently made no attempts to attack man.

Cochliomyia macellaria Fabricius. The screw worm flies were extremely abundant in the vicinity of Camp Pital during our stay there. They usually appeared in large numbers as soon as animals that had been killed were brought into camp and they became very active in darting about and attempting to deposit their eggs on the carcasses. The hunters, after killing and bagging animals, frequently left them lying by the side of some forest trail or hanging from the branch of a tree to be carried into camp on their return. Sometimes these bagged carcasses were left for periods of three or four hours and when much bleeding occurred the bags become blood soaked and large masses of eggs, most of which were probably of *C. macellaria,* were deposited on them. Occasionally these masses of eggs were several inches in diameter and nearly half an inch thick, and must have represented the ovipositions of large numbers of the flies. There were often a number of such masses attached to a bag, adhering very tightly to the cloth and difficult to remove completely by washing or scraping. A novel method finally evolved for cleaning the bags was to hang them in a stream and let the countless numbers of small minnows that were present tear the eggs from the cloth and devour them. These minnows came in great numbers as soon as an egg-bearing bag was placed in the water and they remained to feed as long as a single egg was available.

Simulium quadrivittatum Loew. The small blood-sucking flies of this species were numerous in the vicinity of Camp Pital and proved to be very annoying. They were persistent in their attacks and seemed to be ready to bite at nearly any time during the day or early evening. They would attack freely while in bright sunshine in open spaces but under such condition usually selected the under side of one's arms or hands and did not direct their attacks to the face. On rainy or cloudy days they seemed to appear in greater numbers. While feeding they became swollen and the abdomen when distended with blood assumed a deep red color. After becoming engorged they were very sluggish and could easily be picked off with one's fingers. A large number of specimens of this species was collected.

Culicoides fluviatilis Lutz. The small sandflies of this species were very prevalent at Camp Pital. Any of the members of our party who remained seated in a shady situation for a few minutes were attacked by numbers of these bloodthirsty diptera. They seemed to become more active and persistent in their attacks during late afternoon and early evening.

Culicoides paræensis Goeldi. Only one specimen of this species was taken at Camp Pital. They were, however, very common in the vicinity of Puerto Armuelles. One morning while at the latter place I was engaged in watching the actions of a group of monkeys in the forest about a mile from the sea-shore and remained seated in a small open area for nearly thirty minutes. During this time I was bitten by a number of these flies. Their attacks seemed to be mostly on my arms and hands. A number of specimens captured at this time all proved to be *paræensis.*

Lasiohelea sp., probably *stylifer* Lutz. One specimen was collected at Camp Pital. It was taken while feeding upon my arm in the early evening as I was seated under a palm-thatched shelter.

Ctenocephalides felis Bouché. A few fleas of this species were taken from a dog owned by one of the native hunters at Camp Pital. Undoubtedly this species may be found in abundance throughout all parts of Chiriqui where cats or dogs are present.

Rhopalopsyllus australis tupinus Jordan and Rothschild. Several males and females of this species were taken from two agoutis, *Dasyprocta punctata nuchalis* Goldman, that were captured at Camp Pital.

Rhopalopsyllus lugubris cryptoctenes Enderloin. This species was represented by five specimens on one of the agoutis.

Pediculus (*Parapediculus*) *atelophilus* Ewing. This species of sucking lice was found in abundance upon two baby monkeys purchased at Camp Bogamani by Dr. Clark in 1930. Camp Bogamani is located about five miles from Camp Pital. It is one of the District Camps of the Chiriqui Land Company and many of the men employed in clearing work and banana culture kept monkeys and other animals as pets. Those obtained there consisted of several very young red spider monkeys, *Ateles geoffroyi* Kuhl, and one white-throated monkey, *Cebus capucinus imitator* Thomas. One of the red spider monkeys was noted as being infested with lice at the time it was purchased. It was necessary to confine these six monkeys in the same cage during a period of about three days while being brought to this laboratory. On their arrival many lice were found on the white-throated monkey. It would seem that it must have been infested before being purchased at Bogamani. Both of these infested monkeys were also heavily infected with malaria at this time and were in very poor condition. The heavy infestation of the white-throated monkey was probably due to its weak and emaciated condition. Under normal conditions the *Cebus* monkeys keep themselves well picked over and seldom become infested with lice. The other four red spider monkeys each showed an infestation with lice a few days after arrival at the laboratory. It is of interest to note that no lice were found upon twenty-five red spider monkeys and twenty-nine white-throated monkeys that were examined soon after being captured or killed at Camp Pital while one, probably two, out of six monkeys that had been kept as pets proved to be infested with *Pediculus* (*Parapediculus atelophilus*.

Since nineteen species, representing eleven genera and four families, of Mallophaga were collected from the comparatively small number of infested animals and birds, it is probable that many species of biting lice would be found on more extensive collecting. Seven species were taken from the tinamous, four from the black headed vulture and three from the Swainson's toucans. In listing these species I have followed Harrison's (2) work of 1916, since this seems to be the latest comprehensive paper.

Menopon alternatum Osborn. Specimens of this species were found in small numbers on two black vultures, *Catharista urubu* (Vieillot), examined at Camp Pital.

Menopon balfouri Waterston. This species was present in all stages on five Swainson's toucans, *Rhamphastos swainsonii* Gould. It seems to be the prevailing species infesting these toucans.

Menopon ortalidis Carriker. Many males, females and immature specimens were collected from a curassow, *Crax globiceri* (Linnæus).

Colpocephalum kelloggi Osborn. A few males and females of this species were present on four black vultures, *Catharista urubu* (Vieillot).

Myrsidea extranea Carriker. A number of males, females and young forms were found upon three Swainson's toucans, *Rhamphastos swainsonii* Gould.

Myrsidea mirabilis Carriker. Several males and females of this species were collected from a Wagler's oropendula, *Zarhynchus wagleri wagleri* (Gray).

Læmobothrion glutianans Nitzsch. Several specimens of males and females of the large lice of this species were taken from three black vultures, *Catharista urubu* (Vieillot), examined at Camp Pital.

Trichodectes nasuatis Osborn. The small lice of this species were present in considerable numbers on each of three young coatis, *Nasua narica panamensis* Allen.

Goniodes aberrans Carriker. This species was found to be abundant in all stages on eight tinamous, *Tinamus major castaneiceps* Salvadori, that were eximined. Two of these birds were taken at Camp La Vaca and six at Camp Pital. This species may be considered the most constant and the most numerous of the Mallophaga found in tinamou in Western Panama.

Goniodes laticeps Piaget. A few specimens in various stages of development were found on five out of eight tinamous, *Tinamus major castaneiceps* Salvadori, that were examined.

Goniodes minutes Carriker. Several specimens were collected from each of two tinamous, *Tinamus major castaneiceps* Salvadori.

Goniodes spinosus Piaget. A number of males and females of this species were taken from two tinamous, *Tinamus major castaneiceps* Salvadori, at Camp La Vaca.

Kelloggia brevipes Carriker. Taken in considerable numbers from each of eight tinamous, *Tinamus major castaneiceps* Salvadori, examined.

Ornicholax robustus Carriker. Present in small numbers on each of six tinamous, *Tinamus major castaneiceps* Salvadori, examined.

Philopterus cancellosus Carriker. Several males and females were collected from a Swainson's toucan, *Rhamphastos swainsonii* Gould.

Degeeriella francisi Carriker. This species was represented by six specimens taken from a Wagler's oropendula, *Zarhynchus wagleri wagleri* (Gray), at Camp Pital.

Esthiopterum assesor Giebel. This appears to be the predominating species of Mallophaga found upon the black vultures, *Catharista urubu* (Vieillot). Four of these birds were examined at Camp Pital and each yielded many specimens.

Esthiopterum columbæ Linnæus. One specimen was found on a Cassin's dove, *Leptotila cassini cassini* (Lawrence), at Camp Pital.

Esthiopterum tinami Carriker. One female of this species was taken from a tinamou, *Tinamus major castaneiceps* Salvadori.

Although these records of ticks from Chiriqui represent only seven species, probably only a small part of the total number present, they include two species which do not seem to have been recognized in Panama previously.

Ixodes ricinus (Linnæus). A number of males and females were collected from a forest deer, *Mazama sartorii reperticia* Goldman, killed near Camp Pital.

Dermacentor nitens Neumann. Several specimens of this tick were taken from a horse at Progreso by Dr. Clark. Since this species is commonly found on horses in many parts of Panama it is undoubtedly abundant throughout Chiriqui.

Amblyomma cajennense (Fabricius). One of the native hunters found an unengorged female of this species crawling about on him soon after his return from a trip in the forest near Camp Pital. Several specimens were also collected from a horse at Progreso by Dr. Clark. It is probable that this species is as ubiquitous in Chiriqui as in other parts of Panama.

Amblyomma cœlebs Neumann. A dead female of this species was found in the bag in which a spectacled owl, *Pulsatrix perspicillata* (Latham), had been placed a short time previously at Camp Pital. The tick was quite dry and it is possible that it may have been carried on the feathers of the bird from some nest or dead host. Two females were also taken from a horse at Progreso by Dr. Clark. One of these, partly engorged, was more than 11 mm. in length. This appears to be the first record of this species in Panama.

Amblyomma mantiquirense Aragao. A number of males, females and engorged nymphs were collected from a collared peccary, *Pecari angulatus crusnigrum* (Bangs), that was killed near Camp La Vaca. This seems to be the first occasion on which this species has been found in Panama.

Amblyomma oblongoguttatum Koch. This species was found to be present in abundance upon a collared peccary, *Pecari angulatus crusnigrum* (Bangs), that was killed near Camp La Vaca. Numerous males, females and nymphs were also taken from a forest deer, *Mazama sartorii reperticia* Goldman, killed near Camp Pital.

Amblyomma ovale Koch. A female of this species was found crawling about on a titi monkey, *Saimiri orstedii orstedii* (Reinhardt), when the latter was removed from the bag in which it had been placed two or three hours earlier. Since this tick was not attached and contained no blood it is believed that the monkey was only an accidental host.

Trombicula dunni Ewing. The mites, or "red bugs," of this species were present in great numbers upon two agoutis, *Dasyprocta punctata nuchalis* Goldman, and three coatis, *Nasua narica panamensis* Allen, at Camp Pital. They were scattered in small groups over nearly all parts of the agoutis with additional large masses appearing as bright red spots, nearly 10 mm. in diameter, on either side of the upper and lower jaws, along the edges of the ears and at various places on either side of the body over the ribs on both these animals. One of them also had one of the masses beneath its chin. They were not so abundant on the coatis and were confined mostly to large masses on both ears of each of the animals. One of these coatis also had a large patch of the red bugs located on the dorsal line about midway of its back. These mites proved to represent a new species and were named and described by Ewing.

I wish to express my thanks and appreciation to Dr. H. C. Clark, for his aid in collecting many of the specimens, and also to Dr. C. T. Greene, Dr. J. Bequært, Dr. O. Krober, Dr. G. F. Ferris, Dr. H. E. Ewing, Dr. Karl Jordan and Dr. F. W. Edwards for their kindness in identifying many specimens of the various groups for me.

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REVIEW.

Studies in North American Trichoptera, 1.

By Lorus J. Milne, Cambridge, Mass., April, 1934; 19 pp., small 8vo. (For sale by author, 50c, postage extra; Biological Institute, Harvard Univ., Cambridge, Mass.).

This includes keys to the North American genera and species of *Phryganeidæ*, *Molannidae* and *Leptoceridae*, check-lists of world *Phryganeidae* and *Molannidæ* and of North American *Leptoceridæ*, in each case with only the North American synonomy. Three new genera, five new subgenera, three new species, four new subspecies and one new name are proposed; five old genera are resurrected, nine types of old genera are elected and thirty new North American synonyms are quoted, from a study of the type material in the Museum of Comparative Zoology, of Hagen's and Banks' names.

PSYCHE

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DESCRIPTIONS OF THREE NEW NORTH AMERICAN ANTS WITH CERTAIN ECOLOGICAL OBSERVATIONS ON PREVIOUSLY DESCRIBED FORMS

By William Steel Creighton
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Myrmica (Manica) parasitica sp. nov.

Worker: Length; 5 mm.

Head exclusive of the mandibles quadrate, as broad as long, the sides and occipital border feebly convex, the occipital angles broadly rounded. Anterior border of the clypeus entire, angular, the portion in front of the median lobe flat, the lateral portions at either side straight but receding toward the insertions of the mandibles. Median lobe of the clypeus strongly convex in two planes, sharply separated from the large, triangular frontal area. Mandibles large and powerful, the external border rather feebly convex except near the tip where it turns inward sharply. Masticatory margin armed with a long, sharp and rather thin terminal tooth and a much shorter and stouter subterminal tooth; the remainder of the masticatory margin bearing 12 - 15 small teeth. Frontal carinæ short, thick, bluntly pointed in front and rather widely separated. Antennal scapes short and rather thick, strongly and abruptly curved at the base; in repose the tip of the scape surpasses the occipital border by an amount less than its greatest thickness. First funicular joint longer than broad and somewhat broader than the adjacent joint, joints 2 - 6 gradually increasing in diameter and length, the four apical joints together form a distinct club whose maximum diameter is about three times that of the preceding joints. Eyes oval, moderately convex, set at the middle of the side of the head.

Thorax in profile with the promesonotum rather feebly convex, the promesonotal suture not impressed. Mesoepinotal suture prominent but with a shallow impression on the thoracic dorsum which is principally due to the elevated anterior edge of the epinotum since the posterior face of the mesonotum slopes directly to the suture without any impression. Epinotum in profile with a very feebly convex basal face which passes to the shorter declivious face through a poorly marked and very wide angle. In some specimens the angle between the two faces is virtually eliminated so that the profile of the epinotum is a single, convex, descending slope. Seen from above the promesonotum is pyriform and only a little wider than the subpentagonal epinotum. The sides of the thorax are only slightly constricted at the mesoepinotal suture.

Petiole seen in profile with a node which is very low, broadly and evenly convex above and without sharp transitions to the anterior or posterior peduncles. The ventral tooth on the anterior peduncle is very variable in character, In some specimens it is reduced to an angle, in others it has the form of a blunt, short tooth, in still others it is a very long and slender recurved spine. Dorsum of the postpetiole in profile with a long, sloping, feebly convex anterior face and a very short vertical posterior face. Ventral surface of the postpetiole in profile evenly convex. Seen from above the petiole is narrow and spindle shaped with the anterior peduncle slightly thinner than the posterior peduncle. The postpetiole has the form of a truncated cone with the sides convex. It is a little less than twice as wide as the node of the petiole.

Gaster bulky, oval.

The sculpture of this insect, particularly that of the head, shows considerable variation. In some specimens the entire head is covered with fine, longitudinal striæ. The more lateral of these curve downward under the antennal fossæ and are carried forward to the insertion of the mandible. In such specimens the head is feebly shining with a semi-matte appearance. In other specimens the striæ are almost entirely absent being represented by a few on the posterior parts of the frontal carinæ and others on the side of the head between the eye and the insertion of the mandible. In such specimens the remainder of the head is highly glabrous with numerous, small piligerous punctures. The same variability is true to a lesser extent of the thoracic sculpture. In some specimens the entire thorax is covered with fine punctures which grade into longitudinal striæ on the pleuræ. Such specimens are feebly shining. In other specimens the whole thorax is highly glabrous, entirely without sculpture except for a few feeble lines or punctures at the base of the pleuræ, The sculpture of the petiolar nodes is more constant since even in the heavily sculptured individuals, these are in large part glabrous. Abdomen smooth and shining with fairly numerous small piligerous punctures.

In color and pilosity the insect is more uniform. The head is piceous with the mandibles a somewhat more brownish black and having a wide band of sordid yellow extending along the masticatory margin. Thoracic dorsum blackish brown, the pleuræ of the pronotum clear, brownish yellow, the pleuræ of the mesonotum and epinotum a clear brown which is somewhat lighter on the declivious face of the epinotum. Petiolar nodes blackish brown. Abdomen a darker brown than the petiolar nodes but not as black as the head. The entire insect covered with rather long, slender, curved hairs which are pointed, erect and yellowish in color. These are most abundant on the head particularly on the ventral surface where they form poorly developed gular ammochætæ. Flexor surface of the femora with a row of stiff, erect bristles. Extensor surface of the femora, tibiæ, tarsi, antennal scapes and the proximal half of the funiculi covered with small, fine reclinate hairs. Clubs of the funiculi pubescent.

Host: *Myrmica* (*Manica*) *bradleyi* Wheeler.

Types in my collection and in the collection of Dr. W. M. Wheeler.

The series of workers upon which this species is based was taken on the summit of Polly Dome (elevation about 8600 feet), a small dome adjacent to Tenaya Lake on the Tioga Pass road in the upper part of Yosemite National Park, California. Because of glacial action the domes have precipitous sides planed to a high degree of smoothness. It is actually possible in certain lights to see a glaze on the surface, which resembles that of a polished terrazzo floor. Naturally, the domes themselves are not good areas for collecting since there is very little soil present and when any does occur it is usually in pockets of coarse gravel and sand not suitable for nest making. Despite such unfavorable conditions the nest containing the new species was found in one of these gravel pockets. When first discovered only five *parasitica* workers were taken since, at that time, the author had nothing with which to excavate the nest. These five workers together with a number of workers of the host, *bradleyi,* were taken back to camp alive and the relations between the two species observed. These were to every appearance perfectly normal, the *parasitica* workers taking their share of the activities and being treated as ordinary nest mates by the *bradleyi* workers. The following day the author returned to the nest site and excavated the entire gravel pocket, luckily a small one, down to bed rock. Eight more *parasitica* workers were secured but no queen of any kind was seen. I am of the opinion that she may have moved to a safer place following the initial disturbance of the nest since, due to the ease and completeness with which the gravel could be removed and sorted, it is curious that she should have been missed had she been present. The failure to find the queen is much to be regretted since her structure might have shed some light on the type of relation between the host and *parasitica*. As the matter stands at present it is impossible to state with certainty whether the new species is a slave maker or a temporary social parasite. In view of the fact that *parasitica* is smaller than *bradleyi* and has no mandibular specialization which might offset this disadvantage it seems more likely that the new species is a temporary social parasite.

Because of the close correspondence of general morphological characteristics it can scarcely be doubted that *parasitica* has been derived from *bradleyi.* It differs from *bradleyi,* however, in the following respects: the epinotum is lower and less angular, the node of the petiole is lower and more rounded, the sculpture is more feeble as even the most heavily sculptured individuals of *parasitica* never approach the heavy sculpture characteristic of *bradleyi,* the thorax and petiolar nodes are black (reddish yellow in *bradleyi*), the hairs are stouter, more uniformly erect and considerably more numerous on the ventral surface of the head.

Aphaenogaster (Attomyrma) huachucana sp. nov.

Worker: Length: 4.5-7 mm.

Head exclusive of the mandibles one and one half times as long as broad, the sides subparallel in the anterior two-thirds but narrowing sharply in the posterior third. Occipital border flat, less than half as wide as the greatest width of the head and bordered by a narrow but very distinct reflected flange. Clypeus moderately projecting, the anterior border sinuate with the median impression in some specimens broad, shallow and evenly concave, in others deeper, and more narrow with a distinct notch in the middle. Median lobe of the clypeus rather flat, ecarinate, not sharply marked off from the lateral portions and with an evenly rounded posterior border between the frontal carinæ. Frontal area only slightly depressed, shining with a prominent median carinula. Mandibles slender, the external margin straight except near the tip where it turns inward sharply and is convex. Outer third of the masticatory margin armed with three prominent teeth which decrease in length from the terminal tooth inward, the remainder of the masticatory margin irregularly serrate. The straight inner margin of the mandible meets the masticatory margin at a sharply marked angle. Eyes oval, of moderate size and rather strongly convex with their posterior borders lying slightly in front of the middle of the side of the head. Frontal carinæ prominent and subparallel, their lateral portions in the anterior half turned upwards so that from above this part of the carina appears narrow and welt-like. Antennal scapes long, slender and evenly though slightly curved outward. In repose they surpass the occipital border by one-third their length. The base of the scape is strongly spatulate. Funiculus filiform, joints 1 - 7 all of about the same length and diameter and all several times longer than broad, joints 8 - 12 somewhat broader than the preceding joints and slightly increasing in diameter apically.

Dorsum of the pronotum in profile feebly convex. Just posterior to the promesonotal suture the mesonotum is abruptly elevated. This elevated portion, which is flat on top, occupies the anterior half of the mesonotum and passes to the posterior half through a short and abruptly descending declivity. The posterior half of the mesonotum, which is also flat on top, is slightly if at all higher than the adjacent portion of the epinotum from which it is separated by a narrow U-shaped impression at the mesoepinotal suture. Epinotum in profile angular, the basal face, which is straight and slopes slightly to the rear, twice as long as the almost perpendicular declivious face. The angle between the two faces is armed at either side by a short, rather blunt tooth with a very wide base. Seen from above the pronotum is subpentagonal with the lateral portions carried back past the anterior half of the mesonotum so that the latter has the appearance of being a part of the pronotum. Just behind the pronotum the sides of the mesonotum are slightly constricted. There is no constriction of the sides at the mesoepinotal suture other than the very shallow incision formed by the suture itself. Seen from above the dorsal face of the epinotum bears a shallow longitudinal sulcus extending backwards between the teeth. This sulcus is bordered at either side by a ridge which extends forward from the base of each tooth.

Node of the petiole in profile with a straight, sharply sloping anterior face which meets the anterior peduncle at a wide but well-marked angle. Summit of the node blunt, the posterior face slightly convex and steeply descending to the very short posterior peduncle. There is no ventral tooth on the anterior peduncle but a narrow lamella runs almost its entire length. Postpetiole in profile notably larger than the node of the petiole, its dorsum consisting of a long, sloping anterior face, a rounded summit and a shorter and more declivious posterior face. The ventral face of the postpetiole is straight or feebly sinuate. Seen from above the node of the petiole is subcircular, about twice as wide as the anterior peduncle and a little more than half as wide as the pyriform postpetiole.

Gaster rather small, oval.

Mandibles moderately shining, covered with fine and somewhat irregular longitudinal striæ. Entire head, except for the frontal area and the antennal fossæ, feebly shining or dull, coarsely reticulo-rugose with the interrugal spaces finely granulose. Just above the insertion of the mandibles and on the clypeus the granulation is more feeble than elsewhere. In some specimens the median lobe of the clypeus lacks the granulation altogether. Antennal scapes finely and densely punctate. Thorax densely and rather more coarsely granulose than the head. In certain lights feeble rugæ may be seen on the thorax, especially on the epinotum where they are most prominent. None of them, however, are nearly as well developed as those on the head. Petiolar nodes finely granulose. Abdomen glabrous with exceedingly fine, piligerous punctures.

Hairs moderately numerous, rather short, coarse, golden, erect and somewhat obtuse. About equally numerous on all parts of the body. Femora with short, rather sparse, erect hairs: those on the tibiæ and tarsi more numerous, finer and suberect or appressed. Antennal scapes with numerous, very fine, appressed hairs; those on the funiculi longer, stouter and suberect except on the four terminal joints where the erect hairs are replaced by pubescence.

Color: head, thorax and petiolar nodes rich reddish brown to yellowish brown; the mandibles, legs and abdomen brownish yellow to clear yellow.

Described from a series of ninety workers taken in Ramsey Canyon, Huachuca Mountains, Arizona, at an elevation of 7000 feet.

Types in my collection and in the collection of Dr. W. M. Wheeler.

There can be little doubt that *huachucana* is closely related to *texana,* particularly to the variety *furvescens* Wheeler. Despite the fact that *furvescens* was originally described from material taken in Ramsey and Miller Canyons in the Huachuca Mountains I have no hesitancy in regarding *huachucana* as a distinct species since the structural peculiarities which it shows are reinforced by pronounced ecological differences. On the basis of structure the most obvious difference in the two species lies in the greater size of the new form (4.5-7 mm. in *huachucana,* 4-5.5 mm. in *furvescens*). In addition the head of *huachucana* is of a different shape. This is due largely to the fact that the sides in the narrowed posterior third are less convex, the occipital border narrower and the flange which borders the latter more pronounced in the new species. The antennal scapes in *huachucana* are notably longer than those of *furvescens* and are strongly spatulate at the base, a feature not present in the scape of the latter form. In the thorax of *huachucana* the anterior half of the mesonotum is more sharply set off from the adjacent portions of the thorax, particularly behind where there is a definite descending posterior face not found in the thorax of *furvescens.* The character of the epinotal spines is quite different in the two forms. In *huachucana* these are short and very broad at the base so that they are more aptly regarded as angular teeth than spines. In *furvescens* the spines, while only slightly longer than those of *huachucana,* are slender throughout and not tooth-like. Finally the sculpture of *huachucana* is uniformly heavier than that of furvescens.

The ecological differences are equally distinct. The nest from which the types of *huachucana* were secured was situated at the base of a rocky ledge above a very steep slope on the western side of the canyon. The arrangement was such that the nest was in the shade for the greater part of the day. The elevation, as has been already noted was 7000 feet. I have taken many colonies of *furvescens* both in Ramsey and Miller Canyons. These were invariably under stones in sunny situations not far removed from the stream bottom and at elevations not exceeding 6000 feet. Finally the actions of *huachucana* are quite different from those of *furvescens.* The insects are slow, one might almost say clumsy, in movement even when excited, a marked contrast to the active and energetic workers of *furvescens.*

On the last day of May 1932 one of my students, Mr. Solomon Friedland, while collecting along the top of the Palisades near Englewood, N. J. had the good fortune to secure a single female belonging to the genus Anergates. At that time I considered the insect identical with the European *atratulus* but subsequently, through the generosity of Dr. W. M. Wheeler, I have been enabled to compare it with specimens of *atratulus* collected by Dr. Wheeler in Switzerland. This comparison has revealed a surprising number of significant differences and I now feel that the insect taken by Mr. Friedland must be regarded as a new species. Mr. Friedland's discovery is of twofold interest for it not only gives us first record of Anergates in the New World but also furnishes important data on the distributional status of the host species *Tetramorium cæspitum.* This matter is discussed in detail at the end of the following description.

Anergates friedlandi sp. nov.

Female: Length: 2.2 mm. (the gaster not expanded)

Differing from the female of *atratulus* in the following characteristics:

The single mucronate point with which the mandible is armed longer and stouter; the convex masticatory border of the mandible very feebly serrate (smooth in *atratulus*). Eyes nearly circular in outline and strongly convex with rather fine facets (oval and moderately convex with coarse facets in *atratulus*). Lateral ocelli small and so placed that they are hidden when the head is viewed from directly in front by the rectangular occipital crest on which they are borne (lateral ocelli larger and distinctly visible from the front in *atratulus*). Antennal scapes slightly and evenly curved outward, gradually increasing in thickness from base to apex and in repose surpassing the occipital border by an amount equal to the greatest thickness (in *atratulus* the scapes are almost straight, thickest at a point about three-quarters of the distance to the apex and in repose surpassing the occipital border by an amount less than their greatest thickness). Seen from above the epaulet-like lateral portions of the pronotum are strongly concave, blunted behind and set off from the median portion of the pronotum by a rounded welt or ridge (in *atratulus* the lateral portions of the pronotum are only slightly concave, rather sharp behind and set off from the median portion of the pronotum by a sharp ridge). Scutum longer than in *atratulus* and with more overhang at the anterior edge. The posterior portion of the scutum is evenly depressed all the way across including the paraptera so that there is a sharp transition to the scutellum when the thorax is viewed in profile (in *atratulus* the depression of the scutum is median only, the paraptera not being depressed, so that there is a sort of a shallow trough formed on the dorsum of the thorax; however in profile the transition between the scutum and scutellum appears less abrupt because of the elevation of the paraptera above the level of the middle of the scutum). Scutellum narrower and much more convex than in *atratulus*. Epinotum seen from above with the lateral projections less prominent and more rounded than in *atratulus*. Seen from behind the broad longitudinal impression on the posterior face of the epinotum is broadly rounded above (narrower and rather pointed above in *atratulus*). Seen in profile the node of the petiole has a definite, short posterior face, a rounded and rather narrow summit and a long steeply sloping anterior face. Although both posterior anterior peduncles are short both are distinctly visible in profile and sharply set off from the node (in *atratulus* the node of the petiole is much bulkier with the dorsum broad and obtusely angular. The anterior and posterior peduncles are so short as to be virtually invisible when seen in profile). Postpetiole seen from above thinner from front to back than in *atratulus* with the anterior edge much less convex. The dorsum bears a shallow, median longitudinal sulcus (entire in *atratulus*). Abdomen with a deep median sulcus as in *atratulus*.

Sculpture very finely and evenly punctato-rugose except the very deeply notched clypeal border, the mandibles and the appendages which are shining. The sculpture is uniformly heavier than in *atratulus*, particularly on the posterior abdominal segments where it renders the surface definitely opaque (feebly shining in *atratulus*).

Color: head and thorax blackish brown, gaster a somewhat clearer brown, appendages dirty yellow. Wings hyaline, covered with numerous small hairs, the veins and stigma pale yellow.

Type in my collection.

It is much to be regretted that this interesting insect is known only from a single specimen. Following Mr. Friedland's discovery I returned with him to the type locality, a small meadow at the side of U. S. Highway No. 9 about three miles north of Englewood, N. J. In this place there are many nests of *Tetramorium cæspitum* constructed in coarse, gravelly soil along the sides of a fill over which the highway runs. Although we examined a number of the nests and although, during the following spring, the site was revisited for more extensive observation, no additional specimens have been taken. This is scarcely surprising in view of the rarity of the European *atratulus*.

As has already been mentioned the presence of Anergates in North America presents some points of peculiar interest. In the Old World *Anergates atratulus*, a workerless parasite with degenerate, pupoidal males, is known to occur only in the nests of *Tetramorium cæspitum*. There is no reason to suppose that the American species possesses a generically different host. However it has been generally held that the presence of *Tetramorium cæspitum* in this country has come about through introduction from Europe. In point of fact there is more than a little evidence in favor of such a view. In 1905 when Dr. W. M. Wheeler published a list of the ants of New Jersey (1) he outlined the range of *T. cæspitum* as follows: "It occurs northward and eastward of New York as far as the Connecticut boundary, westward as far as Philadelphia and southward as far as Virginia." In subsequent years Dr. Wheeler published two other faunal lists dealing with New England species. The first of these (2) which appeared in 1906 covered all the New England states. In this paper there is a single record of *cæspitum* based on material taken by Dimmock at Springfield, Mass. The second of the lists mentioned above (3) appeared in 1916 and dealt with Connecticut only. In this paper Dr. Wheeler stated that *cæspitum* must certainly occur in Connecticut but he added that at the time of publication he had no actual records of the insect from that state. In 1927 Dr. Wheeler, reported (4) the first appearance of *cæspitum* in metropolitan Boston, In the same year I found several colonies of this ant along the paths of the Arnold Arboretum in Forest Hills. I have subsequently received specimens from Dr. Geo. Tullock taken at Bridgewater, Mass. Since *cæspitum* is by no means an obscure ant it follows that the virtual absence of New England records prior to 1929 can scarcely be credited to oversight on the part of collectors. For this reason its appearance in the vicinity of Boston in 1928 may be regarded as a migrational ingress. This is entirely in keeping with the character of an introduced species but is not easy to explain in the case of a native form.

All of the above evidence is, of course, negated by the discovery of an American species of Anergates. Under these circumstances to continue the belief that *Tetramorium cæspitum* is an introduced ant necessitates the assumption, that when introduced a nest of *cæspitum* contained specimens of Anergates and since the time of introduction Anergates has undergone sufficient change to rank as a separate species. The author finds neither point tenable and is therefore prepared to regard *cæspitum* as a native member of our North American ant fauna. This bears out evidence presented by two of Emery's earlier records for *cæspitum,* one from Tennessee, the other from Nebraska. These records were always troublesome to the older view of *cæspitum* as an introduced species since both lie well beyond the eastern range of the ant and are separated from it by areas in which *cæspitum* apparently does not occur. Such a distribution need occasion no remark in the case of a native form.

One additional point may be considered here. It is possible that the insect which we now regard as the North American representative of *Tetramorium cæspitum* may not be cospecific with the European form. As far as the author can ascertain there are no differences of specific significance but since *cæspitum* shows a number of variants in Europe it is difficult to make a positive statement in this regard. However, even should the North American *Tetramorium* prove identical with one of the European forms of *cæspitum* its status as a native ant remains unaltered. One need only cite the case of *Formica fusca* to furnish an example of a holarctic host which supports specifically different parasites in the Old and New Worlds and whose distribution cannot possibly be the result of introduction.

ECOLOGICAL NOTES.

(1) An unusual slave of *Formica sanguinea* subsp. *puberula* Emery.

During the summer of 1933 the writer had the opportunity of collecting in the La Sal Mountains in southeastern Utah, an excellent region of unusual scenic beauty. The area worked was in the vicinity of the Warner Ranger Station which is situated on the northwestern side of Mount Allen at an elevation of about 9500 feet. Most of the collecting was done at the upper edge of a sage brush area which covers a large part of the top of Wilson Mesa. At the elevation just mentioned the sage brush is stunted in size and occurs on exposed ridges between which there are valleys filled with aspen trees. In this aspen-sage brush association one of the most abundant ants is *Formica sanguinea* subsp. *puberula* Emery. Of the many colonies of this insect which the author examined one was unique in containing specimens of *Formica microgyna* subsp. *rasilis* Wheeler as slaves. In addition a second slave, *Formica cinerea* var. *altipetens* Wheeler, was present. This second slave need cause no comment since other forms of *cinerea* have been previously reported as enslaved by *puberula*. So far as I am able to determine, however, there is no previous record of the enslavement of any member of the *microgyna* group.

It may be seen that there are two explanations for the formation of the colony just described. The simplest assumption is that the *rasilis* workers had been brought into the nest as a result of dulosis. On the other hand, since *rasilis* is known to be a temporary social parasite, it is possible, though not likely, that the colony might have arisen through the simultaneous entry of a female of *puberula* and one of *rasilis* into the original *altipetens* colony. A thorough excavation of the colony lead to the finding of two females of *puberula* but no female of *rasilis* was seen. In this case I feel that it is permissible to utilize the negative evidence resulting from her absence and state that the *rasilis* workers had been secured through dulosis since, less than a hundred yards from the excavated nest, I subsequently found a *puberula* colony engaged in attacking a nest of the typical *microgyna*. The *microgyna* nest was built at the base of a small sage brush plant around the stem and lower branches of which the rather flat mound had been constructed. On the surface of the mound were numerous clusters of ants. Examination showed that these consisted of two or three *microgyna* workers industriously engaged in dragging away a worker of *puberula.* In no case did I see any dead raiders. Nevertheless the activities of the *microgyna* workers were effective if not lethal for, when their nest was opened, not a single raider was found inside.

Several interesting deductions may be drawn from the above data. In the first place it seems obvious that the *rasilis* workers present in the original *puberula* colony were obtained as the result of some unusual condition which enabled the raiders to enter a nest from which they would have ordinarily been excluded. In the second place we may safely conclude that the infrequent occurrence of members of the *microgyna* group in the nests of slavemakers is due to the defensive activities of the former and not to any discrimination on the part of the slave makers. This is entirely in keeping with the idea advanced by Dr. W. M. Wheeler (5) that the type of slaves which appear in the nests of dulotic species will be determined by the abundance and degree of docility of the enslaved species.

(2) The nest founding of *Formica ulkei* Emery.

While collecting in the Black Hills of South Dakota in September 1933 the author secured numerous specimens of *F. ulkei* Emery in the type locality, Hill City. Among these was a single female which had been adopted by a small colony of *Formica fusca.* It may be recalled that in his monograph of the genus Formica Dr. Wheeler postulated *fusca* as the temporary host of *ulkei* (6). The nest in which the female just mentioned was taken was a small one consisting of not more than three dozen *fusca* workers most of which were minims. It seems likely, therefore, that the nest-founding activities of *ulkei* differ in no essential respects from those of *exsectoides,* the female securing adoption by a depauperate queenless colony of the host species. It may be added that in the neighborhood of Hill City the nests of *ulkei* are widely separated with little evidence for the formation of daughter colonies through migration. Further south, however, in the Custer State Park the author found areas in which there were several nests in close proximity. Although these multiple nest colonies are perhaps less numerous than the enormous groups formed by the eastern *exsectoides* there is ample evidence that *ulkei* does on occasion form daughter colonies by migration.

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MOSQUITO INVESTIGATIONS IN ALASKA

By George S. Tulloch
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During the summer of 1931 the United States Department of Agriculture and the United States Smelting Refining and Mining Company entered into a coöperative agreement in connection with investigations as to the "habits, biology and methods of control of mosquitoes in Alaska". The writer was employed by the United States Smelting Refining and Mining Company to carry on the investigations under the technical direction of F. C. Bishopp of the Bureau of Entomology. The investigations were carried on in the vicinity of Fairbanks, Alaska, with headquarters at the Fairbanks Exploration Company, a subsidiary of the United States Smelting Refining and Mining Company. Laboratory quarters (Fig. 1) were located at Fox, eleven miles northeast of Fairbanks.

The purpose of the investigations was to determine if practical control methods could be suggested which would reduce the annoyance of mosquitoes to men engaged in gold mining operations. In this region workmen must protect themselves from the attacks of these pests. Nets (Fig. 2) and gloves or similar means of protection (Fig. 3) serve this purpose during the periods in which mosquitoes are abundant. Although mosquito investigations have been carried on in many parts of the world, it is believed that this was the first attempt to study the control of mosquitoes in a practically arctic environment.

The area in which the investigations were carried on lies between 64°-10' and 64°-50' north latitude and between 147°-20' and 147°-20' and 147°-50' west longitude in the Yukon-tanana region which forms a part of the central plateau of Alaska. Mr. James Crawford, research engineer of the

Fig. 1. Laboratory Quarters at Fox, Alaska

Fig. 2. Net used as protection against mosquitoes

Fig. 3. Use of gloves as protection against mosquitoes

Fairbanks Exploration Company, has described the general region as follows:

"The region may be described as a plateau, with bed rock composed predominantly of schists, which has been cut by numerous streams and their tributaries. Comparatively broad unsymmetrical valleys with broad interstream areas are characteristic. Isolated prominences, locally known as

Fig 4. Characteristic view of country in the region where mosquito investigations were made

domes, which are composed of igneous rocks and owe their presence to the resistance of such rocks to weathering, rise above the general level of the neighboring ridges (Fig. 4). The average elevation of the ridges is around 2000 feet above sea level, while that of the valleys varies from 470 feet at Fairbanks to 940 feet in the valley of Goldstream at Gilmore."

"The region has been subjected to long continued and intricate stream modeling and since it lies outside the area of glaciation, its topography is due almost exclusively to stream erosion. A mantle of 'muck', in part decomposed organic material, covers the hillsides and the unconsoligated gravel deposits in the valleys. This mantle is in turn covered by varying thicknesses of moss on the hillside, which is combined with bunch grass, locally known as 'niggerheads' in the valleys. Spruce trees grow extensively on the side hill while clumps of birches, willows and alders are found in the valleys. Since the ground is permanently frozen over large areas and during the summer thaws to shallow depths only, the trees are for the most part stunted."

"The drainage in the area is controlled by the Tanana, the chief streams being the Chatanika, Goldstream, and the Tanana. Most of the tributaries head at about the same elevation, have about the same grade and carry approximately the same amount of water. The courses of the small tributary streams are well defined and definite throughout their lengths, however, drainage conditions in the flat portion of the valleys traversed are poor, due in part to frozen ground and vegetation. In most of the valleys shallow swamps interspersed with 'niggerheads' stand above the general elevation of the stream. In the broad valleys such as those of the Chatanika and Goldstream, large areas of such swamps are present. * * * *."

The climate of the interior of Alaska is characterized by extremes in temperature and light precipitation. The so-called "interior" of Alaska is the drainage system of the Yukon River with its tributaries, the Koyukuk, Chandalar, Tanana, Kantishna and Porcupine Rivers. This region lies well to the north of the Gulf of Alaska and the Aleutian chain of islands. It is well known that the vicinity of The Alaska Peninsula is a continuous low pressure area and a breeding place for storms. The cyclones and anti-cyclones occurring in this region move eastward across the Gulf and follow several established routes across the United States and Southern Canada. The offshoots from these lows rarely affect the climate of the interior, although they cause storms and precipitation on the southern slopes of the Alaska Range. Occasionally a low pressure area will move through the interior, coming up from the Bering Sea. These give southerly winds throughout the interior. During the summer the heated interior of Alaska is conducive to low pressure areas of slight intensity which, in turn, induce precipitation.

The precipitation over the greater part of the interior is small. Around Fairbanks it averages from 10 to 14 inches. About 25% of this occurs in the form of snow. Normally the wettest months are July and August with June and September following. These four receive over half the year's precipitation. Over a period of 15 years the records show that the wettest years gave over twice the precipitation of the dry years. This disparity is due largely to the excess of rainfall in the summer months of the wet years and a deficiency of rainfall in dry years rather than marked changes from normal in other months. Around Fairbanks snow is usually gone by the last of April, although an occasional fall of snow in May or June is not uncommon. During the summer months rainfall is sometimes attended by mild thunderstorms and sometimes hail.

The summers of interior Alaska have delightful temperature conditions. They are warm enough for comfort, but are not oppressively hot. The long days and continuous sunshine cause rapid growth of vegetation. The highest temperature ever recorded over many years was 100° F. at Fort Yukon in July, 1915. The spring months have the highest percentage of possible sunshine and the late fall and the early winter months the least. Fairbanks averages 17 clear days in April and only 8 in September. Winter temperatures are as low as 75° F.

The situations in which mosquito larvæ were found developing fall into two fairly well defined categories. The first included those areas in which the water was present during the greater part of the summer while the second included those areas in which the pools were temporary in nature. Prospect shafts and permanent swampy areas are included in the first category while the surface pools found in the moss and in the "niggerheads" are included in the second category.

The larvæ found to be peculiar to the permanent breeding areas represented two species, *Culiseta alaskænsis* and *Culex apicalis*. The larvæ of the first species appeared during the latter part of the season having developed from eggs laid by the overwintering females. The larvæ of the second species were found earlier in the season, having developed from overwintering eggs. The adults of *C. alaskænsis* although they were present in great numbers during the early part of the season of 1931 did not cause any great annoyance to the workmen.

The following species appear to be represented in the material collected during 1931:

TABLE I

1. *Anopheles maculipennis* Meigen	Adult
2. *Culiseta alaskænsis* Ludlow	Larva and Adult
3. *Culiseta impatiens* Walker	Adult
4. *Aëdes diantæus* H. D. and K.	Larva
5. *Aëdes communis* Felt and Young	Larva and Adult
6. *Aëdes fitchii* H. D. and K.	Larva
7. *Aëdes punctor* Kirby	Larva and Adult
8. *Aëdes aldrichi* Dyar	Larva and Adult
9. *Aëdes cyclocerculus* Dyar	Larva
10. *Aëdes leuconotips* Dyar	Larva
11. *Aëdes impiger* Walker	Larva
12. *Aëdes aboriginis* Dyar	Larva and Adult
13. *Aëdes stimulans* Walker	Larva and Adult
14. *Aëdes cataphylla* Dyar	Adult
15. *Culex apicalis* Adams	Larva and Adult
16. *Eucorethra underwoodii* Underwood	Larva and Adult
17. *Chaoborus trivittatus* Loew	Larva
18. *Corethra* sp.	Larva and Adult

The mosquitoes found to be developing in the temporary situations represented several species, many of which were troublesome. The water in these pools resulted from two sources, the more important of these being the melting of the snow. The subsequent accumulation of water in small pools provided excellent breeding places for the development of the larvæ from the overwintering eggs. The second source was not of as much consequence, being the result of the thawing of the frozen ground; the water rising to the surface and forming new pools or adding to the pools which had resulted from the melting of the snow. During some seasons it is possible that the rainfall during April and May may result in the formation of pools similar to those formed by the melting snow. Such a condition did not exist during 1931; water from rainfall acted in a contributory capacity, viz., replenished pools so that the water remained long enough to allow larvæ to complete their normal development.

Although the number of species present was rather large only four, *A. punctor, A. communis, A. aldrichi* and *A. stimulans* were present in large numbers. As far as is known, the life histories of these four species are very similar, the general description which follows being equally applicable to all. The eggs are laid in summer on moist or dry ground and remain unhatched until after having been exposed to winter cold. Early in the spring when rising temperatures cause the accumulated snow and ice to melt forming pools on the frozen ground, the eggs hatch and the first stage larvæ appear. During 1931 some larvæ reached maturity early in June, pupation being first noted on June 8. Adults of *A. communis, A. punctor,* and *A. aldrichi* appeared about the same time in the middle of June and were present in noticeable numbers throughout the same period (Table 2) during the season. *A stimulans* appeared somewhat later and was present in numbers throughout a longer period than the other three. Information pertaining to the distribution and relative abundance of these troublesome species was collected by the timekeepers at four different stations in the gold dredging area. The method employed was to have each timekeeper make a five minute collection at the same time and the same place each day. Specimens were sent in for identification on Saturday of each week. The results from one of these collection points are tabulated below. These results are similar to others collected from other stations except in a few minor details.

TABLE II

Number of specimens of different species taken in five minute collections on man at Gilmore, Alaska.

Date	No. of specimens	Aedes communis	Aedes punctor	Aedes aldrichi	Aedes stimulans	Culiseta alaskaensis	Anopheles maculipennis	Unidentified*
6-17	20	4		6		1	1	8
6-18	11	7						4
6-19	16	5		1				10
6-20	3				1	2		
6-21	30	3	7		1			19
6-22	3							3
6-23	20					2		18
6-24	20	2						18
6-27	8		1					7
6-28	15	1			1	1		12
6-29	6				2			4
6-30	2				1			1
7-2	4				3			1
7-3	4			1	3			
7-6	8				5			3
7-7	7				5			2
7-8	4							4
7-16	3				3			
7-18	3				2			1
8-11	4				4			
8-12	2				2			
8-13	5				5			
8-14	4				4			
8-15	5				5			
8-16	4				4			
8-17	6				5			1

*Specimens damaged during collection.

Although no detailed study of the various natural factors controlling the abundance of mosquitoes was made, the following observations were made which indicated that considerable numbers of mosquitoes were destroyed by predacious insects and other enemies. Larvæ of Dytiscid and Hydrophilid beetles were abundant as well as backswimmers, all of which are known to be efficient enemies of mosquito larvæ. The predacious larvæ of three species of mosquitoes (Table 1) were found in large numbers and birds and amphibians reputed to prey upon the larva or adult mosquito were present also in this region.

It was a generally admitted fact that the mining operations themselves have aided in abating the nuisance from mosquitoes. The removal of the surface moss and muck and the dredging operations have reduced the extent of the breeding areas. The removal of brush has reduced the extent of the natural environment preferred by the troublesome adults and driven them away from the vicinity of the workmen. As a result of these two operations the conditions in certain localized areas have been improved greatly. At the conclusion of the investigation in 1931 specific recommendations were made relative to further improving the conditions near the mining operations.

As indicated before the major portion of the breeding during 1931 was in the pools in the moss and the niggerheads situated in the lower level portions of the valleys, These pools are usually covered partly or entirely with dead grass and moss from the previous year. The presence of this dead vegetation retards the evaporation of water as well as impedes the drainage. It was recommended that all the dead grass and moss around the operations be removed by burning during the spring of the year. This recommendation was prompted by the observation that an area of about one hundred acres which had been fired accidentally contained relatively few pools containing larvæ while in the adjacent unburned areas larvæ were abundant in the pools. Other recommendations included oiling and draining of pools within 500 yards of the operations, the use of copper sulphate as a larvicide and the use of repellants by the workmen. Control work was carried on during 1932 under the direction of Mr. J. D. Crawford. In the report at the end of the season, Mr. Crawford recommended that the work be continued during the season of 1933.

TWO NEW NORTH AMERICAN ANTS

By M. R. Smith
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Recently I received for identification from Illinois, two species of ants which I believe to be new to science. One of these, a *Leptothorax,* was collected by Miss Mary Talbot at Plainsfield. To this species, which is characterized by its peculiar type of sculpturing, I have assigned the name *foveata.* The other new ant is a member of the *Lasius Acanthomyops* group. Workers of this species were collected at Herrin, by Drs. T. H. Frison and H. H. Ross. Although this ant has many characters that will set it apart from its cogeners, I have chosen the name *parvula* for it because of its unusually small size.

Dr. W. M. Wheeler confirms my opinion that both of these species are new.

Leptothorax foveata sp. nov.

Worker:—Length 2.43 mm.

Head moderately large, excluding the mandibles, noticeably longer than broad, with moderately convex sides, rounded posterior angles, and straight posterior border. Eyes large and prominent, oval, convex, placed near the middle of the sides of the head. Mandibles with 5 distinct teeth. Clypeus convex, with anterior border entire. Antennæ 11-segmented; scape lacking its greatest width or slightly more of attaining the posterior border of the head; first funicular segment longer than segments 1 and 2 taken together. Thorax short, robust, convex above; viewed dorsally the humeri are rounded, the pro-mesonotal suture very faintly visible, and the meso-epinotal suture only slightly more perceptible. Epinotal spines moderately long and robust, directed upward, outward and backward. Petiole viewed in lateral profile with feebly concave anterior surface, faintly convex or flattened superior surface, which posteriorly rapidly descends toward the postpetiole. Postpetiole from above with convex node, which is very distinctly broader than long.

Head, thorax, petiole, and postpetiole, with foveate impressions, subopaque; those on the head much finer, especially on the front and vertex where they are intermingled with very fine longitudinal rugulæ; remainder of head, and dorsum of thorax, petiole, and postpetiole reticulate-foveate. Gaster glabrous, appendages very similar.

Head, thorax, petiole, postpetiole, and gaster sparsely covered with short, erect, clavate hairs of a grayish or light yellowish color. Pubescence very fine and appressed, extremely sparse, most easily discernible on appendages.

Color deep reddish brown or ferruginous brown, with lighter appendages and gaster. Eyes and mandibular teeth black.

Described from a single worker, the type of which is in my collection.

The type worker, and an abnormal worker specimen were collected by Miss Mary Talbot in the nest of *Aphænogaster fulva* subsp. *aquia* Buckley in a roadside ditch at Plainfield, Illinois on May 25, 1933.

This species is so different from all of the *Leptothorax* with which I am familiar that I am somewhat hesitant in trying to assign it to its proper taxonomical position. In Wheeler's key to the species of *Leptothorax* (Proc. Acad. Nat. Sci. Phila. p. 223, (1903) the specimen would apparently key down to the *acervorum canadensis* group. From *canadensis* the species can be distinguished by the following characters: (1) lack of a distinct longitudinal impression on the clypeus, (2) longer scape, (3) shorter thorax, (4) poorly developed pro-mesonotal and meso-epinotal sutures, and (5) differently shaped petiole and postpetiole.

The most striking characteristics to me are the unusually prominent eyes of the worker, as well as the peculiar type of sculpturing; the species has, therefore, been very aptly named *foveata*.

Lasius (Acanthomyops) parvula sp. nov.

Worker:—Length 3.0 mm.

Head, excluding the mandibles, only very slightly longer than broad, narrower in front than behind, and with straight or very feebly excavated posterior border and regularly convex sides. Mandibles, each with 6 to 7 very distinct teeth and some smaller, less defined denticulæ; the superior surface without teeth as with *L. interjectus.* Eyes extremely small, resembling somewhat those of *L. flavus* subsp. *nearcticus,* apparently with not more than 6 ommatidia in their greatest diameter. Antennal scapes short, scarcely if at all, exceeding the posterior border of the head. Petiole apparently lower and thicker than with *L. interjectus;* anterior surface convex, posterior surface flattened, and superior surface transverse, entire.

Body, and coxæ and femora of legs covered with rather abundant, moderately long, erect, pale yellowish hairs. Pubescence fine and appressed, sparsely covering all parts of body except the appendages.

Pale yellowish, especially the gaster, which is lighter than the other parts of the body.

Described from 4 workers, the cotypes of which are in my collection.

These ants were collected by Drs. T. H. Frison and H. H. Ross of the Illinois State Natural History Survey at Herrin, Illinois, on October 12, 1933. According to these gentlemen the ants were collected in the soil beneath a rotten log in an open wood lot. They were associated with *Lasius niger* var.

That this species belongs to the subgenus *Acanthomyops* is clearly indicated by the 3-segmented maxillary palpi of the workers. At a glance one would assign the species to *L. flavus nearcticus* because of the pale color, small eyes and general size of the workers. I believe this to be a perfectly valid species as evidenced by the following characters: (1) the extremely small size of the worker, (2) unusually small eyes, (3) very short antennal scapes, (4) lack of teeth on the superior surface of the mandibles, and (5) pale yellow color. This is apparently the smallest North American *Acanthomyops* that has yet been described.

THE EUROPEAN CORN BORER ON LONG ISLAND[1]

By S. M. Dohanian

Bureau of Entomology, U. S. Department of Agriculture

The land area of that part of New York State known as Long Island and composed of Kings, Queens, Nassau, and Suffolk counties, is 30 percent greater than that of the State of Rhode Island. Of the 878,720 acres of land on Long Island 126,108 acres were under cultivation in 1929 according to the latest available agricultural census. Long Island is about 120 miles long, its greatest breadth being 20 miles. An irregular range of low hills extends most of the length of the Island a little north of the center; south of this range the surface is comparatively level, while to its north hills and valleys predominate. The average elevation of the land along the north side is about 100 feet, there being only 4 or 5 hills with an altitude greater than 300 feet.

Outside of a considerable residential portion practically all of Nassau County, a large part of the townships adjacent to it on the east, and the entire eastern half of Suffolk County (where the soil permits) are under intensive cultivation. The chief products are potatoes, corn, cauliflower, lima beans, and various truck crops. The 1930 census figures show that 40,350 acres were planted to potatoes, 6,257 acres to field corn, and 4,957 acres to sweet corn.

The first infestation on Long Island by the European corn borer (*Pyrausta nubilalis* Hübner) was discovered in Kings County (Brooklyn) in August 1923.[2] The larvæ found

[1] "The Long Island Project," conceived by D. J. Caffrey, was started in 1927 by R. A. Vickery. R. E. Kimport continued the work from 1928-1930 under the direct supervision of Mr. Caffrey, in 1931 under B. E. Hodgson, and in 1932 and 1933 under A. M. Vance. Acknowledgement for helpful criticism in the preparation of this paper is due A. M. Vance, and D. W. Jones.

[2] During the period 1923-1928, unsuccessful efforts were made both by State and Federal agricultural authorities to eradicate the corn borer infestation in this and contiguous areas.

proved to be of the one-generation strain. In 1927 four townships (Southold, Shelter Island, Southampton, and East Hampton) at the extreme eastern end of the Island were found to be infested with the two-generation strain of the borer. The Bureau of Entomology, by establishing a field laboratory on the Island, took immediate advantage of the opportunity thus presented of studying the two strains of this pest simultaneously in the presence of extensive corn acreages and in a situation more or less typical of a large area along the Atlantic seaboard. The principal objective of this project, which was carried on in cooperation with the Bureau of Plant Quarantine, was to ascertain the sources of residual overwintering borer population that would form the nucleus of the reinfestation in the following spring.[3] Incidentally much information of a varied character was obtained which has led to a better understanding of the insect.

The easterly dispersion of the one-generation strain of the borer from the site of the original colony at the extreme western tip of the Island has been slow indeed. During the decade of its existence there the borer has invaded an average of only 4 miles of new territory each year. This seems a comparatively slow spread when the nature of the terrain, the general direction of the prevailing winds, and the abundance of corn are considered as factors exceptionally favorable for dispersion. Among the probable factors restraining a more rapid spread may be mentioned (1) the efforts at eradication practiced in this area from 1923 to 1928, inclusive, by the Bureau of Entomology in cooperation with the State of New York; (2) the absence of field corn on that end of the Island, which limits hibernating quarters for the borers; (3) the fact that the one-generation borer rarely attacks weeds, which also limits hibernating quarters; and (4) the fact that in this district, where considerable early sweet corn is grown for metropolitan New York markets, many of the cornfields are plowed under as soon as the ears have been harvested (while the stalks are still green and the corn borer larvæ within are in the immature feeding stages) preparatory to the planting of fall crops.

[3] The results of this investigation have been summarized in an unpublished manuscript by R. E. Kimport.

On the other hand, the westward spread of the two-generation strain of the borer from the eastern end of the Island has been more than twice as rapid. In 1927, Mattituck, on the north fork, and Southampton, on the south fork, formed the western limits of the two-generation infestation, while in the late summer of 1933 evidences of this strain were encountered as far west as Greenvale in Nassau County, a distance of about 60 miles. Consequently, there

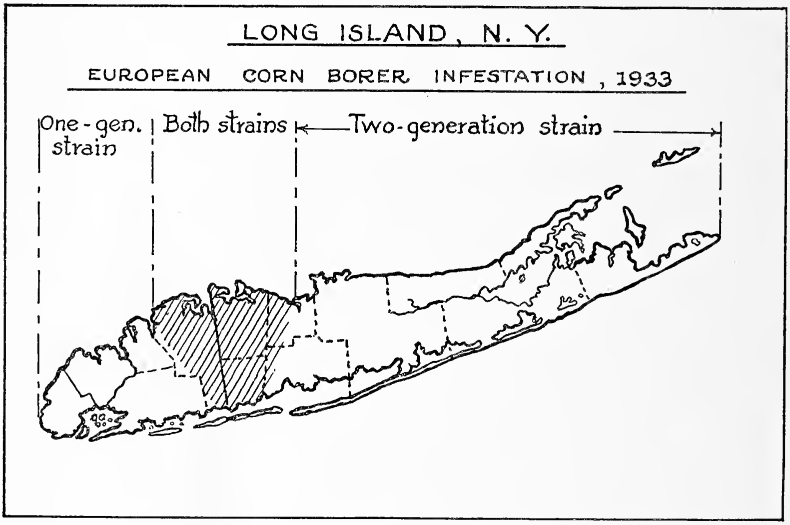

Fig. 1. Map showing distribution of both broods of the European Corn Borer on Long Island

exists (1933) an overlapping of the two strains in an area of approximately 275 square miles a little west of the center of Long Island. In the townships of Oyster Bay in Nassau County and Babylon, Islip, Huntington, and Smithtown in Suffolk County evidences of both the one-generation and the two-generation strains have been found.

Since 1928 annual "infestation surveys" have been made to determine the intensity of European corn borer infestations in corn in both the single-brood and the double-brood districts of Long Island. In the former the surveys were conducted in midsummer, while in the latter they were made in the early fall after the second generation larvæ had become established in corn. There appears to have been a slow but steady increase in the borer population of the one-generation district from 1928 to 1933. The average number of borers per 100 plants was 1.2 in 1928, 2.4 in 1929, 3.4 in 1930, 13.4 in 1931, 5.5 in 1932, and 8.6 in 1933.

In the two-generation district the average number of borers per 100 plants was 128.5 in 1928, 50.9 in 1929, 65.7 in 1930, 401.9 in 1931, 394.4 in 1932, and 356.5 in 1933. It may be seen that previous to 1931 the infestation in Suffolk County was not heavy. The decided increase in numbers that occurred that year in the eastern half of the county, which has since been maintained, made it the most severely infested district in the entire area occupied by the two-generation strain of the European corn borer for the years 1931 and 1932. To illustrate the severity of infestation a cornfield may suffer, an actual case in Southold Township, on the north fork, may be cited. In 1931 this field showed a 100 percent plant infestation. The dissection of 10 infested plants, selected in accordance with a uniform method of sampling, gave an average of 57 borers per plant. The borer population of the field was therefore 5,700 borers per 100 plants. Seventy-four borers was the maximum number found in a single plant in this field. Undoubtedly a number of factors are responsible for the continued heavy infestation in the eastern half of Suffolk County. Not the least among these may be the enormous carry-over in potato plants of the first-generation borers, which afterward infest corn. Thousands of acres of both corn and potatoes are interspersed throughout the eastern half of Suffolk County.

The larvæ of the European corn borer have been found infesting 23 kinds of plants on Long Island, among which are vegetables, flowers, and weeds. A systematic survey of the Island would probably enlarge the following list of host plants compiled by R. E. Kimport.

Zea mays L. (corn).
Holcus sorghum L. (Sudan grass).
Echinochloa crusgalli (L.) Beauv. (barnyard grass).
Chaetochloa sp. (foxtail).

Iridaceae (iris family) : Gladiolus hybrids (gladiolus).
Rumex sp. (dock).
Polygonum hydropiper L. (common smartweed).
Rheum rhaponticum L. (rhubarb).
Chenopodium album L. (lamb's-quarters).
Beta vulgaris crassa Alef. (beet).
Spinacia oleracea L. (spinach).
Amaranthus retroflexus L. (pigweed).
Phaseolus vulgaris L. (kidney bean).
Phaseolus lunatus macrocarpus Benth. (lima bean).
Solanum tuberosum L. (potato).
Solanum melongena L. (eggplant).
Lycopersicon esculentum Mill. (tomato).
Cucumis sativus L. (cucumber).
Cucumis melo L. (muskmelon).
Cucurbita pepo L. (pumpkin).)
Ambrosia elatior L. (ragweed).
Dahlia pinnata Cav. (dahlia).
Arctium sp. (burdock).

According to B. E. Hodgson[4] eight of these plants are "true hosts," serving the dual purpose of food and hibernation. To date corn is the only plant known to suffer real commercial damage. Two other major crops of the area, however, although their yield is probably not seriously lowered by the European corn borer, are considered extremely important hosts. The first of these is the potato. This plant is attacked rather severely at times by the first-generation borer. For example, in 1933, in Suffolk County, potato plants harbored 51 first-generation borers per square rod to 99 borers in each square rod of corn. The liking which the European corn borer appears to have for the potato plant is of considerable significance in view of the fact that this plant serves as a convenient and very important carry-over host, thus furnishing moths of the first generation to attack corn and some of the late vegetable crops. Where corn and potatoes are planted in close proximity, danger of serious commercial damage to corn, and possibly also to potatoes, is greatly enhanced.

[4] Hodgson, B. E. The host plants of the European corn borer in New England. U. S. Dept. Agr., Tech. Bull. 77, 63 pp., illus. 1928.

The other important host plant is the lima bean. Although there is but little loss in yield from the attacks of the European corn borer on lima beans, this plant becomes a potential means of spread for the insect into noninfested areas, when its pods are transported into such territory.

The development of a severe infestaton in the two-generation district on the eastern tip of the Island, and its practical isolation from neighboring infestations, presented an excellent opportunity to demonstrate the extent and efficacy of control by parasites. Accordingly, during the summer of 1933 a total of 67,435 imported parasites of the European corn borer were liberated at carefully selected points in the eastern half of Suffolk County. In these liberations were represented 13 European and 3 oriental species, as shown in the following list:

Species	*Number of Individuals*
Apanteles thompsoni Lyle	126
Campoplex multicinctus (Grav.)	35
Campoplex pyraustae Smith	12
Ceromasia lepida Meig. (oriental)	278
Chelonus annulipes Wesm.	1,630
Cremastus flavoorbitalis (Cam.) (oriental)	233
Eulimneria alkae Ell. & Sacht.	696
Eulophus viridulus Thoms.	21,017
Inareolata punctoria (Roman)	3,686
Lydella stabulans var. *grisescens* R.D.	19,524
Macrocentrus gifuensis Ashm.	17,139
Microgaster tibialis Nees	2,804
Phaeogenes nigridens Wesm.	20
Phorocera erecta Coq. (oriental)	4
Zenillia mitis Meig.	99
Zenillia roseanæ B. & B.	132
Total liberated	67,435

Judged by their past ability to adapt and acclimatize themselves, and by the effective work they have done since their introduction into both the New England and the North Central State areas, it seems very probable that the two parasites *Inareolata punctoria* and *Lydella grisescens* will be the first to become established and to prove beneficial on Long Island. In addition to the numbers of these two species liberated in 1933, as shown above, 1,229 individuals of *I. punctoria* and 5,916 of *L. grisescens* were colonized in the township of Southold, in the north fork, during the summer of 1932. Except for these two species, no parasites of the European corn borer, however, had ever been liberated on Long Island previous to 1933. A parasite census here four or five years hence should supply interesting results and useful information.

When the European corn borer invaded Long Island it seemed to have found ideal conditions in which to live and to thrive. Favorable weather conditions combined with the abundance of corn on the Island furnished an environment strongly in its favor. The absence of its natural parasites and diseases also aided its rapid increase. Paradoxical though it may seem, the farmers themselves unwittingly assisted its increase by failing to destroy the materials in which the borers hibernate. (New York State has not enacted the "compulsory corn borer clean-up" law in force in some of the New England States). The history of the European corn borer on Long Island has been such as to make the invasion by this insect an important economic problem not only for Long Island but also for other areas along the Atlantic seaboard where conditions are similar, and some of these are already infested.

AN ANNOTATED LIST OF THE ANTS OF THE SNAKE RIVER PLAINS, IDAHO (HYMENOPTERA:FORMICIDAE)

By A. C. Cole, Jr.
Twin Falls, Idaho

The ants of the Snake River Plains region, while comprising relatively few forms in comparison with other areas, are, however abundant in so far as the number of colonies is concerned. Floristically, the region is divided into (1) the vast semidesert plains of sagebrush, rabbitbrush, greasewood, shadscale and bromegrass; (2) the tall perennial grass upland habitats, in which grow the Agropyrons and Stipas and subalpine meadow vegetation; and (3) the mountainous and hilly areas, chiefly inhabited by western yellow pine, with juniper and alder at slightly lower elevations.

1. *Pogonomyrmex occidentalis* Cresson[1]

This is the dominant and most abundant ant of the semidesert areas. It usually builds pebble mounds with cleared surrounding area. Winged forms appear from late June to late July. Food consists of seeds of many plants although chiefly those of *Bromus tectorum* L. (Downy Bromegrass) when present. Crater nests of *Dorymyrmex pyramicus* are occasionally on the mound faces and in the denuded areas.

2. *Pheidole californica* Mayr.

This ant is abundant in sagebrush areas of the Snake River Canyon but decreases in number with northward progression, being only occasional in the tall grass meadows. It nests beneath rocks, usually on hillslopes. Colonies are rather populous. Soldiers are present, in proportion to workers about one to ten. Food consists chiefly of small seeds and some insects. Winged forms appear in August.

[1]Determinations and checkings by Dr. M. R. Smith.

3. *Pheidole oregonica* Emery

P. oregonica occupies the same habitats as does *P. californica,* but its colonies are usually less populous.

4. *Leptothorax curvispinosus rugatulus* Emery

This ant is rather frequent in moist habitats near Twin Falls, Hagerman and Buhl, chiefly along the Snake River. Colonies are small, the workers timid and sluggish and the brood scant. Winged forms appear at Twin Falls in late September.

5. *Leptothorax eldoradensis* Wheeler

The species *eldoradensis* occurs in small numbers near Twin Falls, where it occupies small crater nests in moist areas.

6. *Monomorium minimum* Buckley

Occurring in small numbers, this species occupies either minute crater-nests or nests beneath fallen timber and loose rocks. The populous colonies often contain several queens each. Winged forms appear in the nests from the middle of June to late August.

7. *Monomorium pharaonis* L.

One colony of this species was found under a house near Twin Falls. This locality is decidedly out of its normal range.

8. *Solenopsis molesta* Say

This ant is occasionally found beneath rocks in moist habitats throughout southern Idaho, and is usually observed in the superficial nest chambers of other ants (*Formica fusca subsericea* and *F. fusca neorufibarbis* Emery).

9. *S. molesta validiuscula* Emery

Much more abundant than the typical species, colonies of this variety are widely scattered throughout the region under discussion, but make their appearance only in moist areas. The nests are similar to those of the typical *molesta* but are more isolated and of smaller size.

10. *Manica mutica* Emery

One colony of this ant was observed beneath a large rock along a stream, thirty-five miles south of Twin Falls. It was quite small and the occupants, all workers, were sluggish and unoffensive.

11. *Myrmica brevinodis* Emery

Three nests of this species, which is rather abundant in the Middle West, were beneath rocks in a very moist *Agropyron repens* area near Twin Falls.

12. *M. brevinodis sulcinodoides* Emery

Several colonies of this variety were beneath rocks in *Hordeum jubatum* areas along streams at Twin Falls. The workers were abundant and very sluggish. Winged forms appeared in the nests during early July.

13. *Aphaenogaster uinta* Wheeler

Six large colonies of *uinta* nested beneath rocks in the moist Snake River Canyon, near Twin Falls. Only the workers were found, all of whch were very timid.

14. *A. subterranea occidentalis* Emery

This variety is rather commonly distributed in moist areas, where it builds small nests beneath rocks. Winged forms apear in July and August, depending upon the locality.

15. *Stenamma brevicorne* var.

This undetermined variety of *brevicorne* is of lesser importance in the Twin Falls area, where it occupies very minute nests near streams or in other moist habitats.

16. *Crematogaster lineolata* var. (near *cerasi* Fitch)

Large colonies of this ant abounded beneath flat rocks throughout the semidesert area, being more numerous, however, in rather moist places. Each colony contained many queens. Winged forms appeared in late June near Twin Falls.

17. *Dorymyrmex pyramicus* Roger

Nests of this species were found in limited numbers near

Twin Falls, occupying small, flat crater-nests of fine sand, in open areas of the sagebrush semidesert, and occasionally on the faces and in the denuded areas of mounds of *Pogonomyrmex occidentalis* Cresson.

18. *Tapinoma sessile* Say

Large colonies of this very common and well known ant are beneath rocks in moist places. Winged sexes appear in late June at Twin Falls.

19. *Iridomyrmex pruinosus* var.

Populous colonies of very active workers of an undescribed variety of *pruinosus* were found near Hagerman, inhabiting aggregated crater nests of fine sand in an area of greasewood.

20. *Lasius niger americanus* Emery

This very common occupant of the more moist areas throughout the state, nests beneath fallen timber or rocks, and more rarely occupies small, rude crater-nests of earth or sand. The workers are abundant and much brood develops into winged forms throughout June, July and August, depending upon the location of the nests. The ants are secretivorous and in some cases also scavengeristic.

21. *L. niger sitkaënsis* Pergande

Although less common than the variety, *americanus*, *sitkaënsis* is, nevertheless, a rather frequent occupant of moist places. Its nests and habitats are almost identical with those of *americanus*.

22. *L. umbratus mixtus aphidicola* Walsh

This variety lives beneath stones in very moist areas throughout the Snake River Plains. Its food consists chiefly of secretions from aphids and coccids which are attended in the nests.

23. *Polyergus rufescens breviceps* Emery

Only one nest of this species, which contained many workers of *Formica fusca subsericea*[1], was observed by the writer.

[1]Slave complex.

It was beneath a large flat rock on a dry sagebrush-covered hillslope in the Snake River Canyon, near Twin Falls.

24. *Myrmecocystus melliger semirufus* var.

Numerous crater nests, about six inches in diameter, predominated in a semidesert sand dune area near Indian Cove, and have also been found on sand hills near Buhl. The populous colonies contained both males and females in early June at Indian Cove. Repletes were not present.

25. *M. yuma* Whlr.

Many small crater nests of fine sand were found on a sagebrush plain near Hammett. The workers were very active. Winged forms appear in the nests during early July. Repletes were not found.

26. *M. mexicanus* var.

Sandy crater nests of an undescribed variety of *mexicanus* abounded in a sandy area near Indian Cove. Other localities include Hollister and Twin Falls. Males and females appeared in the nests in early June near Indian Cove and in late June near Twin Falls. True repletes were not present in the nests.

27. *Camponotus maculatus vicinus nitidiventris* Emery

This variety abounds beneath rocks in the more moist places of the sagebrush plains and in wooded areas of aspen and western yellow pine at higher elevations. The colonies are large and the workers active. Males and females appear in the nests throughout June and July near Twin Falls. I have taken this ant as far north as Boise.

28. *C. hyatti* Emery

A very few colonies of this species were beneath rocks on rather moist sagebrush and bromegrass-covered hillslopes near Twin Falls.

29. *C. modoc* Whlr.

This species is abundant in pine and aspen groves south of Rogerson. It inhabits nests in moist, rotting logs.

30. *Formica rufa obscuripes* Forel

This ant is a very common occupant of the Snake River Plains, where, as populous colonies, it inhabits large thatched mounds, usually surrounding plants of sagebrush. It has been taken by the writer as far north as Stanley, where it is replaced by the variety *melanotica* Emery. Winged sexes appear during late June near Twin Falls.

31. *F. subpolita* Mayr.

Common to the semidesert plains and occurring throughout the state, this species is found inhabiting nests beneath rocks, and less commonly small crater mounds. Winged forms appear in early July at Twin Falls. Coccids and pseudoscorpions have been removed from nest chambers.

32. *F. subpolita camponoticeps* Whlr.

This variety is of less common occurrence than is the typical species but, nevertheless, very often nests beneath rocks under similar conditions and in the same localities as the typical *subpolita.* Workers were infested with the fungus *Laboulbenia formicarum* Thaxter.

33. *F. fusca neorufibarbis* Emery

F. neorufibarbis lives beneath rocks or in earthen mounds in rather moist, shady and grassy areas throughout the Snake River plains. It feeds chiefly on honeydew and dead insects.

34. *F. fusca subsericea* Say

This very common ant is found in practically all parts of the region where it inhabits nests beneath rocks or occupies large earthen mounds.

35. *F. fusca subaenescens* Emery

F. subænescens is more rare than is *subsericea* and occupies more moist habitats. Where found, the nests are beneath large rocks. The an thas been collected near Twin Falls and Stanley.

36. *F. neogagates* Emery

A few nests of this species have been found by the writer in a deep canyon near Twin Falls. These were rather small and were beneath rocks on moist hillslopes covered with bunchgrass (*Agropyron* sp.).

37. *F. sanguinea subnuda* Emery

Nests of *subnuda* were found, although rather infrequently, from the southern border of the state northward to Boise. The small colonies, in which abounded workers of *F. fusca subsericea* as slaves, were beneath large rocks in moist sagebrush areas.

38. *F. sanguinea puberula* Emery

Several small colonies of this ant were observed near Nampa, on the sagebrush plains. Many of the adults were infected with the fungus, *Laboulbenia formicarum* Thaxter.

39. *F. oreas comptula* Wheeler

Three nests of this rather uncommon ant were found by the writer near Rogerson, beneath large flat rocks on a sagebrush-covered hillslope. Winged forms appeared in early July. Each of the nests contained two or three beautiful golden-yellow queens.

40. *F. lasioides vetula* Whlr.

Several colonies of this ant were found at the upper limits of the Snake River Plains. The ants live beneath rocks in moist areas of abundant vegetation.

A SPECIES OF EPISTENIA (HYMENOPTERA, CHALCIDOIDEA) FROM COLORADO

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

On April 5, 1934, Mr. Charles H. Hicks bred a very beautiful Chalcidoid from the nest of an Odynerid wasp, found a short distance above the mouth of Boulder Canyon, Boulder County, Colorado. Trying to determine its affinities, I thought it might be referable to the genus *Ormyrodes* of Brues, said to be recognisable by "the extremely long, awl-shaped abdomen, uniformly punctuate body, hairy eyes, and long postmarginal vein in wings." The hind coxæ, also are considerably enlarged. However, there were discordant characters: the shorter abdomen, not at all constricted at end of third segment, and first tergite smooth, as well as the well developed parapsidal grooves. The specimen was transmitted to the Museum of Comparative Zoology, and Professor C. T. Brues kindly examined it and at once referred it to the genus *Epistenia* of Westwood, of the Cleonymidæ. This is a widespread genus of rather numerous species, but apparently they are nowhere common, as I do not remember ever having captured a specimen. The resemblance to the Ormyridæ is presumably entirely superficial. Up to the present time 24 species of *Epistenia* have been described, distributed as follows: Georgia (1), California (1), Guatemala (1), Panama (2), Brazil (5), Paraguay (4), Peru (1), Chile (2), South Africa (1), Philippines (1), Borneo (2), Queensland (3). The Colorado species has the following characters:

Epistenia regalis sp. n.

Female: Length about 8 mm.; anterior wing nearly 5; elongate, coarsely punctured, head, thorax, abdomen and coxæ rich purple, legs otherwise clear red, with very fine pruinose white pubescence; antennæ long, with a stout black flagellum, pointed at apex, its basal joint blue; the long scape, shining greenish blue on outer side, is inserted very little above the mouth; head and thorax dull, with very dense coarse punctures, making a cancellate surface; profile of thorax above practically straight; prothorax very large, swollen, parapsidal grooves very distinct, the mesonotum accordingly trilobed; a black curved keel bounding axillary region anteriorly; scutellum very large and convex, with no groove, the apex nipple-like; base of metathorax shining; tegulæ small and black; wings hyaline with black veins; marginal vein less than half length of submarginal; stigmal long and distinct, thickened at end; postmarginal at least as long as marginal; front femora robust, with a tooth beneath toward end; hind femora moderately stout; the large hind coxæ rough with fine dense punctures, running in rows; abdomen nearly 5 mm. long, long-fusiform; the short first tergite smooth, shining green and rosy; second to fourth deep purple, with black hind margins, the surface covered with very large round punctures, not in rows, the dorsum not keeled; apical part of abdomen black and keeled, the ovipositor little exserted. The eyes have very long hairs.

Type in Museum of Comparative Zoology, Cambridge, Mass.

It may be that all the species of *Epistenia* are parasitic on Eumenidæ. *E. odyneri* Ashmead (Psyche, VII, 1896, p. 336) was bred by Dr. A. Davidson in California from *Odynerus rufobasilaris* Ashmead. It is quite a different species, the female 6 mm. long, strongly green, flagellum rufopiceous beneath, knees honey-yellow, tibiæ and tarsi dark fuscous.

SOME ANTS FROM THE BAHAMA ISLANDS

By William Morton Wheeler
Biological Laboratories, Harvard University

Our knowledge of insect distribution in the Bahamas is very meager, limited as it is to a very few of the nearly seven hundred islands and cays composing the archipelago. Of the ants, a group of greater importance in zoögeographical discussion than many other families or even orders less intimately dependent on the soil, I have records from only three of the islands. The account of these insects which I published nearly 30 years ago[1] was based on material which I collected on New Providence and Andros. Mann, 1920, in addition to recording and describing several new forms from the same localities, cited seven species collected by Bluff on Eleuthera Island[2]. I was glad, therefore, to receive from Dr. David Fairchild and Mr. James Greenway a collection of ants which they made on New Providence Island and on some thirteen of the other islands while they were collecting plants, birds and mammals on two expeditions, during 1932 and 1933, of Mr. Allison Armour's yacht, the "Utowana." Both gentlemen accompanied the first expedition, but owing to Dr. Fairchild's illness, Mr. Greenway alone collected ants on the second. The collection comprises 22 forms, and though there are no new forms it furnishes two new records (*Iridomyrmex pruinosus* and *Camponotus planatus*) for the archipelago.

Ponerinæ

Odontomachus hæmatoda insularis Guérin var. *pallens* Wheeler-Wemyss Bight and Bannermantown, S. Eleuthera I. ☿ (Greenway).

[1]Wheeler, W. M. The Ants of the Bahamas, with a List of the Known West Indian Species. Bull. Amer. Mus. Nat. Hist. 21, 1905, pp. 79-135, 1 pl., 12 figs.

[2]Mann, W. M. Additions to the Ant Fauna of the West Indies and Central America. Bull. Amer. Mus. Nat. Hist. 42, 1920, pp. 403-439, 10 figs.

Pseudomyrminæ

Pseudomyrma flavidula F. Smith—One worker from Watlings I. (Greenway).
Pseudomyrma elongata Mayr—One worker from Conception I. (Greenway).

Myrmicinæ

Pheidole megacephala Fabr.—Grand Bahama I. ♃ ☿ ♀ and Watlings I. ♃ ☿ (Greenway).
Pheidole fallax jelskii Mayr var. *antillensis* Forel—New Providence I. ♃ ☿ and Watlings I. ☿ (Greenway).
Pheidole flavens Roger—Bannermantown, S. Eleuthera I. (Greenway).
Crematogaster (*Orthocrema*) *steinheili* Forel—Bannermantown, S. Eleuthera I. ☿ (Greenway); Mayaguana I. ☿ ♀, nesting in pods of mahogany (Fairchild).
Crematogaster (*Acrocoelia*) *lucayana* Wheeler—Grand Bahama I. ☿ (Greenway).
This form is probably only a variety of *C. sanguinea* Roger of Cuba.
Monomorium carbonarium ebeninum Forel—Watlings I. ☿ ♀, New Providence I. ☿ and Bannermantown, S. Eleuthera I. ☿ ♀ (Greenway).
Solenopsis geminata Fabr.—Great Inagua I. ☿, Watlings I. ☿, New Providence I. ☿, Crooked I. ☿ and Clarence Harbor, Long I. ☿ (Greenway); Conception I. ☿ (Fairchild and Greenway). The typical black West Indian form of the species.
Cyphomyrmex rimosus minutus Mayr—Crooked I. ☿ (Greenway).

Dolichoderinæ

Iridomyrmex pruinosus Roger—Mayaguana I. ☿ (Greenway). Common in Cuba and Florida but not previously recorded from the Bahamas.
Dorymyrmex pyramicus Roger—Nassau, New Providence I. ☿, Crooked I. ☿ and Cat I. ☿ (Greenway).
These workers are intermediate in color between the typical form of the species and the following variety.
Dorymyrmex pyramicus var. *niger* Pergande—Goat Cays ☿,

Crooked I. ☿, East Plana Cay ☿ and Conception I. ☿ (Fairchild); Watlings I. ☿, Mayaguana I. ☿ and Rum Cay ☿ (Greenway).

Formicinæ

Brachymyrmex heeri Forel—Two workers from Cat I. ☿ (Greenway).

Brachymyrmex heeri var. *obscurior* Forel—Rum Cay ☿ ♀ ♂ (Fairchild and Greenway); New Providence I. ☿, Watlings I. ☿, Great Inagua I. ☿ and Crooked I. ☿ (Greenway).

Camponotus (*Tanæmyrmex*) *conspicuus æqualis* Roger—Nassau, New Providence I. ☿ (Greenway).

Camponotus (*Tanæmyrmex*) *fumidus lucayanus* Wheeler—Nassau, New Providence I. ☿ and Bannermantown, S. Eleuthera I. ☿ (Greenway).

Camponotus (*Tanæmyrmex*) *ramulorum* Wheeler var. *marcidus* Wheeler—East Plana Cay ☿, living in dead stems of Cocothrinax (Greenway).

Camponotus (*Colobopsis*) *triton* Wheeler—I have recently described this species (Bull. Mus. Comp. Zool. 77, 1934) from a single female specimen taken by Dr. W. M. Mann at Fresh Creek, Andros I.

Camponotus (*Myrmobrachys*) *planatus* Roger—A single small worker from Grand Bahama I. (Greenway).

Not previously recorded from the Bahamas though common in Cuba and Southern Florida.

Paratrechina longicornis Latr.—New Providence I. ☿, Great Inagua I. ☿, Abaco I. ☿, Rum Cay ☿, Crooked I. ☿ ♀, Watlings I. ♀ ♀ and Bannermantown, S. Eleuthera ☿ (Greenway).

Nylanderia steinheili Forel—Cat. I. ☿ ♀ (Fairchild).

SOME NEW LONGICORN BEETLES FROM BRITISH HONDURAS

By E. Gorton Linsley
Oakland, California

The new species described below were noted among some miscellaneous Cerambycidæ from British Honduras, very kindly sent to me for study by Mr. Lionel Lacey of New Rochelle, New York.

Protaneflus Linsley, new genus

Elongate, parallel, subcylindrical. Head concave between the antennæ; maxillary palpi longer than labial, last segment slightly triangular; eyes very convex, coarsely granulated; antennæ longer than the body (♂), twelve-segmented; scape stout, subcylindrical, segments six to twelve flattened, serrate, carinate, segments three to seven spinose at apex. Prothorax cylindrical, slightly longer than broad. Elytra scarcely more than three times as long as broad; apices bispinose. Prosternum narrow between the coxæ; mesosternum rather broad. Anterior coxal cavities feebly angulated externally; intermediate coxal cavities closed behind. Metasternal epsterna very narrow, slightly wider at base and apex. Legs long, slender; tibiæ feebly carinate on outer side.

Genotype: *Protaneflus pubescens* n. sp.

A genus related to *Aneflus* and *Axestinus*, but differing from these in the densely pubescent body and very narrow metathoracic episterna. From the former it may be further distinguished by the twelve-segmented antennæ (♂), and from the latter by the spinose antennal segments.

Protaneflus pubescens Linsley, new species

Piceous, very densely clothed with short, white, recumbent pubescence. Head rather coarsely, closely punctured; antennæ densely clothed with short, white pubescence, sparsely ciliate at apex of segments. Prothorax transversely rugose, coarsely, densely punctured, densely pubescent. Scutellum white. Elytra coarsely and moderately closely punctured, clothed with recumbent, white pubescence intermixed with scattered, suberect hairs. Legs and ventral surface densely clothed with white pubescence. Length 31 mm; breadth 6.5 mm.

Holotype male, a unique taken at Punta Gorda, British Honduras, in June 1932, by Mr. J. J. White.

This fine species is rather suggestive of *Aneflus cylindricollis* Bates, but may be easily distinguished by the dense, white pubescence, twelve-segmented antennæ (♂), and narrow metathoracic episterna.

Stizocera laceyi Linsley, new species

Elongate, subparallel, rufo-testaceous, shining, sparsely clothed with erect pale hairs. Head with scattered coarse punctures; antennæ attaining the middle of the elytra (♀), carinate, segments three to seven spinose at apex; punctation irregular; pubescence short, sparse, intermixed with flying hairs along inner side and at apex of segments. Prothorax slightly longer than broad, coarsely but not closely punctured, clothed with scattered, erect, pale hairs. Scutellum densely pubescent. Elytra nearly four times as long as broad, yellowish-testaceous; punctation moderately coarse, not dense; pubescence pale, sparse, suberect; apex piceous, bispinose. Legs slender, clothed with long, suberect, yellowish hairs; femora bispinose at apex, the spines piceous. Ventral surface shining, sparsely, finely punctured, sparsely clothed with suberect, yellowish pubescence. Length 22 mm; breadth 5 mm.

Holotype female, captured at Punta Gorda, British Honduras, June 1932, by Mr. J. J. White.

A moderately large, shining, rufo-testaceous species with yellowish-testaceous elytra which become piceous at the apex. It is related to *S. armata* Serv. from Brazil, but in addition to differences in color, may be easily distinguished from that species by the short antennæ, which in the female attain only the middle of the elytra (in *S. armata* ♀ the antennæ are slightly longer than the body), and by the bispinose intermediate and posterior femora (in *S. armata* only the posterior femora are spinose at apex).

Stizocera aliena Linsley, new species

Elongate, slender, reddish-brown, shining. Head coarsely, closely punctured; antennæ attaining apical one-third of elytra (♂), middle of elytra (♀), carinate, ciliate, segments three to five spinose at apex. Prothorax about one-fourth longer than broad, coarsely, closely punctured, sparsely clothed with erect, pale pubescence. Scutellum densely pubescent. Elytra four times as long as broad; punctation coarse; pubescence short, erect, yellowish; apices emarginate, the outer angle dentiform. Abdomen shining, sparsely pubescent. Legs slender, sparsely clothed with erect, yellowish hairs; femora not spinose. Length 15.5 mm; breadth 2.75 mm.

Holotype female, and allotype male, taken at Punta Gorda, British Honduras, June 1932, by Mr. J. J. White.

This species differs from typical *Stizocera* as characterized by Gounelle[1] in that the femora are unarmed at the apex. In spite of this difference, *S. aliena* agrees more closely with *Stizocera* than with any other described genus. It may be associated in our lists with *S. cribricolle* Bates (from Mexico), from which the elongate, cylindrical prothorax, and slender, unarmed, non-clavate, non-pedunculate femora will easily separate it.

[1]Bull. Soc. Ent. France, 1907, p. 241.

A SPECIMEN OF THE JAMAICAN VERMILEO

By William Morton Wheeler

In a collection of Jamaican Diptera recently received by the Museum of Comparative Zoölogy I find what might be regarded as a topotype of the Rhagionid *Vermileo tibialis* (Walker). This specimen, a male, was taken by Miss Lilly Perkins at Baron Hill, near Jacksontown, Trelawny, and is interesting both because the species has not before been recovered since it was described and figured by Walker, nearly eighty years ago, in his "Diptera Sandersiana" (p. 156, Pl. 4, Fig. 3.) as the type of his genus Pheneus, and because of its very close relationship to a Cuban Vermileo which I described in my "Demons of the Dust" (1930) and in Psyche, Vol. 36, 1931, p. 167. This form I regarded as a distinct variety (*dowi*) of *tibialis* since it differed in certain respects from Walker's description and figure, which were based on a male specimen. Miss Perkins' specimen lacks the hind legs and portions of the antennæ and anterior tarsi, but there are in other portions of the body several peculiarities which show that the Cuban form is, as I inferred, at least varietally and possibly even subspecifically distinct.

The specimen is larger and more robust than the *dowi* males which I reared from larvæ taken by Mr. R. P. Dow in August, 1930, in the Trinidad Mountains of Cuba[1]. Its body and wing measure 12 and 11.5 mm. respectively, whereas the corresponding dimensions of *dowi* are 9.5-10 and 8 mm. In the Jamaican type the face and vertex are decidedly broader, the eyes less convex, the first antennal joint shorter, not more than one and one-half times as long as broad, the humeri more prominent and more acute. The body is more uniformly fulvous, the abdominal segments

[1]More recently, one of my students, Mr. B. B. Leavitt, collected a large number of larvae of this form at much lower elevations not far from the Atkins Laboratory of Harvard University at Soledad, near Cienfuegos, and has studied their structure, transformation and behavior.

not infuscated posteriorly and the first segment bears anterodorsally a deep black, transverse band. The halteres have yellow knobs as in the Cuban variety and the wing-venation is the same, but both the membranes and the veins are more deeply fulvous and the black, transverse band across the middle of the wing is decidedly narrower, with more irregular contour.

Since we know the precise locality in which Miss Perkins took her specimen it should now be easy to find the larvæ, which make their pits like the ant-lions in sand or dust under overhanging rocks or embankments, and to ascertain, by rearing a number of imagines of both sexes, the precise differences between the Jamaican and Cuban forms of this beautiful fly.

NOTES ON *MEGARHYSSA LUNATOR*

By Cyril E. Abbott
Morgan Park, Ill.

For several years I have had the opportunity to observe rather closely the activities of *Megarhyssa lunator,* and have discovered some curious, and apparently hitherto unknown peculiarities of behavior.

Emergence of Adult Insect

In view of the fact that the adult virgin female is found in a burrow opening just beneath the bark, as well as from the fact that this burrow must be enlarged to permit emergence, it seems likely that the larval Megarhyssa pupates near the surface of the tree. The insect is enabled to escape by biting bits of wood from the walls of her prison. In all observed cases the overlaying bark had been removed by the observer. No doubt the insect is capable of gnawing through the bark; at least a virgin female imprisoned in a cloth sack in an effort to attract males chewed her way to freedom.

The emerging female is much disturbed by suitors, which, having gathered in numbers about her burrow, insert their abdomens into the opening. In some cases a male becomes so firmly wedged into this opening, clinging meanwhile with his claws to the bark, that he is removed with difficulty by the observer.

The details concerning emergence of the males have not been observed. The openings from which they leave the tree have an average diameter of 2.27 mm., those of the females 4.30 mm.

After enlarging the opening of the burrow the female insect rests for a few seconds. She then crawls out onto the surface of the tree.

Mating

In spite of the ardor of the male insects (see Riley, 1888) there is no mad rush for union with the female. Sometimes there is a mild contest between two or three individuals; more often only one male reaches the female. He rests upon the back of her abdomen which he clasps with his legs. He then flexes his abdomen ventrally, forming thereby a flat spiral. In this position the extreme tip of his abdomen, in an inverted position, is directed toward the corresponding free or caudal end of the female abdomen. The penis, the median of the three terminal appendages of the male (the others are claspers) thus enters the genital opening of his mate in a posterior direction; a condition made necessary by the peculiar fact that the female genitalia open anteriorly.

Mating requries only a few seconds: at the end of that time the female dislodges her mate by backward thrusts of her posterior legs.

It does not seem likely that the female Megarhyssa ever again requires the attentions of a mate. Males ignore all but emerging, and hence virgin, females. Moreover, since the female possesses a definite spermatheca, it is probable that she, like other Hymenoptera, carries with her the sperm necessary for the fertilization of eggs.

Oviposition

In spite of the generally accepted conclusion that Megarhyssa deposites her eggs by *drilling* through solid wood, my own observatons contradict this claim. Of literally hundreds of ovipositing females observed, not *one* could be said to drill in the true sense of the word. In cases where this appeared to be true a judicious prying off of the overlaying bark revealed that the ovipositor had penetrated a crack in this same bark and entered the end of an open burrow. Where bark had already been stripped from the tree, individuals were often seen inserting the ovipositor directly into an open burrow.

It is of course possible that the female Megrahyssa may drill through the bark to a burrow. It is also possible that individuals may take advantage of openings made by an ovipositing Tremex. As long ago as 1794 Marsham observed this kind of behavior on the part of *Ichneumon manifestor.*

We may conclude from this that Megarhyssa is not as well equipped with wonderfully mysterious instincts for prey as some students would have us believe. In fact I once found this insect ovipositing in the burrow of a Buprestid!

Trees Attacked

Naturally Megarhyssa lives in trees most abundantly supplied with specimens of Tremex. In this region these seem to be almost exclusively soft maples (Acer saccharinum). The only other trees troubled to any extent are elms. The maples, probably because of the softness of the wood, are especially susceptible to insect attacks.

Literature Cited

Marsham, T. 1794. Observations on the economy of *Ichneumon manifestor.* Linn. Soc., Trans., 3.

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POMPILID WASPS AND PREY-TRANSPORTATION BY WATER

By Phil Rau
Kirkwood, Mo.

One of the most interesting items of wasp behavior is reported by Needham and Lloyd[1] on the use of water as a medium for the easy transportation of spider prey by *Priocnemis flavicornis.* This Pompiled wasp was occasionally seen on Fall Creek, New York, where it combines flying and water transportation.

"Beavers swim with boughs for their dam, and water-striders run across the surface carrying their booty, but there is a wasp that flies above the surface towing a load too heavy to be carried. The freight is the body of a huge black spider several times as large as the wasp. It is captured by the wasp in a waterside hunting expedition, paralized by a sting adroitly placed, and is to be used for provisioning the nest. It could scarcely be dragged across the ground, that is with the dense vegetation of the waterside; but the placid stream is an open highway. Out into the surface the wasp drags the huge limp, black carcass of the spider, and, mounting into the air with her engines going and her wings steadily buzzing, she sails away across the water, trailing the spider, and leaving a wake that is a miniature of a passing steamer. She sails a direct and unerring course to the vicinity of her burrow in the bank, and brings her cargo ashore at some nearby landing. She hauls it upon the bank and then runs to her hole to see that all is ready. Then she drags the spider up to the bank and into her burrow, having so saved much time and energy by making use of an open waterway."

It would seem from the records that this highly intelligent behavior is an isolated case; therefore the purpose of this note is to record three similar instances of this singular behavor. It is however to be regretted that in all three cases was it impossible to get either Pompilid or spider for identification.

[1]Life on Inland Waters, page 331, 1916.

In 1915 on the water near the shore of a lake at Lakeview, Kansas, a Pompiled and her spider were seen behaving in the same way as described above but at that time I was a novice in waspology and did not fully appreciate the drama that was being enacted before me. I thought at the time that both had fallen from the branches overhead, and the wasp was trying to regain the shore. In 1919 at Wickes, Missouri, my wife saw the same behavior on the surface of a small pond, but not having a net was unable to capture the pair; but knowing of Needham and Lloyd's account by this time she was fully prepared to appreciate the behavior.

And the third observation was made by Dr. Gustave Dahms, an ardent fisherman, who pays much attention to nature study. Here is his account as he related it to me:

On July 20th, 1932, while watching his cork bob in the stream near Creve Couer Lake, Mo., he saw a black wasp towing a spider twice as large as herself on the surface of the water. Straddling her spider, she looked like an aquaplane, while she made a distance of six feet to the wooden pillar in the water supporting a railroad trestle. Landing on this pillar, she moved upwards and backwards dragging her spider after her to the top of the trestle, and then disappeared. There was soil packed in between the railroad ties at the edges, and in this she evidently buried her spider. Most interesting of all was the fact that between 10:30 and 2:00 o'clock while this fisherman was watching his bob, this behavior was repeated four times with hardly any variation in her course, in relation to this bob. The trip, as he enthusiastically explained, was purposeful each time, and the distance of ten feet of travel in the water from the bob where he always first noticed the wasp to the post on which she clmibed consumed only about one minute, so fast did she sail. There was a slight current in her direction which helped her to make speed. Unfortunately he paid no attention from whence she came, but saw her each time as she neared the bob. Unfortunately too he did not get the specimen for identification and he never found out whether all four spiders went into one burrow or into four burrows.

A NOTE ON THE ATTACHMENT OF THE WASP, *BEMBIX NUBILIPPENNIS*, TO THEIR NESTING SITES

By Phil Rau
Kirkwood, Mo.

In "Wasp Studies Afield" in 1917 I describe the nesting behavior of *Bembix nubilipennis.* The wasps have emerged year after year in early summer, and then have dug their new tunnels in the same site where they were born, in this instance the hard-baked barren soil of a baseball diamond. This gave me at that time an opportunity to study four successive generations of these wasps in as many years.

Dr. Wm. M. Wheeler in his introduction to the above work especially calls attention to the strong attachment of these wasps to their nesting site, for they keep to the same locality for generation after generation. "Such a habit," says Dr. Wheeler, "has the ear-marks of great antiquity, and seems to indicate that the present type of nesting site is like the one in which the group originated." This statement has caused me often to visit this site over a period of years, to see how long they would maintain this colony. The colony was first observed in a vacant lot in the heart of southwest St. Louis in 1914 (*loco citato* pp. 1-36) and today, twenty years later, the colony is nesting in the same way in the same site. They have not spread to the surrounding grass plots or to a roadway nearby; the population has not diminished with the passing of the years, and neither has the population increased during this period. There is one slight variation, however, in that a portion of the population has wandered away and become colonized in a second and smaller baseball diamond two hundred feet away. This smaller diamond was made ten years ago, and I watched it yearly to note any Bembix migration. I felt the site was suitable for Bembix, and it would be only a matter of time before they would become established. The new barren area was not adopted until the seventh year of its existence, and now after four years it has only about twenty burrows of this wasp, whereas several hundred may be counted on the older diamond.

Thus we see that not only do Bembix stay on one site generation after generation, but many years are likely to elapse before certain mothers turn their attention to an attractive area just within a stone's throw of their old home. Dr. Wheeler's conclusion is probably correct when he says that the species shows its archaic origin by its nesting habits.

THE STING OF THE MALE WASP, *MONOBIA QUADRIDENS*

By Phil Rau
Kirkwood, Mo.

The females of solitary wasps have a functional sting, while male wasps are devoid of stings, but often the latter are not devoid of the desire to sting. In picking up males of *Sceliphron cæmentarium* and *Chalybion cæruleum,* one occasionally notes attempts to pierce one's flesh with the tip of the abdomen. Stinging by the males in these two species is not possible, but it may prove useful in frightening an enemy.

In *Monobia quadridens* the female can sting one's hand and cause a slight pain, but I was indeed surprised when I picked up a male to find him also able to inflict pain by piercing the flesh with the tip of his abdomen. The pain resembles that of a sharp needle prick and is over after a few seconds, since of course no poison is injected. The attempt at stinging by the male fulfills a purpose similar to the sting by the female because it effects the release and escape of the insect; the same behavior in its natural habitat, when trapped by an enemy, would prove beneficial to the male.

PSYCHE

INDEX TO VOL. XLI. 1934

INDEX TO AUTHORS

INDEX TO SUBJECTS

All new genera, new species and new names are printd in SMALL CAPITAL LETTERS.