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(Continued on inside of back cover)

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NOTES ON *ATYLOTUS* AND DESCRIPTION OF A NEW SPECIES FROM EASTERN NORTH AMERICA (DIPTERA: TABANIDAE)¹

L.L. Pechuman²

ABSTRACT: *Tabanus incisuralis* Macquart and *Tabanus intermedius* Walker belong in the genus *Atylotus*. *a. incisuralis* is not Nearctic and the first available name for the North American species currently called *incisuralis* is *insuetus* Osten Sacken. *A. intermedius* is regarded as a distinct species. *Atylotus woodi* from eastern North America is described as new.

Through the kindness of John E. Chainey of the British Museum (Natural History), I have been able to examine the type material of *Tabanus incisuralis* Macquart (1847) and of *Tabanus intermedius* Walker (1848). Both are species of the genus *Atylotus* Osten Sacken (1876) as has been recognized by previous workers.

Atylotus incisuralis (Macquart)

The type locality is given as "America" but the type shows no close relationship to any North American species. Its affinities seem to be with a group of Palaearctic species that includes *fulvus* (Meigen), *loewianus* (Villeneuve) and *quadrifarius* (Loew). It is quite different from the Nearctic species now called *incisuralis* (Philip, 1965). The first available name for the latter is *insuetus* (Osten Sacken, 1877) according to Philip (1965).

Atylotus intermedius (Walker)

This species has been placed as a synonym of *incisuralis* but is quite different from the type of *incisuralis* which, as noted above, is not Nearctic and also is distinct from *insuetus*. *A. intermedius* has a small rounded basal callus and a linear median callus (Fig. 1) whereas *insuetus* has two roundish calli (Fig. 2). The western *A. tingaureus* (Philip) (Fig. 3) and the eastern species described below (Fig. 4) have calli similar to *insuetus*. All other Nearctic *Atylotus* lack frontal calli.

In addition to the syntype female of *intermedius*, which I hereby designate as lectotype and have so labeled, and the male syntype, both from St. Martin's Falls, Albany River, Ontario, I have seen a female from Isle

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Royale, Michigan, and a female and male from Chippewa County, Michigan. The male agrees well with the syntype male of *intermedius*. Both have long hairs on the upper occipital border that recurve over the eye (Fig. 5) as is the case in most eastern species and the western *Atylotus tingaureus* (Fig. 7), but is not the case with *insuetus* (Fig. 6) or the species described below (Fig. 8). I regard *intermedius* as a distinct species.

Atylotus woodi n. sp.

Holotype ♀. Length, 10.5 mm.

Head. Frons 3 times as high as width at base, grayish yellow pollinose with recumbent yellow hairs and more erect black hairs near vertex; frons with two black roundish callosities well separated from each other and the eye margins (Fig. 4). Eye yellow brown (greenish brown in life) with (in life) a purple diagonal band extending from edge of frons $\frac{3}{4}$ across eye; eye with many fine, pale, short hairs. Subcallus pollinose, concolorous with frons. Upper portion of cheeks concolorous with subcallus, with many yellow hairs; lower portion of cheeks more gray than yellow; beard pale yellowish gray. Antenna wholly yellow, scape and pedicel paler than flagellum; scape and pedicel with stiff black hairs plus fine pale hairs below on scape; basal plate of flagellum with tooth barely indicated; length of basal plate 1.3 times greatest width and 1.3 times length of annulate portion. Palpus very pale yellow; first segment with long, fine, pale hairs; second segment rather stout at base, gradually tapering to a point, with stiff black hairs and fine pale hairs below near base. Proboscis brown.

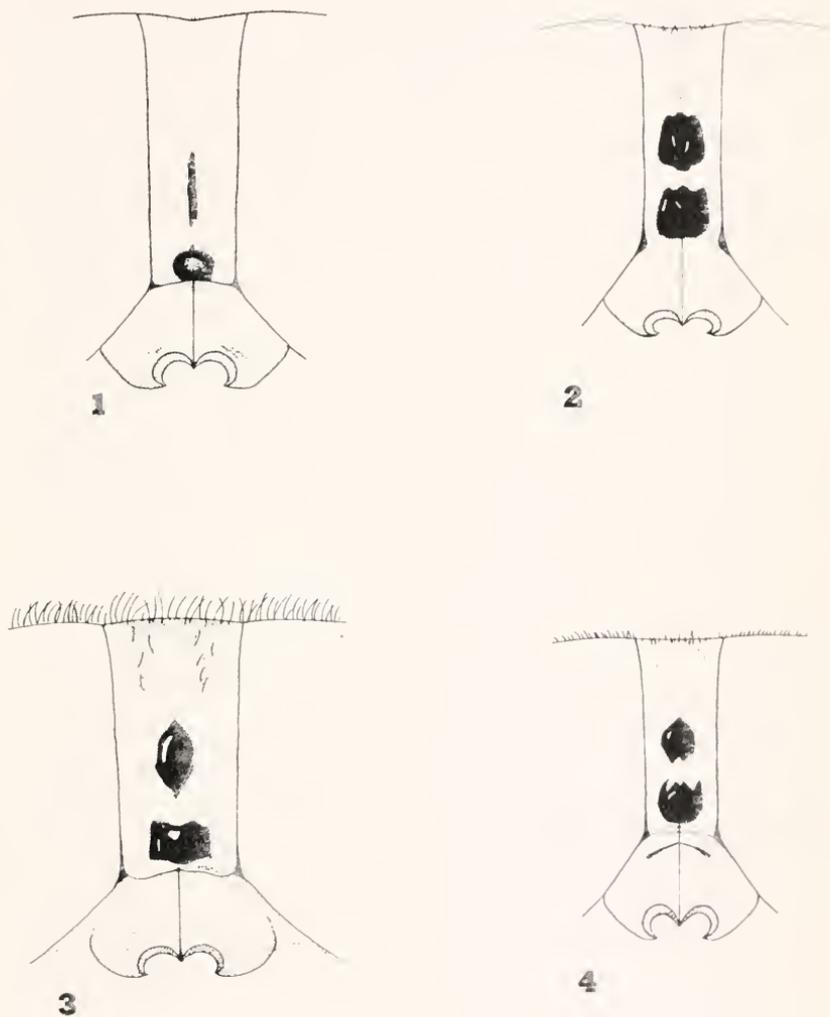
Thorax. Dorsum, including scutellum, very dark gray, somewhat paler gray anteriorly, with a single narrow middorsal dark line reaching nearly to scutellum, and with recumbent yellow hairs with a few black hairs intermixed; prescutal lobe (postpronotal lobe) grayish yellow with stiff black and fine yellow hairs. Pleura gray with pale yellow hairs above and gray hairs below. Legs yellow, fore tarsus brown and middle and hind tarsi darker yellow; fore femur and fore and middle tibiae mostly black haired; middle and hind femora mostly yellow haired; hind tibia with black and yellow hairs and tibial fringe black. Wing membrane clear including costal cell; veins brown; venation normal with all posterior cells wide open at margin and no spur at bifurcation of third longitudinal vein (R_{4+5}). Halteres yellow.

Abdomen. First tergite dark gray with posterior sublateral margins yellow and yellow haired; tergites 2, 3, and 4 with a median rectangular fuscous spot completely crossing tergite (except for barely indicated pale posterior border of tergites 2 and 3) forming a broad median stripe; laterally these tergites yellow with concolorous hairs and at edge of each tergite a vague dark spot with dark hairs; tergite 5 with yellow area greatly reduced and following tergites all dark except for narrow yellow stripe at extreme edge; the integument shows no pale median markings but patches of yellow hairs present in center of tergites 2, 3, and 4. The venter of abdomen completely yellow and yellow haired.

Allotype ♂. Length 10.25 mm.

Head. Frontal triangle and upper cheeks yellowish gray, the latter with pale yellow hairs; lower cheeks gray; beard white. Eye brownish green with traces of a short diagonal purple stripe; line of demarcation between large upper eye facets and smaller lower facets quite distinct below, but smaller facets extend laterally around larger facets and above them where the sizes blend with no line of separation; upper occipital fringe of pale, short hairs not recurved over upper eye margin (Fig. 8); eye heavily haired with hairs pale and much longer than in female. Antenna as in female but basal plate relatively more slender with length 1.54 times greatest width; basal plate 1.18 times length of annulate portion. Second palpal segment 1.6 times as long as thick, pale yellow, almost white, with long black and fine white hairs.

Thorax. Similar to female but dark median line and two pale stripes flanking it are nearly obsolete; hairs of dorsum much longer than in female, pale grayish yellow. Legs as in female



Figs. 1-4. *Atylotus* females, frons. 1. *intermedius*, 2. *insuetus*, 3. *tingaureus*, 4. *woodi*.

but apex of fore tibia grades to a darker yellow. Wing as in female.

Abdomen. Dorsum much like female but black median band narrower so that yellow lateral margins more extensive and dark lateral spots obsolete although dark hairs in this area remain. Sternites 1 and 2 with small gray median spot and sternites 6 and 7 mostly gray; remainder of venter yellow with yellow hairs except sternite 7, which has black hairs.

Holotype and Allotype. S. of Lot 31, Conc. Gore, Puslinch Twp., Wellington Co., Ontario, 15 August 1963 (L. L. Pechuman). Canadian National Collection No. 16288.

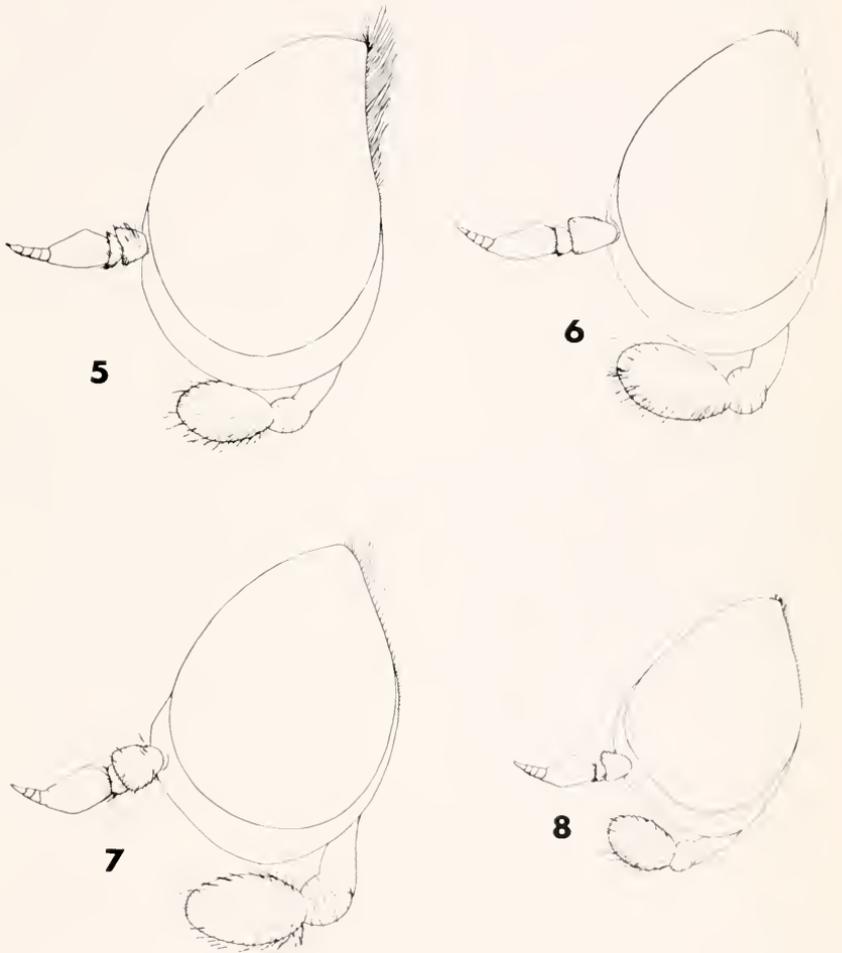
Paratypes. ONTARIO: Same data as holotype and allotype, 12 ♀♀, 8 ♂♂; Same locality as types, 24, 28, 29 August 1962, 5 ♀♀, 8 ♂♂ (D.M. Wood), 1, 2, 7, 12 August 1963, 25 ♀♀, 22 ♂♂ (H.J. Teskey) plus 12 ♀♀, 7 ♂♂ reared by H.J. Teskey in 1963, 1964, and 1965; Spencer Ck. Cons. Auth., Beverley Swamp, 1 mi. N. of Valens, 30 August 1962, 1 ♀ (R.M. Idema); Moosonee, 1 ♂ reared by H.J. Teskey in 1961. ILLINOIS: Cedar Lake, 4 August 1906 "bog", 1 ♀. WISCONSIN: Kegonsa State Park, 11 August 1970 "marsh area, trap-CO₂", 1 ♀ (Eugene Devenport).

Paratypes will be deposited in the collections of the British Museum (Natural History), California Academy of Sciences, Canadian National Collection, Cornell University, Illinois Natural History Survey, Museum of Comparative Zoology, Ohio State University, U.S. Museum of Natural History, University of Wisconsin, J.F. Burger and G.B. Fairchild.

Variations. The series is quite uniform. Length of females ranges from 9.25 to 10.5 mm with a median and mean of 10.25 mm; the males range from 10 to 11.5 mm with a median of 10.5 and a mean of 10.75 mm. The ratio of width of frons at base to height varies from 2.9 to 3.4 with a median and mean of 3.1. The ratio of length of basal plate to its greatest width varies from 1.2 to 1.4 (median 1.29, mean 1.28) in the females and in the males from 1.18 to 1.5 (median 1.31, mean 1.35). The ratio of the length of the basal plate to the annulate portion of the third antennal segment varies from 1.27 to 1.4 (median 1.33, mean 1.32) in the females and in the males from 1.11 to 1.24 (median 1.18, mean 1.17). A few males have the extreme base of the hind femur vaguely darkened. In the reared Moosonee male, the hairs on the dorsum and pleura of the thorax and on the abdomen are bright yellow and the median dark markings on the abdomen are reduced on tergites 3, 4, and 5.

Atylotus woodi is the only species found in eastern North America that has frontal callosities, except for *intermedius*, which has a linear median callus, not rounded as in *woodi*. The males lack the long recurved hairs on the upper occipital margin that are present in all other eastern species, including *intermedius*.

The affinities of *woodi* lie with the western *Atylotus insuetus* and related forms although it seems to be well separated geographically from these. *A. insuetus* and *A. tingaureus* usually have the hind femur partly or wholly darkened, the prescutal lobe often is concolorous with the rest of the mesothorax, the venter of the abdomen is extensively darkened and the bifurcation of the third longitudinal vein frequently has an appendix. *A. insuetus* is very variable in abdominal color, varying from all dark to mostly yellow; when the abdomen is yellow laterally as in *woodi*, the median dark marking is usually divided into two stripes by a pale line or series of triangles; in the few exceptions to this, the middle and hind tibiae were partly black, the prescutal lobe dark and the venter had extensive black markings. *Atylotus utahensis* (Rowe and Knowlton), considered by Philip (1965) to be a variety of *insuetus*, has all yellow legs but the abdominal pattern is obsolete and the frontal callosities are usually greatly reduced.



Figs. 5-8. *Atylotus* males, lateral view of head. 5. *intermedius*, 6. *insuetus*, 7. *tingaureus*, 8. *woodi*.

Unlike *A. insuetus*, which attacks man and animals, *A. woodi* did not attack collectors in the Puslinch area. Both sexes were swept from vegetation. The capture of the Wisconsin specimen in a CO₂-baited trap may indicate that it occasionally seeks a blood meal. Its habits may be similar to *A. ohioensis* (Hine), which only occasionally attacks man or enters CO₂-baited traps even in areas where it is known to be fairly abundant.

It is a pleasure to name this species for D. M. Wood, Biosystematics Research Institute, Ottawa, who first called my attention to an eastern *Atylotus* with frontal calli. *A. woodi* is the species reared by H.J. Teskey as "*Atylotus* species C" (1969). He describes the immature stages and gives a detailed description of the habitat.

ACKNOWLEDGEMENTS

I wish to thank Dr. Teskey for the loan of specimens. I also wish to thank Dr. Teskey and Dr. John J.S. Burton, who read the first draft of this paper, and offered valuable suggestions. The figures were drawn by Catherine Komar Outlaw.

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SPECIES COMPOSITION AND SEASONAL ABUNDANCE OF CARRION BEETLES IN AN OAK-BEECH FOREST IN THE GREAT SWAMP NATIONAL WILDLIFE REFUGE (N.J.)¹

Paul P. Shubeck², N.M. Downie³, Rupert L. Wenzel⁴, Stewart B. Peck⁵

ABSTRACT: A total of 6066 beetles was collected on carrion in the Great Swamp National Wildlife Refuge from early April to late November, 1979. Represented were 62 taxa, which included 58 species, plus three genera and one subfamily which could not be identified to the species level. Over 99% of the individuals belong to seven families: Silphidae, Nitidulidae, Staphylinidae, Histeridae, Dermestidae, Scarabaeidae, and Leiodidae. With the exception of one scarabaeid, *Serica* sp., all individuals in these seven families were identified to the species level. *Omosita colon* was the most abundant species, making up 35.00% of all beetles, and *Silpha noveboracensis* the second most abundant, accounting for 29.12% of all Coleoptera. A species list by rank order for the top 11 species indicates that these 11 species accounted for more than 92% of all beetles collected on carrion during the eight-month long study.

Species lists of the amphibians, reptiles, birds, and mammals of the Great Swamp National Wildlife Refuge (GSNWR), Basking Ridge, N.J., have been prepared by the biologists at the refuge and are available at the refuge office. With the exception of butterflies, however, nothing has been done about insect species lists for the swamp. Our project was initiated by the senior author for the purpose of (1) determining the species composition and seasonal abundance of carrion beetles in an oak-beech forest in the swamp, and (2) comparing the results with findings in Hutcheson Memorial Forest (HMF), a dry mixed-oak forest near East Millstone, N.J., where a similar study was conducted in 1975 (Shubeck et al., 1977).

The most abundant and conspicuous beetles found on carrion are Silphidae and they are not difficult to identify. Many of the species from other families usually require the assistance of specialists for identification and the senior author was very fortunate to have the services of his co-authors to assist. Dr. N.M. Downie of Purdue University identified all Staphylinidae, Carabidae, and several other difficult taxa. Dr. Rupert L.

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Wenzel of the Field Museum of Natural History, Chicago, identified all Histeridae, and Dr. Stewart B. Peck of Carleton University, Canada, identified all Leiodidae. Several other specialists were helpful in identifying or confirming other taxa, and their names are given in the acknowledgements.

The primary purpose of this study was to determine all species of Coleoptera that were attracted to carrion in a moist oak-beech forest in the GSNWR from the first week of April to the last week of November in 1979.

Methods

Our collecting station was located in an oak-beech forest about 1 km northeast of refuge headquarters. This forest is situated in the management area which is off-limits to visitors. The beetles were trapped in four No. 10 food cans (3.78 liter), each of which was concealed in a wooden box having 1.27 cm wire mesh at the top and a rain cover above that. These traps have been described elsewhere (Shubeck, 1976). They were placed on the forest floor along a north to south line at intervals of 5 meters. The first and third traps were baited with fish (smelt), and the second and fourth traps were baited with chicken legs (drumsticks). Carrion bait in each trap consisted of three "fresh" fish (about 90 gms total weight) or one "fresh" chicken leg (about 90 gms) in a styrofoam cup (.258 l), and three "stale" fish or one "stale" chicken leg in a styrofoam cup (.258 l).

These traps were initially baited with "fresh" carrion on the first Saturday of April, 1979 and on the second Saturday (when the first collection was made) "fresh" carrion was added to the "stale" carrion. Each trap was serviced once each week, throughout the study, at which time the oldest carrion (and cup) was replaced with fresh carrion (and cup), and all beetles were collected and preserved in jars containing 70% alcohol. At all times, therefore, there were two traps baited with fish, each having fish 1-7 days old (fresh) and fish 8-14 days old (stale), and two traps baited with chicken legs, each having a leg 1-7 days old and one 8-14 days old. This technique (Pirone, 1974) resulted in the presence of fairly uniformly "attractive" carrion on a continual basis.

Results and Discussion

A total of 6066 beetles was collected in the four carrion-baited traps during the months of April through November in 1979 (Table 1). These beetles represent 62 taxa, which include 58 species, plus three genera and one subfamily which could not be identified to the species level. More than 99% of the individuals belong to seven families which are designated the major families of carrion beetles in the Great Swamp National Wildlife

Refuge. Of the remaining families, two are considered to be minor families and six are considered to be accidental families. Individual numbers of species are given in Table 2. This table shows also the numbers collected during each of the eight months the study was in progress.

Silphidae: The most important major family of beetles in the carrion microsera studied was Silphidae, the carrion beetles (Table 2). The 2423 individuals accounted for nearly 40% of all the beetles taken. Of the seven species in the family, *Silpha noveboracensis* was the most numerous, making up almost 73% of the family and over 29% of the order. This species was the second most abundant beetle collected (Table 3). It appears to be bivoltine in the Great Swamp, with a major peak in early May and a second, smaller peak, in early July. The second most abundant silphid, *Silpha americana*, ranked fifth in overall abundance, making up 4.60% of all beetles (Table 3). Well over half of these individuals were taken in July and a quarter in early August. The third, fourth and fifth most abundant silphids were *Silpha inaequalis* (5.74%), *Nicrophorus orbicollis* (5.16%), and *Necrodes surinamensis* (2.52%). These species ranked eighth, ninth, and eleventh, respectively, in overall abundance (Table 3). *Silpha inaequalis* was present from the second week of April through the second week of July (during the same period that *S. noveboracensis* was most abundant). The former population, however, peaked in April and declined rapidly thereafter. *Silpha inaequalis* actually ranked second among all beetles in the HMF study where it accounted for virtually 11% of the order. This species may be near its northernmost boundary in N.J. since Pirone did not collect any of these individuals at Armonk, N.Y. which is about 63 km northeast of the Great Swamp. *Nicrophorus orbicollis* was the only silphid species that was present each month of the study and it peaked in August when the three *Silpha* species had declined or disappeared (Table 2). *Necrodes surinamensis* also peaked in August.

Nitidulidae: The second largest family of beetles was Nitidulidae, the sap-feeding beetles (Table 2). The 2131 specimens accounted for 35.10% of all beetles collected, whereas, in the HMF study they made up but 9.99% of the order. Most significant is the fact that *Omosita colon* actually accounted for all but six of the family members. This amounted to 35% of all beetles, ranking this species in the number one position for Coleoptera (Table 3). In the HMF study *O. Colon* accounted for almost 10% of all beetles with an overall rank of three. It was taken, in Great Swamp, each week from the second week in April to the first week in November (Table 3) and the species peaked in September when the silphids all but disappeared.

Four individuals of the species *Omosita discoidea* were also taken (Table 2). This is probably an introduced species which is occasionally found on carrion with *O. colon* (Parsons, 1943). The former was also collected in very low numbers in HMF, as was the case with *Glischrochilus*

quadrisignatus (2 specimens in HMF and 1 in GSNWR). Only one specimen of *Nitidula bipunctata* was taken in this study but according to Connell (personal communication), both *Omosita* and *Nitidula* are the true carrion-feeding genera of the family. They apparently feed on the fluids exuding from the decomposing carrion.

Staphylinidae: The third largest family of beetles collected was Staphylinidae, the rove beetles, and the staphylinids accounted for just under 10% of all individuals. This family, however, did exhibit the greatest diversity of species (Table 1). It is interesting to note that in the HMF study this family comprised over 22% of all beetles and more than 36% of all species. It is possible that the very moist soil conditions in the refuge are a limiting factor to the ground-loving staphylinids and, as a result, fewer species and fewer individuals are present. The three most abundant species were *Creophilus maxillosus*; *Aleochara lustrica*, and *Ontholestes cingulatus* and together they accounted for 76.65% of the family, but only 7.62% of the order (Table 2). These three species, none-the-less, were numerous enough to be included in the 11 most abundant carrion beetles in the Great Swamp and they ranked sixth, seventh, and tenth, respectively (Table 3). *Creophilus maxillosus* was present each month of the study but was most abundant in July, August (when it peaked), and September. *Aleochara lustrica* was most abundant from August into October and manifested a pronounced peak in September. *Ontholestes cingulatus* was present from May to November but most abundant from July to September. Staphylinids are active predators on arthropods that are found in the carrion community (Arnett, 1963).

Histeridae: Histeridae, the clown beetles, made up the fourth largest family of beetles collected (the position they also held in HMF). In spite of this position, the 398 individuals accounted for less than 7% of all beetles taken. Although 6 species were taken, almost 93% of the individuals consisted of the species *Euspilotus assimilis* (which was also the most abundant species in HMF). The number of these individuals collected ranked the species in the number three position (Table 3). This species appeared in May, increased steadily into July, peaked sharply in August, then all but disappeared during September and October. Histerid beetles, found on carrion are predators on other arthropods present in this microhabitat (Arnett, 1963).

Dermestidae: The fifth major family, Dermestidae, the skin beetles, was represented by but one species, *Dermestes caninus*. The 294 individuals accounted for almost 5% of all beetles and in regard to overall species abundance *D. caninus* ranked in fourth place. It was most abundant during the last week of April and the first two weeks of May. During the latter half of May and through June it was present in moderate numbers. Only seven individuals were taken in July, three in August, one in

September, and none thereafter. This well known scavenger usually feeds on animal remains and has been used by zoologists to deflesh skeletons for study (Borror et al., 1975).

Scarabaeidae: The sixth major family in this study was Scarabaeidae, the lamellicorn beetles. Although nine species were included in this family, the 90 individuals accounted for less than 1.5% of all beetles (Table 2). *Trox unistriatus* and *Onthophagus hecate* were the more common species collected, together making up more than 76% of all scarabs but little more than 1% of the order. Neither one ranked in the top 11 species of the order. This family accounted for the second greatest diversity of species, exceeded only by the rove beetles. It is a large family of beetles whose many species have adapted to a wide variety of niches. *Trox* spp., for example, are found on dry carrion while *Onthophagus hecate* is a dung feeder and *Onthophagus striatulus* is a fungus feeder (Arnett, 1963). *Geotrupes splendidus*, a large and beautiful (metallic bronze) beetle, is normally found beneath dung and carrion, *Onthophagus orpheus* is found on fungi and carrion, and *Copris* spp. are found on and under dung (Dillon and Dillon, 1961). *Dialytus* spp., according to Arnett (1963), feed by preference on deer droppings. The only scarab species collected that seemed to be completely out of place (on carrion or decomposing animal matter) was *Serica* sp. According to Dr. Brett C. Ratcliffe (personal communication), the latter taxon is made up of foliage feeders and the three individuals were probably trapped accidentally.

Leiodidae, Catopinae (= Leptodiridae): The seventh, and last, major family of carrion beetles collected during this study was Leiodidae, subfamily Catopinae (= Leptodiridae, the small carrion beetles). The total number of these individuals taken was only one-fourth of the number of leptodirids taken during the HMF study conducted in 1975. As was the case in that study, *Sciodrepoides fumatus terminans* accounted for better than half of all the family members collected. The 39 individuals, however, accounted for much less than 1% of all beetles and it did not rank in the top 11 species of the order. *Catops simplex* and *Prionochoeta opaca* together made up the bulk of the remaining individuals. The three species mentioned thus far were also the three most abundant leptodirids in HMF. The senior author has often taken these species at carrion; Peck has taken them on human dung (personal communication); and Smith published records of the latter two collected on old store cheese (1910).

The preceding seven families of carrion beetles have been referred to as "major families" for several reasons. (1) Twenty years of field work by the senior author indicated that members of these seven families were consistently associated with carrion. (2) Each of these families, during this study, contributed a minimum of 1% of all beetles taken. (3) Together, these families accounted for 99.05% of all beetles taken.

Minor Families: Two families have been designated "minor families." The primary reason for assigning this appellation was the fact that the total number of individuals in each family amounted to less than 1.0% but at least 0.1% of all Coleoptera collected. The secondary reason for the use of this category was the realization that, although the number of individuals collected may have been quite small, the presence of the given individuals might normally be expected on carrion.

Family Carabidae, the ground beetles, are predaceous as larvae and as adults so they very well might be expected to prey upon arthropods found on carrion. The 40 individuals taken in this study represented eight species and .66% of all Coleoptera (Table 2). Although not really abundant, they were much more plentiful when compared with the two carabids taken in HMF. According to Arnett (1963), carabids "are found in large quantities under stones along streams and in moist areas." The oak-beech woodland, where collecting was done, in Great Swamp is much more moist than the mixed-oak woodland in HMF. *Platynus decentis* and *Pterostichus tristis* together accounted for 80% of the 40 carabids taken at Great Swamp.

Family Cleridae, the checkered beetles, are small to medium in size. Most of the species in this family are predaceous on other insects and they are usually found under bark and around flowers (Arnett et al., 1980). There are three species of *Necrobia* that have been introduced into the U.S. (Arnett, 1963), and they are commonly called "ham beetles" but they do not hesitate to feed on carrion "when ham is scarce" (Arnett et al., 1980). All six individuals collected in this study were members of the taxon *Necrobia violacea* (Table 2).

Accidental Families: Of the 6066 specimens collected during this eight-month study, 6056 are included in the seven major and two minor families that have been presented thus far. The remaining ten specimens represent eight different species within six additional families. In view of these very small numbers it seems highly likely that most of these ten specimens either accidentally flew, or crawled into the traps. For this reason, the following families are considered "accidental families" in terms of this study.

Family Mycetophagidae, the hairy fungus beetles, was represented by two specimens of *Mycetophagus pluripunctatus* and one of *Typhaea stercorea* L. (Table 2). According to Arnett (1963), "These beetles probably feed exclusively on fungi." The three individuals were taken during the last week of April and the first week of May.

Family Lathridiidae, the minute brown scavenger beetles, was represented by two individuals of one species, *Melanophthalma cavicollis* (Table 2). They were collected in April. Most lathridiids are found in moldy and decomposing plant material (Arnett, 1963).

Family Elateridae, the click beetles, was represented by a specimen of

Hemicrepidius decloratus and one of *Ctenicera hieroglyphica* (Table 2). According to Dillon and Dillon (1961) the adults of the latter are predaceous and are found on shrubs and trees.

Family Hydrophilidae, the water scavenger beetles, was represented by one individual of the species *Cryptopleurum minutum* (Table 2). This species is a member of subfamily Sphaeridiinae, whose members are not adapted for swimming but are reported as being associated with carrion or dung (Connell, personal communication).

Family Anobiidae, the drug store and death-watch beetles, was represented by one individual of the species *Lasioderma serricorne* (Table 2). This species is commonly called the cigarette beetle and it usually breeds in stored products such as tobacco and spices (Arnett, 1963).

Family Cryptophagidae, the silken fungus beetles, was represented by one specimen of *Anichicera* sp. (Table 2). Most members of this family "feed on mold, fleshy fungi, decayed leaves and similar materials" (Arnett, 1963).

ACKNOWLEDGEMENTS

The senior author would like to thank Mr. John L. Fillio, Refuge Manager of the GSNWR, for permission to work in the Swamp, Mr. Theodore W. Gutzke, Assistant Refuge Manager, provided encouragement, and general information when called on for assistance. Montclair State College provided a substantial contribution for publication charges and the Alumni Association of Montclair State College provided a small grant to partially defray the cost of supplies for the project. We are indebted to the following specialists for assistance in identifying and/or confirming the taxa mentioned: Dr. Walter A. Connell of the University of Delaware - Nitidulidae; Dr. Terry L. Erwin of the Smithsonian Institution - Carabidae; and Dr. Brett C. Ratcliffe of the University of Nebraska - Scarabaeidae.

Table 1. List of families of Coleoptera collected, showing for each the number of individuals trapped and the percentage of the order this represents, also the number of species and the percentage of all Coleoptera species this represents.

Family	Individuals		Species	
	Number	Percent of all beetles	Number	Percent of all beetles
Silphidae	2423	39.92	7	11.26
Nitidulidae	2131	35.10	4	6.43
Staphylinidae	605	9.98	14	22.56
Histeridae	398	6.57	6	9.68
Dermestidae	294	4.85	1	1.62
Scarabaeidae	90	1.49	9	14.52
Leiodidae	69	1.14	4	6.46
Carabidae	40	.66	8	12.91
Cleridae	6	.10	1	1.62
Mycetophagidae	3	.05	2	3.23
Lathridiidae	2	.04	1	1.62
Elateridae	2	.04	2	3.23
Hydrophilidae	1	.02	1	1.62
Anobiidae	1	.02	1	1.62
Cryptophagidae	1	.02	1	1.62
Totals	6066	100.00	62	100.00

Table 2. List of all species (or nearest taxon) trapped on carrion in GSNWR during 1979. Total number of each captured with percentage this is of family and of all beetles is also given.

	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	Total	Percent of Family	Percent of Order
SILPHIDAE											
<i>Silpha noveboracensis</i> Forst.	404	714	254	373	22	—	—	1	1768	72.95	29.12
<i>S. americana</i> L.	3	21	15	166	71	2	2	—	280	11.56	4.60
<i>S. inaequalis</i> Fab.	71	39	26	3	—	—	—	—	139	5.74	2.30
<i>Nicrophorus orbicollis</i> Say	1	20	3	18	59	18	4	2	125	5.16	2.06
<i>Necrodes surinamensis</i> Fab.	—	—	7	9	43	2	—	—	61	2.52	1.01
<i>Nicrophorus pustulatus</i> Hersch.	—	2	15	3	5	1	—	—	26	1.08	.43
<i>Nicrophorus tomentosus</i> Web.	—	—	1	5	11	3	4	—	24	.99	.40
									2423	100.00	39.92
NITIDULIDAE											
<i>Omosita colon</i> (L.)	108	294	281	170	384	763	123	2	2125	99.71	35.00
<i>O. discoidea</i> (Fab.)	2	—	2	—	—	—	—	—	4	.19	.06
<i>Glischrochilus quadrisignatus</i> (Say)	1	—	—	—	—	—	—	—	1	.05	.02
<i>Nitidula bipunctata</i> (L.)	—	1	—	—	—	—	—	—	1	.05	.02
									2131	100.00	35.10
STAPHYLINIDAE											
<i>Creophilus maxillosus</i> (L.)	5	5	19	36	74	32	6	1	178	29.40	2.92
<i>Aleochara lustrica</i> Say	—	3	7	—	21	127	8	—	166	27.41	2.72
<i>Ontholestes cingulatus</i> (Grav.)	—	6	12	23	34	30	11	4	120	19.84	1.98
<i>Aleochara</i> spp.	4	11	2	4	23	10	—	—	54	8.93	.89
<i>Aleochara lata</i> Grav.	10	8	—	2	3	1	4	—	28	4.63	.47
<i>Philonthus politus</i> (L.)	1	—	—	—	14	5	4	—	24	3.97	.40
Aleocharinae	4	6	1	2	1	2	2	2	20	3.31	.33
<i>Omalius rivulare</i> (Payk.)	—	1	—	—	—	—	1	2	4	.67	.07
<i>Staphylinus viridanus</i> Horn	—	—	1	1	1	—	—	—	3	.50	.05
<i>Philonthus lomatus</i> Er.	2	—	—	—	—	—	—	1	3	.50	.05
<i>P. cyanipennis</i> (Fab.)	—	—	—	—	—	—	2	—	2	.33	.04
<i>Quedius capucinus</i> (Grav.)	—	—	—	—	—	—	1	—	1	.17	.02
<i>P. cruentatus</i> Grav.	—	—	—	1	—	—	—	—	1	.17	.02
<i>Carpelimus</i> sp.	—	1	—	—	—	—	—	—	1	.17	.02
									605	100.00	9.98
HISTERIDAE											
<i>Euspilota assimilis</i> (Payk.)	—	22	44	83	214	3	3	—	369	92.69	6.07
<i>Hister depurator</i> Say	—	—	—	—	3	17	1	—	21	5.27	.35
<i>Margarinotus hudsonicus</i> Csy.	1	1	2	1	—	—	—	—	5	1.26	.09
<i>M. cadaverinus</i> (Hoffm.)	—	—	1	—	—	—	—	—	1	.26	.02
<i>H. abbreviatus</i> Fab.	—	1	—	—	—	—	—	—	1	.26	.02
<i>E. conformis</i> (LeC.)	—	—	—	—	1	—	—	—	1	.26	.02
									398	100.00	6.57
DERMESTIDAE											
<i>Dermestes caninus</i> Germ.	68	154	61	7	3	1	—	—	294	100.00	4.85

Percent of Percent of
APR MAY JUN JUL AUG SEP OCT NOV Total Family Order

SCARABAEIDAE

<i>Trox unistriatus</i> Beauv.	—	3	6	—	30	8	—	—	47	52.20	.75
<i>Onthophagus hecate</i> Panz.	1	6	4	1	1	4	4	1	22	24.43	.36
<i>Geotrupes splendidus mirophagus</i> Say	—	1	—	1	2	1	2	—	7	7.78	.12
<i>Dialytes striatulus</i> (Say)	—	—	—	—	2	2	—	—	4	4.45	.07
<i>Serica</i> sp.	—	—	3	—	—	—	—	—	3	3.33	.05
<i>Trox hamatus</i> Robinson	—	1	1	—	—	—	—	—	2	2.23	.04
<i>O. orpheus canadensis</i> (Fab.)	—	—	2	—	—	—	—	—	2	2.23	.04
<i>Copris minutus</i> (Drury)	—	—	—	—	—	1	1	—	2	2.23	.04
<i>O. striatulus striatulus</i> (Beauv.)	—	—	—	—	—	—	1	—	1	1.12	.02
									90	100.00	1.49

LEIODIDAE

<i>Sciodrepoides fumatus terminans</i> LeC.	16	8	1	1	2	6	5	—	39	56.51	.63
<i>Catops simplex</i> Say	9	1	—	—	—	1	7	1	19	27.54	.32
<i>Prionochaeta opaca</i> (Say)	4	—	1	—	1	1	2	—	9	13.05	.15
<i>Dissochaetus oblitus</i> Lec.	—	—	—	—	—	1	1	—	2	2.90	.04
									69	100.00	1.14

CARABIDAE

<i>Platynus decentis</i> (Say)	—	—	—	1	—	1	14	1	17	42.50	.26
<i>Pterostichus tristis</i> DeJ.	—	—	1	—	1	2	11	—	15	37.50	.24
<i>Pinacodera platicollis</i> (Say)	—	—	—	—	—	—	—	2	2	5.00	.04
<i>Pinacodera limbata</i> Dej.	—	—	—	—	—	—	2	—	2	5.00	.04
<i>Pterostichus pennsylvanicus</i> LeC.	—	—	—	—	—	1	—	—	1	2.50	.02
<i>Pterostichus mutus</i> (Say)	—	—	—	—	—	—	1	—	1	2.50	.02
<i>Chlaenius impunctifrons</i> Say	—	—	—	—	1	—	—	—	1	2.50	.02
<i>Platynus cincticollis</i> Say	—	—	—	—	—	—	1	—	1	2.50	.02
									40	100.00	.66

CLERIDAE

<i>Necrobia violacea</i> (L.)	—	—	—	1	2	3	—	—	6	100.00	.10
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MYCETOPHAGIDAE

<i>Mycetophagus pluripunctatus</i> Lec.	1	1	—	—	—	—	—	—	2		
<i>Typhaea stercorea</i> L.	1	—	—	—	—	—	—	—	1		

LATHRIDIIDAE

<i>Melanophthalma cavicollis</i> Mann.	2	—	—	—	—	—	—	—	2		
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ELATERIDAE

<i>Hemicrepidius decloratus</i> (Say)	—	—	1	—	—	—	—	—	1		
<i>Ctenicera hieroglyphica</i> (Say)	—	—	1	—	—	—	—	—	1		

	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	Total	Percent of Family	Percent of Order
HYDROPHILIDAE											
<i>Cryptopleurum minutum</i> (Fab.)	—	—	—	—	—	—	—	1	1		
ANOBIIDAE											
<i>Lasioderma serricornis</i> (Fab.)	—	1	—	—	—	—	—	—	1		
CRYPTOPHAGIDAE											
<i>Anchicera</i> sp.	1	—	—	—	—	—	—	—	1		

Table 3. The 11 most abundant beetles trapped on carrion in the Great Swamp National Wildlife Refuge during 1979, together with the percentage of Coleoptera each represents, and the family of each. Only those species that contributed a minimum of 1% of all beetles are included. These 11 species actually accounted for 92.63% of all individuals collected.

Species	Percent of Coleoptera	Family
<i>Omosita colon</i>	35.00	Nitidulidae
<i>Silpha noveboracensis</i>	29.12	Silphidae
<i>Euspilotus assimilis</i>	6.07	Histeridae
<i>Dermestes caninus</i>	4.85	Dermestidae
<i>Silpha americana</i>	4.60	Silphidae
<i>Creophilus maxillosus</i>	2.92	Staphylinidae
<i>Allocharya lustrica</i>	2.72	Staphylinidae
<i>Silpha inaequalis</i>	2.30	Silphidae
<i>Nicrophorus orbicollis</i>	2.06	Silphidae
<i>Ontholestes cingulatus</i>	1.98	Staphylinidae
<i>Necrodes surinamensis</i>	1.01	Silphidae

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NEW SPECIES OF *RHOGOSANA* AND *PONANA*, (HOMOPTERA:CICADELLIDAE) FROM CENTRAL AND SOUTH AMERICA¹

Dwight M. DeLong²

ABSTRACT: Two new species of *Rhogosana*, *R. fosteri* n.sp. (Bolivia) and *R. amazona* n.sp. (Brazil), and three new species of *Ponana*, *P. balloui*, n.sp. (Venezuela), *P. ornatella* n.sp. (Brazil) and *P. areya* n.sp. (Mexico) are described.

The genus *Rhogosana* was described by Osborn (1938). DeLong and Freytag treated the genus (1971). Three species have since been described by DeLong (1975). The genus *Ponana* was described by Ball (1920). DeLong and Freytag reviewed the genus (1967). New species have been added since by DeLong and Martinson (1973) and DeLong and Kolbe (1974). Two closely related species of *Rhogosana* and three species of *Ponana* are described in this paper. All type specimens are in the DeLong Collection, the Ohio State University.

Rhogosana fosteri n. sp.

(Figs. 1-6)

Length of male 13 mm, female unknown. Crown broad, thin, short, more than twice as wide between eyes, at base, as length at middle. Color, crown pale brownish with a few darker areas, especially along margin. Pronotum with median third, anterior to caudal margin darker brownish, widened caudally to width of scutellum. Lateral third, each side, yellowish. Scutellum mostly dark brown with a little yellow coloring in basal angles and along anterior margin. Forewings dull yellowish with small irregular dark brown markings mostly between veins. Veins mostly pale brownish.

Male genital plates almost four times as long as wide at middle, apices narrowed caudally and rounded. Style long and narrow, curved dorsally at apex which is slightly enlarged, blunt, bearing spines on ventral margin near apex. Acdeagal shaft bearing two apical processes which are slightly more than half length of shaft and extend basad. Paraphyses extending two-thirds distance to apex of shaft. Pygofer with a produced, rounded protrusion near dorsal margin.

Holotype male, Sta. Cruz Exper, Sta. Saavedra, Bolivia 2-IV-1979 at trap light. D. Foster, V. Gonzales, I. Caballero colls.

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I take pleasure in naming this species for Dr. Donald R. Foster.

R. fosteri is related to *R. aldeia* DeL. and can be separated by the much shorter aedeagal apical processes, which extend laterally, and the more produced apex of the aedeagal shaft.

Rhogosana amazona n. sp.

(Figs. 7–11)

Length of male 12.5 mm., female 13 mm. Crown broadly rounded, more than twice as broad at base, between eyes, as median length. Color, crown yellow with three broad, longitudinal black stripes, one at middle and one each side between ocellus and eye. Pronotum yellow with a broad longitudinal brown stripe on median third. Scutellum yellow with brown basal angles and a medial brown longitudinal stripe. Forewings dull yellowish, claval and apical portions with brown areas.

Female seventh sternum roundly, concavely excavated one-third distance to base each side of a broad, median lobe, half the width of segment.

Male genital plates four times as long as width at middle, apex rounded. Style with apical third of blade narrowed, apex curved dorsally, slightly enlarged. Aedeagal shaft bearing a pair of short apical processes, one-fourth length of shaft, which extend basally. A pair of short slender paraphyses extend to two-thirds length of shaft. Pygofer with a basal process extending caudally.

Holotype male Igarape, Acu, Faz B. Susesso, Brazil, Sept. 12, 1964, Apol. Sousa. Paratype female Belem, MPEC, Brazil, July 16, 1973; 1 female Ammanaus Res. Ducek, Brazil, W.L. Overall coll.

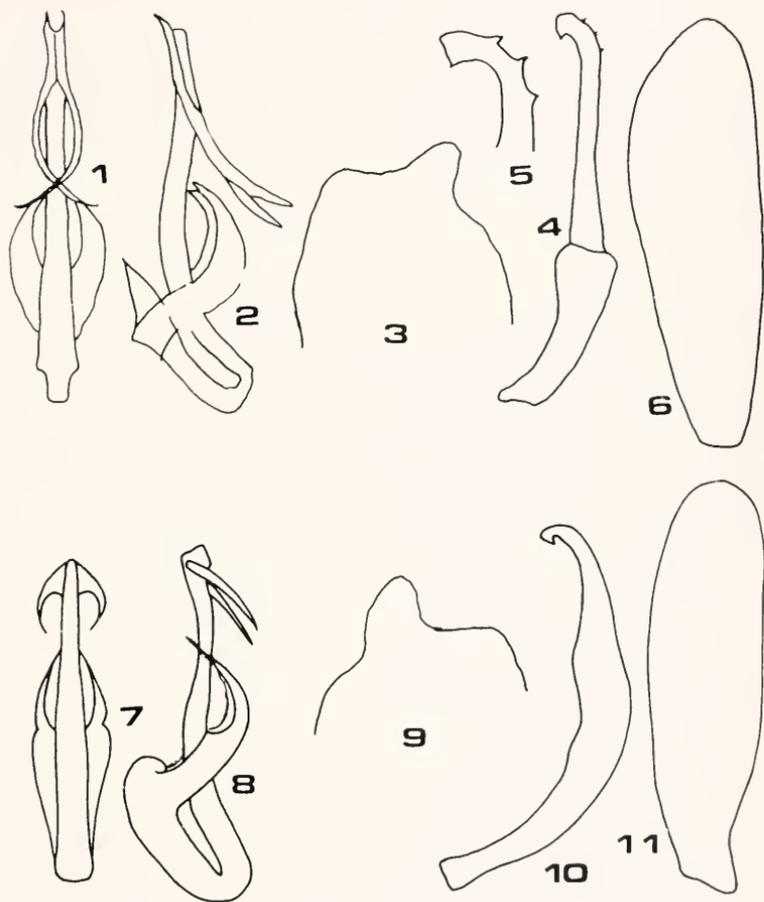
R. amazona is related to *R. aldeia* DeL. and can be separated by the blunter apices of the style and by the broader basal portion of the paraphyses.

Ponana balloui n. sp.

(Figs. 12–15)

Length of male 7.5 mm., female 8.5 mm. Crown broadly rounded more than half as long at middle as wide at base between eyes. Ocelli equidistant between eyes and median line. Color, dull yellow tinged with brown. Crown with 4 black spots, one just in front of each ocellus near apex and one behind each ocellus near base. Pronotum with numerous reddish brown flecks on disc. Scutellum with anterior portion a little darker brownish than apical half. Forewings dull yellowish with a pair of small dark brown spots on terminus of first pair of claval veins at commissure and a pair of larger spots at apex of second pair of claval veins. Numerous dark brown spots along costa, longer spots at apex of apical veins, cross veins of first antepical cell and fourth apical cell. Numerous irregular small brown spots scattered over wing.

Female with posterior margin of seventh sternum broadly angularly excavated $\frac{1}{3}$ distance to base with a slight notch at middle.



Figs. 1-6 *Rhogosana fosteri* n. sp. 1. aedeagus ventrally, 2. aedeagus laterally, 3. pygofer laterally, apical portion, 4. style laterally, 5. style laterally, apical portion enlarged, 6. plate ventrally. Figs. 7-11 *R. amazona* n. sp. 7. aedeagus ventrally, 8. aedeagus laterally, 9. pygofer laterally, apical portion, 10. style laterally, 11. plate ventrally.

Male genital plates narrow, broadened dorsoventrally at $\frac{2}{3}$ their length then narrowed to form slender apices which curve dorsally. Aedeagal shaft slender, bearing a pair of subapical processes which extend apically along each side of apex and curve slightly inwardly and apically. Paraphyses slender, arising near base and extending to apex of shaft. Apical fifth enlarged bearing a pointed tooth at base of enlarged portion, which is concavely rounded on inner margin and is curved inwardly and pointed apically.

Holotype male, Caracas Venezuela XII-1-'39 C.H. Ballou coll., from Avacado flowers.

P. balloui is related to *P. pana* DeL. and Frey., and can be separated by the 4 black spots on the crown and by the more prominent apical processes at the apex of the aedeagal shaft.

Ponana ornatella n. sp.

(Figs. 16-17)

Length of female 7 mm., male unknown. Crown broadly rounded, two-thirds as long at middle as width at base between eyes. Ocelli as close to eyes as to median line and on anterior portion of crown. Color, crown yellow tinged with brown, with a large round black spot behind each ocellus, near base. Pronotum without spots, with pale brownish areas along anterior margin and behind eyes. Scutellum dull yellowish with dark brown basal angles. Forewings with a pale yellowish margin, bordered by dark brown spots and lines, on anterior margin along scutellum and for a short distance along commissure. A series of dark brown short lines, mostly portions of black veins, form a diagonal, broken line, extending from apex of claval suture to median portion of costa. The portion of the wing cephalad to this line is dull yellow opaque, the caudal portion of the forewing is pale yellow subhyaline. Veins and cross veins of apical cells, dark brown.

Female seventh sternum with posterior margin slightly roundly produced, almost truncate.

Holotype female, Serra Lombard, Limoa, Brazil VIII-24-1961, J. & B. Bechyne colls.

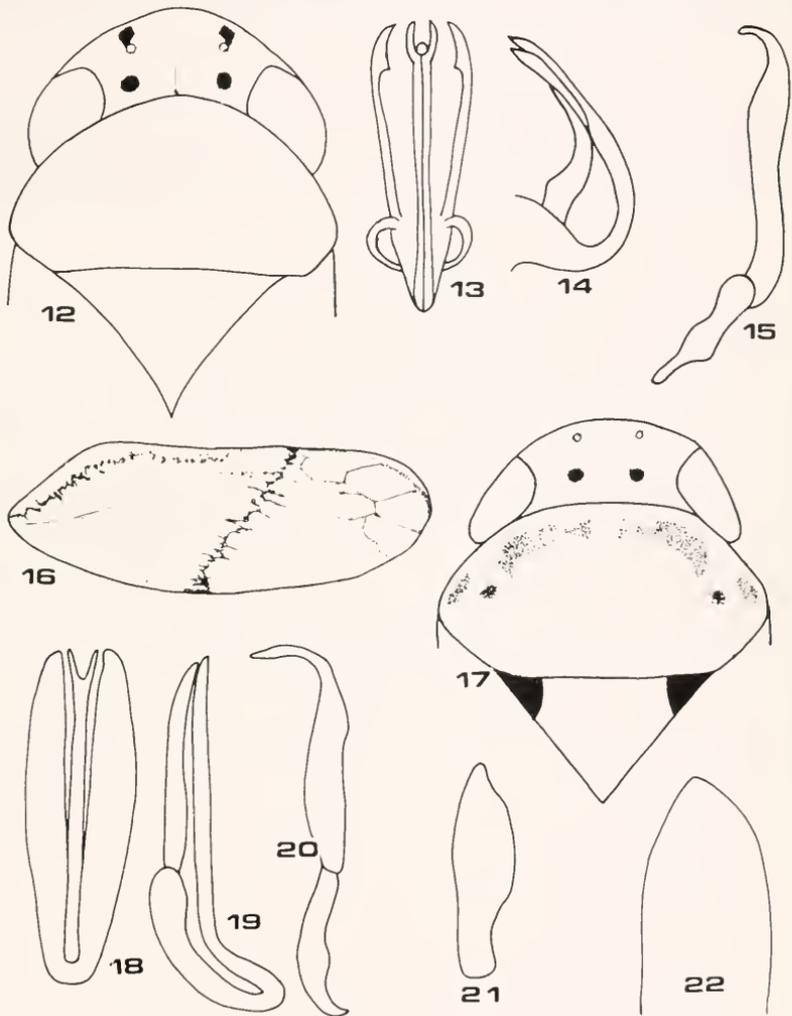
The color pattern of this species is distinct and will separate it from all described species in *Ponana*.

Ponana areya n. sp.

(Figs. 18-20)

Length of male 7 mm., female 8 mm. Crown $\frac{3}{5}$ as long at middle as basal width between eyes. Ocelli closer to anterior than to posterior margin and equidistant between eyes and median line. Color, pale grayish yellow, pronotum with four round black spots near posterior margin. One behind each ocellus and one posterior to each eye. A black spot on base of each forewing at humeral angle of pronotum.

Female seventh sternum with posterior margin shallowly concavely rounded each side of slightly produced median third, which is slightly notched at middle.



Figs. 12-15 *Ponana balloui* n. sp. 12, head and pronotum dorsally, 13, aedeagus ventrally, 14, aedeagus laterally, 15, style laterally. Figs. 16-17 *P. ornatella* n. sp. 16, forewing, 17, head and pronotum dorsally. Figs. 18-22 *P. areya* n. sp. 18, aedeagus ventrally, 19, aedeagus laterally, 20, style laterally, 21, plate ventrally, 22, pygofer laterally, apical portion.

Male genital plates almost four times as long as width at middle, apex narrowed, bluntly pointed. Style broadened on median portion, apical fifth narrowed and bent laterally. Aedeagus with shaft broadly U-shaped, notched at apex. Paraphyses broad, blunt at apex, extending to apex of shaft. Pygofer narrowed at apex and rounded.

Holotype male, 2 mi. E. Le Huerta, Baja Calif., Mexico, Sur. X-9-68, at black light, E.L. Sleeper and F.J. Moore coll. Paratypes: 1 male, 2 females same data as holotype.; 11 males and 1 female, 2 ml. N.W. El Triunfo, 1900 ft. el., Baha Calif., Mex. X-10-68; 1 male and 1 female same except 7.5 mi. W. 1600 ft. el. X-11-68; 1 male & 1 female La Burrera, 1800 ft. el. X-18-68; 1 female 2.5 mi. S.E. Valle Perido, 2000 ft. el., X-15-1968; 5 females & 2 males mi. E. Casas Viejas, 800 ft., X-27-68; 2 males & 1 female 7 mi. W. of Santiago 1600 ft. el. X-30-68. All paratypes were collected in Baja California, Mexico.

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NOTES ON THE YELLOWJACKET PARASITE *BAREOGONALIS CANADENSIS* (HYMENOPTERA: TRIGONALIDAE)^{1,2}

David Carmean, Roger D. Akre, Richard S. Zack, Hal C. Reed³

ABSTRACT: *Bareogonalis canadensis* (Harrington) is recorded for the first time from colonies of *Vespula vulgaris* (L.) and *V. acadica* (Sladen). Emerging parasites are chased or forcibly removed from the nest by workers, but are apparently unharmed. Trigonalids reared in reproductive cells are larger and have one more antennal segment than those reared in worker cells.

The family Trigonalidae is represented by 4 species in America north of Mexico (Carlson, 1979). All are parasitic. In most cases eggs are laid along the periphery of the undersides of leaves where they are ingested by a foliage feeding intermediate host, usually a larval lepidopteran. Although the eggs hatch inside these caterpillars, the first instars do not develop until the intermediate host is further parasitized by another hymenopteran or dipteran, or predated upon by a social hymenopteran. In the latter case, trigonalid development begins when the caterpillar is fed to the wasp larvae by workers. Further information on the biology of this group is available in Clausen (1929, 1931, 1940), Cooper (1954), Malyshev (1968), and Carlson (1979).

Bareogonalis canadensis (Harrington) was recorded by Harrington (1896) as parasitizing the social vespid *Vespa occidentalis* Cresson [= *Vespula pensylvanica* (Saussure)] in southwestern British Columbia. In all probability, though, because of the aerial location of the nest from which *B. canadensis* was collected, and the presence of a second smaller species of parasitic hymenopteran [probably *Sphecochaga vesparum burra* (Cresson) (Hymenoptera: Ichneumonidae)] we believe that Harrington actually collected *B. canadensis* from a nest of *Dolichovespula arenaria* (Fab.), the aerial yellowjacket. *S. vesparum burra* is the only common yellowjacket parasite in the Pacific Northwest and is occasionally found in the nests of *D. arenaria* (MacDonald et al., 1975; Greene et al., 1976). It is rare in

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colonies of the subterranean nesting *V. pensylvanica*. *B. canadensis* has also been collected from northwestern California by Stage and Slobodchikoff (1962) from a *D. arenaria* nest and from 2 colonies of *Vespula pensylvanica* from Gabriola Island, British Columbia (Taylor, 1898).

Collections

From 1974-1980, 170 colonies of *D. arenaria*, 197 of *V. pensylvanica*, 43 of *Vespula vulgaris* (L.) and 10 of *Vespula acadica* (Sladen) were collected from various locations in Idaho and Washington without encountering this parasite. However, on 3 August 1979, colonies of *V. vulgaris* and *V. acadica* with nests containing the parasite were collected from an east-facing slope of a grand fir [*Abies grandis* (Douglas) Lindl.] and western red cedar (*Thuja plicata* Donn) forest in Latah County, Idaho. Both colonies were located in the same decayed log with nest entrances 92 cm apart. The *V. acadica* combs were brought into the laboratory and placed into containers to collect emerging individuals. The *V. vulgaris* nest was placed into an observation box and screenhouse as described in Akre et al. (1973).

From the *V. acadica* nest 3 pupae of *B. canadensis* were obtained: 2 males and one pupa unidentifiable as to sex. Specimens of *B. canadensis* were first collected from the combs of *V. vulgaris* on 8 August. As of 21 August, 4 male and 1 female specimens had emerged. Final examination of the combs shortly thereafter revealed 8 additional trigonalid pupae (6 males and 2 females) and one prepupa.

On 13 September, a second *V. vulgaris* colony was collected from a log within 3 m of where the other parasitized colonies had been collected. Again, combs from the nest were placed into a container to collect emerging wasps. Seventeen male and 24 female *B. canadensis* were obtained from this nest. In all 3 cases, the colonies were also parasitized by the ichneumonid *Sphécophaga vesparum burra*.

Behavioral Interactions

Mature trigonalid larvae constructed thick (.4 mm) white styrofoam-like pupal caps just underneath the thin (.08 mm) pupal caps of *V. vulgaris*. Emerging trigonalids cut round holes approximately half the diameter of these caps. Normally, the cap remnants of *V. vulgaris* are removed by the workers immediately after emergence. New eggs are laid in these cells by the queen in 20 minutes or less. However, cells from which *B. canadensis* emerged had no significant cap remnants removed by workers until 5-6 days later, when with just the edge of the caps remaining, the queen again laid eggs into the cells.

Observations showed that although newly emerged *B. canadensis* adults were either chased out or forcibly removed by workers from the *vulgaris* colony, they usually escaped unharmed. In one case, a *B. canadensis* chewed out of its pupal cell but was relatively unnoticed by a worker which was inspecting adjacent cells. Once out of the cell the parasite was antennated by a worker and then ignored. Eventually the parasite was attacked by a worker which flipped it over using her mandibles and then left it. Within the next few minutes workers attacked the parasite twice in a similar fashion. Approximately 12 minutes after emergence, the parasite was carried outside the nest by a worker. Workers were never seen attempting to sting the newly emerged *B. canadensis*. This behavioral sequence contrasts with that observed with the parasite *S. v. burra*. Workers immediately killed and ate the parasites as they emerged from the cells in the same *V. vulgaris* nest.

Our results agree with Yamane and Yamane (1975) that body size was dependent on the type of cell from which the parasite emerged. Those from reproductive cells were larger than individuals from worker cells. Individuals developed in reproductive cells were 10.4-11.4 mm long with an intertegula distance of 3.0 to 3.4 mm while those from worker cells were 8.5 to 9.5 mm long with an intertegula distance of 2.4 to 2.6 mm. In addition, specimens reared from the small worker cells had 18 antennal segments (with the exception of one which had 18 segments on the left side and 19 on the right side), while those reared from the larger reproductive cells had 19 segments.

Discussion

The rearing of *B. canadensis* from 2 species of *Vespula* combined with reports of its occurring in *V. pensylvanica* (and possible *D. arenaria*) nests shows that this parasite is not host specific. Although a number of yellowjacket species are parasitized, *B. canadensis* is also not very successful as determined by abundance. Sixteen yellowjacket colonies were collected within a 10 mile radius of the infested colonies, but no parasitism was found except in this limited area. This is probably due, at least in part, to the complex life cycle of the parasite, and to its observed performance as a relatively poor flyer. The ability of *B. canadensis* adults to disperse after emergence from a vespine nest is probably quite limited.

Since adult trigonalids emerge late in the year (August-September), it is likely that inseminated females overwinter and deposit their eggs on foliage the following spring. If so, the seasonal cycle of the parasite probably coincides with that of the yellowjacket hosts which initiate colonies in the late spring (April-June).

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A POLYGYNOUS COLONY OF *VESPULA PENNSYLVANICA* (SAUSSURE) (HYMENOPTERA: VESPIDAE)^{1,2}

Roger D. Akre, Hal C. Reed³

ABSTRACT: In 1979 a colony of *Vespula pensylvanica* (Saussure) with three functional queens was collected at Prosser, Washington. This is the first polygynous colony of yellowjackets recorded from a cool temperate area.

All yellowjacket colonies are initiated by a single inseminated queen, the only member of the colony to survive the winter. During the first warm days of spring (April – June) the queens emerge from hibernation (reproductive diapause) and search for nest sites. Once the site has been selected, the queen initiates the construction of a small nest of up to 45 cells in which she lays her eggs. At this time, the queen forages for construction materials and for arthropod prey to feed the larvae. However, once the first five to seven workers emerge, they assume all the duties of the colony, and the queen rarely leaves the nest again. Her primary responsibility from this point onward is the laying of eggs. The nest is constantly expanded and successive broods of workers are reared. Later in the season (August – September) the workers build larger reproductive cells in which both males and queens are produced. The colony enters a declining phase shortly thereafter, when workers pull larvae from the comb and feed them to other larvae or discard them. After emergence the new queens and males leave the nest and mate. The males eventually die while the inseminated queens hibernate. The next spring the cycle is repeated. Thus, typical yellowjacket colonies are monogynous and annual. Attempts by other queens to enter the nest usually result in fierce fighting between the intruder and the resident queen and/or the workers (Matthews and Matthews 1979).

However, there are reports of atypical, perennial colonies of yellowjackets containing numerous queens. While vespines (hornets and yellowjackets) are essentially north temperate in distribution, two species, *Vespula germanica* (Fab.) (Edwards 1976) and *V. vulgaris* (L.) (Spradbery 1973a, Richards 1978) have been introduced into south temperate regions.

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Wherever *V. germanica* occurs, colonies seem to have a propensity for becoming perennial in the warmer temperate or subtropical regions. For example, perennial colonies of this species occur in New Zealand (Thomas 1960), Tasmania (Spradbery 1973b), Algeria and Morocco (Viillaume *et al.* 1969) and Chile (Jeanne 1980). Perennial colonies are usually large, and one nest was estimated to weigh 1,000 pounds (Spradbery 1973a). There are also reports of several other species of yellowjackets (primarily in the *V. vulgaris* (L.) species group) establishing perennial colonies in the warmer areas of their temperate distribution. Huge perennial colonies of *V. squamosa* (Drury) have been recorded from Florida (Tissot and Robinson 1954, Akre *et al.* 1981), and a single perennial colony of *V. vulgaris*, having 21 comb levels and 22 functional queens, was discovered in California (Duncan 1939). A perennial colony of *V. pensylvanica* (Saussure) has been reported from Hawaii (Nakahara 1980) and in addition, there is a report of a possible perennial colony of *V. pensylvanica* in Vancouver, British Columbia (Spencer 1960). However, no perennial colonies have been reported in those species which have relatively small colonies (*Dolichovespula* spp.) and nests with only one worker comb (*V. rufa* (L.) species group).

Since 1971 more than 450 colonies of *Vespula* species have been collected from northern Idaho and Washington. Slightly more than half these colonies were *V. pensylvanica* and 10% were *V. vulgaris*. With one exception, these colonies contained only one functional queen. However, a large colony of *V. pensylvanica* with multiple queens was collected 23 October 1979 and is the basis of this report.

Collection Data

The colony was located in Benton County, Washington 4 miles NE of Prosser. On 22 October when the colony was discovered, workers were still actively foraging. The colony was killed with carbon disulfide after dark. The nest and its contents were excavated the next day and immediately frozen for later analysis.

The subterranean nest was located on a south facing slope protected from winds by a large bank. This area is favored as an overwintering site for honey bee colonies since it is one of the lowest (590 ft. elevation) areas in the vicinity and is situated so the area is basked in sunlight early in the spring.

The bank where the nest was located is extremely rocky, and the nest was irregularly constructed in spaces where the yellowjackets had been able to excavate soil from among the rocks. Although external dimensions do not give a reliable indication of nest size, the nest was approximately 42 cm long x 22 cm wide x 15 cm deep.

Nest and Colony Analysis

The nest consisted of 7 comb levels with 8 combs. The first (uppermost) two combs consisted entirely of worker cells, the next two a combination of worker cells and queen cells, and the final four were entirely queen cells. Thus, this colony had a normal transition from worker to reproductive cells with no reversal to worker cell production. Thirty-six percent of the cells were queen cells and the worker/queen cell ratio was 1.77. This is well within the normal range of these parameters for *V. pensylvanica* colonies (Roush and Akre 1978). There was a total of 14,300 cells.

The colony was obviously declining as 5,391 cells were empty and more than 200 had multiple eggs (2-4). In addition, there were 1,081 new queens, 1084 males, but only 510 workers.

Besides the 1,081 new queens there were three queens that appeared old as evidenced by "age spots" (brownish discoloration of gastral terga II and III) and the frayed condition of the wings. The wings of one of these queens were extremely frayed, the other two to a lesser extent. Dissections showed that all had fully developed ovaries packing the entire gaster (Fig. 1), and



Fig. 1. Ovaries of the three functional queens. The ovary of the probable foundress queen, as indicated by her extremely frayed wings, is on the left.

spermathecae filled with sperm. All three were functional (egg laying) queens.

Discussion

Although it is not known if the colony had been there the previous year, this is considered unlikely based on size. Most perennial colonies have more individuals and much larger nests (e.g. a perennial *V. squamosa* nest of 120,000 cells; Akre *et al.* 1981). However, 1979 had a warm, dry spring (Akre and Reed, 1981), and the colony could have been initiated very early, perhaps in March. In addition, the area where the colony was located is probably one of the warmest in the Columbia Basin, an area with one of the longest growing seasons in Washington. During 1979 hot, dry weather continued through October and this gave the colony an extremely long season.

This is the largest nest of *V. pensylvanica* recorded from Washington. The largest nest collected previously contained 12,316 cells, but most analyzed colonies had nests of 4,000 to 10,000 cells (Akre *et al.*, 1981). However, at slightly more than 14,000 cells, this nest was still considerably smaller than nests from a few nonperennial colonies of *V. vulgairs* reported from Europe. The largest nest collected in Germany had 21,692 cells (Kemper 1961).

Since all three functional queens had age spots and frayed wings, it is highly unlikely that any were new queens from this or a nearby colony that had subsequently developed ovaries. *V. pensylvanica* queens usually develop these spots only after they are several months old and have been actively laying eggs, typically by late August or early September. Non-functional queens never develop these discolorations no matter how old they become.

Many new queens do not initiate a nest of their own in the spring and, in Washington, are still flying as late as August. Perhaps two of these queens joined the colony. *V. pensylvanica* queens frequently attempt to usurp control of colonies of conspecifics and those of *V. vulgaris* (Akre *et al.* 1977, unpublished data). If they attempted to join the colony late in the year when queen control was low and workers had begun to develop their ovaries, resistance to their entry may have been minimal. Or perhaps a situation developed similar to that which frequently exists between the social parasite *Dolichovespula arctica* (Rohwer), and its host, *D. arenaria* (Fab.), in which a period of coexistence occurs between the host queen and the parasite female (Greene *et al.* 1978). During seasons with intense intraspecific queen competition an intruding queen may coexist with the foundress queen. An example of coexistence early in the nesting season was a *V. vulgaris* colony which was collected and killed on 22 July 1980. It

contained two queens but only 1 worker comb of *ca.* 100 cells.

The development of a large, polygynous colony of *V. pensylvanica* in the Columbia Basin of Washington, with at least a potential for becoming perennial, indicates that areas such as the Columbia Basin, an island of warmth in the northern tier, could provide a suitable habitat for increasing colony longevity and thus enhancing the possibility of perennial colonies.

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LARVAE OF ALDERFLY (MEGALOPTERA: SIALIDAE) FROM PITCHER PLANT¹

Thomas N. Mather²

Leaves of the eastern pitcher plant (*Sarracenia purpurea*) create a suitable habitat for a few species of dipteran larvae, including *Wyeomyia smithii* (Coquillett) (Culicidae), *Metricnemus knabi* Coquillett (Chironomidae), and *Blaesoxipha fletcheri* (Aldrich) (Sarcophagidae). The digestive fluids of these insectivorous plants restrict this habitat, for the most part, to these specially adapted insects. However, a few other insect species have occasionally been found alive in this leaf-contained aquatic habitat (Jones, 1920; D. Fish, Fordham Univ., person. commun.). During a 2-year survey of the arthropod fauna of *S. purpurea* in a southern New Jersey bog (Salem Co.), 2 sialid (Megaloptera: Sialidae) larvae were discovered. The first was found in a large, water-filled leaf (pH=6.8) on April 25, 1980. The second was collected May 30, 1980 from a smaller leaf (pH=7.1) approximately 40 m from the first. Both leaves were from plants situated on moss-covered tussocks approximately 20 cm above the surface water of the bog. These leaves had been produced during the previous growing season (1979) and contained larvae of both *W. smithii* and *M. knabi*.

The first sialid larva was preserved in 70% EtOH and sent to Dr. Lawrence Canterbury (U. of Cincinnati) who identified it as *Sialis joppa*. By comparison the second larva was determined to be the same species. Both specimens were in the pre-pupal stage and may have entered the pitcher plant in search of a pupation site. Normal pupation occurs in soil a short distance from the water. The preferred larval habitat of *S. joppa* are small, shallow streams (Canterbury, person. commun.), yet no larvae were ever recovered from the small stream (\bar{X} pH=6.1) flowing through the bog.

Sialis joppa has not been recorded from New Jersey, although it has been collected nearby in Delaware and Pennsylvania (Tarter, et al., 1978). Therefore this report not only records another insect using the pitcher plant habitat, but serves as a new state record for *S. joppa*.

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AN ANNOTATED LIST OF TREEHOPPERS (HOMOPTERA: MEMBRACIDAE) OF DELAWARE¹

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ABSTRACT: Sixty-one membracid species are reported for Delaware of which 48 are new state records. The species list includes information on their locality, seasonal occurrence and biology, including plant species association.

Thirteen species of membracids have been previously reported from Delaware (Bray and Triplehorn 1953, Metcalf and Wade 1965, Kopp and Yonke 1973b, c). Nine of these were reported by Bray and Triplehorn in association with red and pin oaks.

The present list includes 61 species, 48 of which are new state records. Records on all but one species (*Ophiderma salamandra* Fairmaire) in the list are based upon recent field collections (Mason and Loye 1981) and examination of specimens in museum collections. Determinations of species were verified by Duane Flynn of Michigan State University.

The arrangement of taxa in the list follows that of Kopp and Yonke (1973a, b, c, 1974). Species within each genus are listed alphabetically. Information listed for species collected in this study includes: locality and (or) county, range of seasonal occurrence, host data and biological notes where available. Gleason and Cronquist (1963) was used as a source for the host identifications. For museum specimens, information is given on locality and months when they were collected. This information was obtained from specimens in the University of Delaware Entomological Collection.

More extensive collecting is needed to determine the extent of the membracid fauna in the state. Our list represents a compilation of known Delaware species. However, about 40 other species not listed here have been reported from adjacent states and should be present in Delaware. We hope this publication will stimulate additional investigations on the Membracidae in Delaware.

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Family Membracidae

Subfamily Centrotinae

- * *Microcentrus perditus* (Amyot and Serville). Newark, New Castle Co. Aug. 8.

Subfamily Hoplophorioninae

- * *Platycotis vittata* (F.). Newark, New Castle Co.; Georgetown, Sussex Co. June 19 – July 4.
Quercus alba.

Subfamily Membracinae

- Campylenchia latipes* (Say). Newark, New Castle Co. June 12 – Oct. 31. *Erigeron annuus*, *Solidago* sp. Nymphs collected from *Solidago* sp. root feeding at the surface of the ground 4th week of May and 1st week of June. Aggregation and ant attendance seen for nymphs, but not adults. Museum specimens: Newark, New Castle Co., July; Dover, Kent Co., July and Aug.; Glasgow, New Castle Co., Aug.
- * *Enchenopa binotata* (Say). Newark and Wilmington, New Castle Co.; Dover, Kent Co. June 5 – Sep. 22. *Carya glabra*, *Juglans nigra*. Nymphs collected from *J. nigra* and *C. glabra* June 3-26 were attended by ants.

Subfamily Smiliinae

Tribe Acutalini

- * *Acutalis tartarea* (Say). Newark, New Castle Co. June 5 – Oct. 1. *Ambrosia artemisiifolia*, *Arctium minus*, *Erigeron annuus*, *Eupatorium* sp., *Solidago* sp. Nymphs collected from *Solidago* sp. June 10-26. Museum specimens: Odessa, New Castle Co., June, July.
- * *Micrutalis calva* (Say). Newark, New Castle Co.; Dover and Woodland Beach, Kent Co. June 26 – Sep. 5. *Solidago* sp., *Spartina* sp.

Tribe Ceresini

- Hadrophallus borealis* (Fairmaire). Newark, New Castle Co. May 24 – Aug. 3. *Ambrosia artemisiifolia*, *Liquidambar styraciflua*, *Malus* sp., *Morus* sp., *Solidago* sp. Museum specimens: Newark, New Castle Co., Aug.
- * *Stictocephala bisonia* Kopp and Yonke. Newark, New Castle Co. July 21 – Aug. 29. *Arctium minus*, *Asclepius syriaca*, *Glycine max*, *Solidago* sp. Museum specimens: Camden, Sep., Nov., and Dover, Aug., both Kent Co.; Newark, July and October.
- S. brevitylus* (Van Duzee). Newark, New Castle Co. Apr. 29 – June 20. *Liriodendron tulipifera*, *Quercus bicolor*, *Q. borealis*, *Sambucus canadensis*, *Smilacina racemosa*, *Solidago* sp.
- * *S. diceros* (Say). Newark, New Castle Co. July 23 – Aug. 12. *Arctium minus*, *Sambucus canadensis*. Museum specimens: Odessa, New Castle Co., July.
- * *S. lutea* (Walker). Newark, June 4-18. Museum specimens: Newark, New Castle Co., July and Nov.
- * *S. taurina* (Fitch). Newark and Claymont, New Castle Co. July 27 – Oct. 12. *Liquidambar styraciflua*.
- * *Tortistilus inermis* (Fitch). Museum specimen: "Dunraven", DE, July, 1961.

- * state records

Tribe Polyglyptini

- Entylia bactriana* Germar. Museum specimens: Wilmington, New Castle Co., Aug. and Sep.
- * *E. carinata* (Forster). Newark and Wilmington, New Castle Co. May 26 – Oct. 23. *Ambrosia artemisiifolia*, *Arctium minus*, *Cirsium pumilum*, *Prunus serotina*. Nymphs collected June 19 – July 19 from *C. pumilum*. Eggs present in ventral midrib of leaves of *C. pumilum* were collected June 2 – July 14. Females seen "brooding" eggs and nymphs on *C. pumilum*. Two egg masses had 101 and 76 eggs, respectively. Ant attendance seen for nymphs and adults. Museum specimens: Dover, Kent Co., Aug.; Yorklyn, New Castle Co., May and Sep.; Bridgeville, Sussex Co., Aug.
- E. sinuata* (F.). Museum specimen: Newport, New Castle Co. July 24, 1951.
- * *Publilia reticulata* Van Duzee. Newark and Hockessin, New Castle Co. June 5-29.
- * *Vanduzeeea arquata* (Say). Newark, New Castle Co. June 10 – Nov. 12. *Robinia pseudoacacia*. Nymphs collected May 26 – Aug. 8. Ant attendance seen for nymphs and adults. Museum specimens: New Castle Co., Sep.

Tribe Smiliini

- * *Aymna castancae* (Fitch). Newark, New Castle Co. June 26 – July 27.
- * *A. querci* (Fitch). Newark. May 29 – July 4. *Quercus borealis*, *Q. velutina*, *Rhus radicans*, *R. typhina*. Museum specimens: Dover, Kent Co., July.
- * *Cyrtolobus arcuatus* (Emmons). Newark, New Castle Co. June 19.
- * *C. aureoreus* Woodruff. Newark, New Castle Co.; Redden State Forest and Georgetown, Sussex Co. May 28 – July 6. *Quercus alba*, *Q. borealis*, *Q. nigra*, *Q. phellos*.
- * *C. discoidalis* (Emmons). Newark, New Castle, and Blackbird State Forest, New Castle Co.; Millsboro, Sussex Co. June 1-19. *Quercus alba*, *Q. Nigra*, *Q. Palustris*, *Q. Prinus*, *Q. velutina*. Museum specimen: "Gatesburg", DE, June, 1893.
- * *C. dixianus* Woodruff. Newark, New Castle Co.; Georgetown, Sussex Co. May 7 – July 5. *Liquidambar styraciflua*, *Quercus bicolor*, *Q. borealis*, *Q. prinus*, *Q. velutina*. Mating pairs observed on *Q. bicolor* June 7 and 10; copulation lasted more than 10 h for one pair.
- C. fuliginosus* (Emmons). Newark, New Castle Co.; Georgetown, Sussex Co. May 29 – Sep. 22. *Quercus borealis*.
- * *C. funkhouseri* Woodruff. Newark, New Castle Co.; Redden State Forest, Sussex Co. June 12-15. *Quercus phellos*.
- * *C. fuscipennis* Van Duzee. Newark, New Castle Co. June 1 – July 13. *Quercus alba*, *Q. borealis*.
- * *C. inermis* (Emmons). Newark, New Castle Co.; Redden State Forest, Sussex Co. June 15. *Carya glabra*.
- * *C. maculifrons* (Emmons). Newark, New Castle Co. June 4-22. *Quercus nigra*.
- * *C. ovatus* Van Duzee. Newark, New Castle Co.; Georgetown, Sussex Co. May 29 – July 12. *Quercus borealis*, *Q. nigra*, *Q. velutina*.
- * *C. pallidifrons* (Emmons). Newark, New Castle Co.; Georgetown, Sussex Co. May 29 – July 13. *Quercus alba*, *Q. bicolor*, *Q. borealis*, *Q. velutina*, *Q. lyrata*.
- * *C. pulchellus* Woodruff. Newark, New Castle Co. June 1-10. *Quercus alba*.
- C. puritanus* Woodruff. Newark, New Castle Co. June 15. *Quercus alba*.
- * *C. tuberosus* (Fairmaire). Newark and New Castle, New Castle Co. May 16 – July 19. *Liriodendron tulipifera*, *Quercus alba*, *Q. bicolor*, *Q. borealis*, *Q. velutina*. Mating pair collected from *Q. bicolor* May 28.
- * *C. vau* (Say). Newark and Blackbird State Forest, New Castle Co.; Dover, Kent Co.; Georgetown and Redden State Forest, Sussex Co. May 25 – July 28. *Quercus alba*, *Q. borealis*, *Q. marilandica*, *Q. phellos*.

- Ophiderma definita* Woodruff. Newark, New Castle Co. June 14 – July 19. *Quercus alba*, *Q. borealis*.
- * *O. evelyna* Woodruff. Newark, New Castle Co.; Bridgeville, Millsboro and Rehoboth Beach, Sussex Co. June 5-6. *Quercus borealis*, *Q. marilandica*. On June 6, 1979, 101 males and no females were taken in a black-light trap at Rehoboth Beach.
- * *O. Flava* Goding. Newark, New Castle Co. May 28 – Aug. 28. *Quercus alba*, *Q. velutina*, *Rhus radicans*.
- * *O. flavicephala* Goding. Newark, New Castle Co.; Redden State Forest, Sussex Co. May 25 – June 24. *Quercus alba*, *Q. borealis*, *Q. nigra*, *Q. phellos*. Museum specimens: Newark, New Castle Co., June.
- O. pubescens* (Emmons). Newark, New Castle Co.; Georgetown, Sussex Co. June 1 – July 10. *Quercus borealis*, *Q. velutina*.
- O. salamandra* Fairmaire. Kopp and Yonke (1973c).
- * *Smilia camelus* (F.). Newark, New Castle Co.; Redden State Forest, Sussex Co. May 25 – July 10. *Quercus alba*, *Q. borealis*, *Q. marilandica*, *Q. phellos*, *Q. velutina*.
- Xantholobus intermedius* (Emmons). Newark, New Castle Co. July 5.
- * *X. lateralis* Van Duzee. Newark, New Castle Co. May 25 – June 4. *Quercus bicolor*, *Q. borealis*, *Q. velutina*.
- * *X. muticus* (F.). Newark, New Castle Co. May 22 – July 4. *Quercus borealis*, *Q. velutina*. A female was observed ovipositing June 19 at 1645 hr. on *Q. borealis*.

Tribe Telamonini

- * *Archasia belfragei* Stal. Newark, New Castle Co. June 10 – July 13. *Quercus alba*, *Q. borealis*, *Q. phellos*.
- * *Carynota mera* (Say). Newark, New Castle Co. Aug. 2-29.
- * *Glossonotus acuminatus* (F.). Newark, New Castle Co.; Georgetown, Sussex Co. June 5 – Sep. 14. *Quercus alba*, *Q. bicolor*, *Q. palustris*.
- * *G. crataegi* (Fitch). Newark and Hockessin, New Castle Co. July 5-19. *Fagus grandifolia*.
- * *Heliria cristata* (Fairmaire). Newark, New Castle Co. June 20.
- * *H. molaris* (Butler). Newark, New Castle Co. June 12 – Oct. 1. *Quercus alba*, *Q. bicolor*, *Q. velutina*. Fifth instar molting nymph was collected from *Q. bicolor* June 1.
- * *Helonica excelsa* (Fairmaire). Newark, New Castle Co. June 12 – Aug. 17. *Quercus alba*, *Q. palustris*.
- * *Telamona ampelopsidis* (Harris). Newark, New Castle Co. June 26 – Aug. 17.
- * *T. collina* (Walker). Newark, New Castle Co. Sept. 21.
- * *T. decorata* Ball. Newark, New Castle Co.; Georgetown, Sussex Co. June 12 – Sep. 24. *Quercus bicolor*, *Q. phellos*. Fifth instar nymph observed molting on *Q. bicolor* 2nd week of June.
- * *T. extrema* Ball. Newark, New Castle Co.; Atlanta and Georgetown, Sussex Co. June 15 – Aug. 25. *Quercus phellos*.
- T. monticola* (F.). Newark, New Castle Co. June 4 – Sep. 15. *Quercus bicolor*, *Q. borealis*, *Q. phellos*, *Q. velutina*. Nymphs collected from *Q. bicolor* and *Q. borealis* Apr. 30 – June 7.
- * *T. tiliae* Ball. Newark, New Castle Co. June 13 – Aug. 2. *Liquidambar styraciflua*, *Quercus borealis*. Nymphs collected from *Q. borealis* June 13.
- * *T. unicolor* Fitch. Newark, New Castle Co. June 6 – Aug. 17. *Carya glabra*. Two ant attended fifth instar nymphs were collected the 3rd week of May.
- * *T. westcotti* Goding. Newark, New Castle Co. July 27.
- Thelia bimaculata* (F.). Newark and Hockessin, New Castle Co. July 7 – Aug. 6. *Robinia pseudoacacia*, *Fagus grandifolia*. Museum specimens: New Castle Co., June, Aug., Oct.

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The following are Univ. of California Publications in Entomology, Univ. of Calif. Press, Berkeley:

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REVIEW OF NORTH AMERICAN *EXOMALOPSIS* (HYMENOPTERA: ANTHOPHORIDAE) Parts I - IV (subgenera *Anthophorula*, *Anthophorisca*, *Phanomalopsis*, *Megomalopsis*, *Panomalopsis* & *Exomalopsis*). P.H. Timberlake. 1980. Vol. 86. 158 pp. 257 figs. \$17.00.

(Continued on page 47)

TWO RARE SPECIES OF EPHEMEROPTERA IN THE LOWER MISSISSIPPI RIVER^{1,2}

Larry G. Sanders,³ C. Rex Bingham³

During a research effort on the lower Mississippi River from Lake Providence, Louisiana (river mile 480) upstream to Greenville, Mississippi, river mile 530, the following records of rare mayflies were obtained. Specimens have been deposited in the collection of Dr. G. F. Edmunds, Jr., University of Utah.

Spinadis Edmunds and Jensen

In June 1978, a single *Spinadis* nymph was collected in a 500-micron mesh plankton net drifting at 2400 hrs during a diel sampling effort on the lower Mississippi River at river mile 529. Previous distributional records were from Georgia, Indiana, and Wisconsin. It is not certain whether the known records represent more than one species. The type locality is Georgia and based on distribution patterns of other mayfly species, it is likely that the specimen represents *S. wallacei* (Edmunds, personal communication). Stage of maturity of the specimen agrees with predicted emergence in late June or early July (Edmunds et al, 1976).

Pseudiron McDunnough

On 17 May 1978 two *Pseudiron* sp. nymphs poss. *centralis* were collected in a shipek grab sample at a depth of 9 meters in a dike field at river mile 515. *Pseudiron* sp. was previously recorded from Central Mississippi (LeFlore County) by Berner in 1977. (Berner, 1977). Concomitant water chemistry data were as follows: temperature 18.0 °C, dissolved oxygen 8.1 mg/l, specific conductivity 395 mhos, and pH 7.6. Sediment type was coarse sand.

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A NEW SPECIES OF *JANETSCHEKBRYA* FROM COSTA RICA (COLLEMBOLA: ENTOMOBRYIDAE)¹

Richard J. Snider^{2, 3}

ABSTRACT: A new species, *Janetschekbrya matthewsi* Snider, is described from Costa Rica. This is the first record of the genus for Central America. The species may be allied with *J. arida* Christiansen and Bellinger, but can be separated on the basis of color pattern, labral papillae, claw and dorsal chaetotaxy. The type locality is Llorona, Parque Nacional Corcovado, collected from the nests of *Microstigmus* sp. (Sphecidae).

Recently, a colleague, Dr. Robert W. Matthews, collected the nests of sphecid wasps in Costa Rica. Among the prey stored in them, as larval food, were six species of Collembola. Included in the samples was a new species of *Janetschekbrya*. This constitutes a new record for the genus in Central America. The type and paratype series will be deposited in the Entomology Museum, Michigan State University.

Janetschekbrya matthewsi, n. sp.

Color and pattern. Background pale yellow to cream. Purple pigment as follows: first antennal segment without purple pigment, segments two to four with light dusting, distally each segment darker; postero-lateral edge of abdominal segment III sometimes with a small, single macula of pigment on each side; abdominal segment V with a single macule of pigment on antero-lateral margin; legs and furcula light yellow, without purple markings (Figs. 1 and 2).

Antennae. Longer than head; ratio of segments as 1 : 2 : 2 : 3 (Fig. 3); apical bulb of segment IV in a distinct pit, completely apical (Fig. 4), protective papillae absent; segment III with an apical pair of curved sensory papillae contained in shallow folds (Fig. 5); segment II with two to three outstanding setae located at midpoint of segment (Fig. 6), all other setae normal.

Head. Eyes 8 + 8 with dark pigment, ocellus H half the diameter of C (Fig. 7); mandible with molar plate and apical teeth; four spheroid labral papillae (Fig. 8); labial appendages normal (Fig. 9).

Body. Unguis curving, lanceolate, with a pair of lateral teeth, two small distal inner teeth, and basal outer tooth (Figs. 10 and 11); unguiculus obliquely truncate, untoothed, inner corner strongly pointed (Fig. 12); tenent hair longer than inner edge of unguis; pretarsi lack setulae. Trochanteral organ variable, usually with five apical setae, posterior external and internal setae variable (Fig. 13). Corpus of retinaculum with a single heavy seta, rami quadridentate (Fig. 14). Furcula reaching the ventral tube, manubrium to dens ratio 1:1.5; manubrium without ventral scales; dens normal, with ventral scales, with dorsal crenulations; mucro with

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anteapical tooth erect, basal spine strong, not reaching apex of anteapical tooth; distal ventral seta of dens reaching apex of mucro (Fig. 15).

Clothing. Head and trunk with hyaline, serrated scales three times as long as wide (Fig. 16). Body setae of type I, II, III, IV and V (Christiansen, 1958) (Fig. 17). Macrosetal pattern of abdominal segments III and IV as illustrated (Fig. 18). The specimens examined from the samples were in poor condition. They had been tightly packed into the burrows by the wasps, and lost much of their setae and scales when placed in collection fluid. At this time it is impractical to figure the entire setal configuration.

Remarks

According to Christiansen and Bellinger (in press), *Janetschekbrya* was erected by Yosii (1971) to include two species from the Himalayas. While the single Nearctic species, *J. arida* Christiansen and Bellinger (in press) shares similar morphological characters to Yosii's species, it differs by having scales ciliated for 1/5 to 1/3 their lengths. The Himalayan species on the other hand, are ciliated for most of their lengths. Further, *arida* exhibits a chaetotaxy very different from Yosii's description.

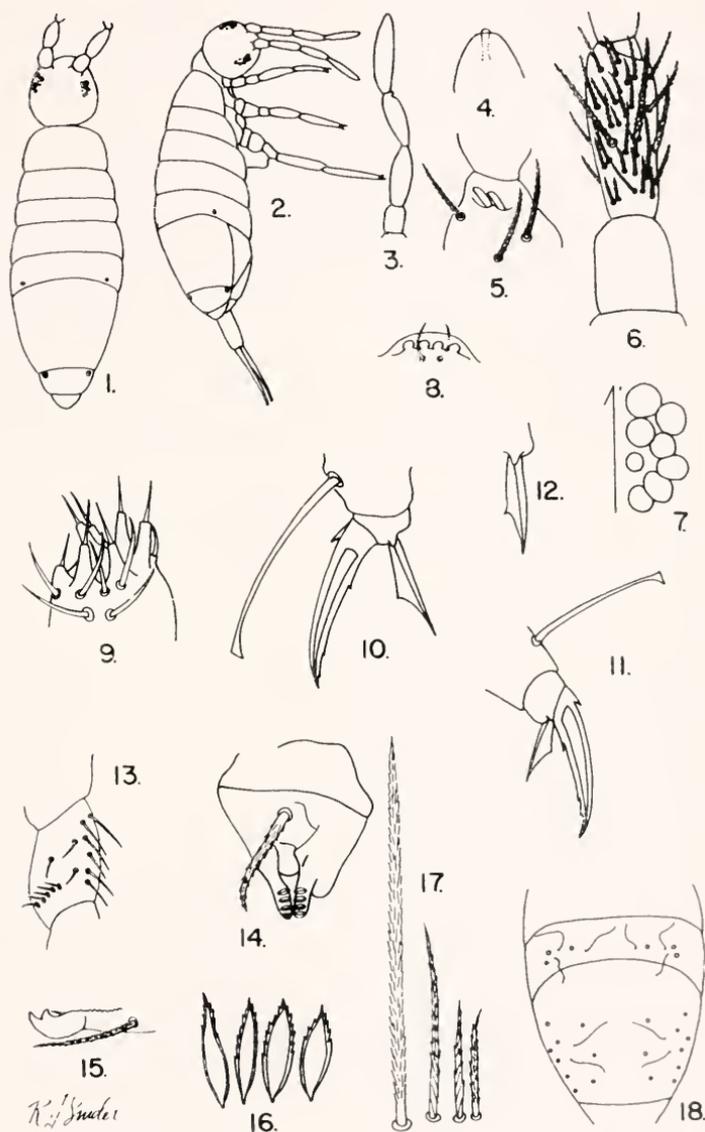
Here, *matthewsi* differs from *arida* in the following respects: labral papillae spheroid, not rectangular; external differentiated seta of the labial appendage normally tapered and curved instead of thicker than normal; unguis lacks lateral tooth; unguiculus without external ciliations, and is obliquely truncate, not lanceolate; chaetotaxy of third abdominal segment appears very different between the two species; and finally the restricted pigmentation of *matthewsi*.

While *matthewsi* does not exactly fit the genus as described by Yosii, I agree with Christiansen and Bellinger that the species can be placed in *Janetschekbrya* on the basis of scale form. Until additional species are discovered, it is desirable not to erect a new genus.

The specimens were taken as prey from the nests of *Microstigmus* sp. (Sphecidae) located in an uncut lowland forest. Collection record: Costa Rica, Puntaremas Province, Parque Nacional Corcovado, Peninsula de Osa, Llorona, January 4 - 13, 1980, R. W. and J. R. Matthews, collectors. One type on slide, five paratypes on slides, and 86 paratypes in alcohol.

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Figs. 1 - 18. *Janetschekbrya matthewsi* sp. Fig. 1 Dorsal view, 2. Lateral view (holotype), 3. Antennal segments, 4. Apical bulb of Ant. IV, 5. Sensory papillae of Ant. III, 6. Segment II of antenna, 7. Ocelli of right side, 8. Labral papillae (holotype), 9. Right labial appendage (holotype), 10. Claw of third leg (holotype), 11. Claw of first leg, 12. Unguiculus of second leg, 13. Trochanter of third leg (holotype), 14. Retinaculum, 15. Mucro, 16. Scales, 17. Body setae, 18. Macrochaetotaxy of Abd. III and IV.

NOTE ON COLLEMBOLA OF PEDREGAL DE SAN ANGEL, MEXICO, D.F.¹

Jose G. Palacios-Vargas²

ABSTRACT: Seventeen taxa of Collembola, representing fourteen genera, are cited for the first time from the Pedregal de San Angel. Thirteen of these species are new for Mexico, D.F. and twelve are recorded as new for the country.

RESUMEN: 17 taxa de Collembola, representando 14 géneros, son citados por vez primera del Pedregal de San Angel. 13 de estas especies son nuevas para México, D.F. y 12 son registradas como nuevas para el país.

Pedregal de San Angel is located in the Southwest region of the narrow Valley of México and is part of the Xochimilco and Chalco region. (Between 19° 14' and 19° 25' North latitude and 99° 08' and 99° 15' West).

The soil is mainly basaltic rock with an age of about 2500 years. The altitude in the northern part, where most of the samples were taken, is between 2250 and 2400 m. The climate (García, 1964) is Cw₂(w)b(i'), and is the most humid of the temperate subhumid climates, with its rainy season during the summer but less than 5% of the annual precipitation during the winter.

The summer is long and fresh with a monthly temperature average between 11.9°C in January and 17.5°C in June; rainfall ranges from 3.4 mm during February to 221.2 mm in July. The vegetation is a *Fruticetum* (Rzedowsky, 1954) with the dominant species, *Senecio praecox* (Compositae), flowering in September and October.

Some interesting papers have been written about the Pedregal de San Angel, such as that of Rzedowski (*op. cit.*) and Diego (1970) concerning the vegetation, and the works of Bravo (1975), Carbajal (1975), Lechuga (1971) and Serrano (1970), dealing with insects. There is one paper about the spiders (Ibarra, 1979) but none about the springtails.

Some articles concerning the Collembola from Distrito Federal, México, have been written (Bonet, 1942, 1944, 1945, 1947, Folsom, 1898; Handschin, 1928; Yosii, 1962) in which a total of 34 species have been cited. These are mainly from forests. Nothing has been said about those species occurring in the lava flows or on rocky ground.

During the past five years, some samples of litter and soil have been taken, along the basaltic zone, close to the university campus. The Collembola were identified by the author and determinations were checked

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by Dr. Peter F. Bellinger.

The following list is the result of our study. Most of the specimens are from the northern region of Pedregal de San Angel, except as otherwise noted.

Onychiuridae

Mesaphorura krausbaueri Borner, 1901. ex litter of *Eucalyptus* sp., 10-VII-77, J.G. Palacios col.

Onychiurus armatus (Tullberg) 1869. ex soil and litter, 15-VII-75, J. Llorente col. 12-XI-77, J.G. Palacios col.

Onychiurus cf. *folsomi* Schaeffer, 1900. ex pots from the greenhouse, 6-II-78, L.A. Hernandez col.

Hypogastruridae

Xenylla cf. *humicola* (Fabricius) 1780. ex litter of *Eucalyptus* sp., 10-VII-76, J.G. Palacios col.

Tomoceridae

Tomocerus flavescens (Tullberg) 1871 ex litter, 15-VII-75, J. Llorente col.

Isotomidae

Folsomides americanus Denis, 1931 ex litter of *Eucalyptus* sp., 10-VII-76, J.G. Palacios col.

Folsomides angularis (Axelson) 1905. ex litter, 21-VI-79, J.G. Palacios col.

Isotomurus sp. ex litter of *Eucalyptus*, 10-VII-76 and 14-XI-77 J.G. Palacios col.

Entomobryidae

Orchesella sp. nov. near *zebra* ex litter from the *Arboretum* and *Fruticetum*, 21-IV-79, J.G. Palacios col.

Entomobrya sp. ex bark of *Pinus* sp. from the *Arboretum*, 3-VII-76, P. Rojas col.

Entomobrya cf. *sinelloides* Christiansen, 1958. ex litter of *Eucalyptus*, 10-VII-76, J.G. Palacios col.

Pseudosinella sp. nov. near *sexoculata* ex litter of *Eucalyptus* sp., 10-VII-76, J.G. Palacios col.

Seira sp. ex soil, 21-VIII-76, G. Ibarra col

Janetschekbrya sp. Collected only in the *Arboretum* region, Contreras, D.F. ex decomposing trunks, decomposing *Yucca* sp., and bark of *Pinus* sp. 28-XI-76, J.G. Palacios col. 3 100 m msn.

Katiannidae

Arrhopalites sp. near *diversus*. from *Arboretum* region, Contreras, D.F. ex decomposing *Yucca* sp., 28-XI-76, J.G. Palacios col. 3 100 m snm.

Sminthuridae

Sminthurinus elegans (Fitch) 1863. ex litter of *Eucalyptus* sp., 10-VII-76. J.G. Palacios col.
Sphyrotheca sp. near *confusa*. ex litter of *Eucalyptus* sp., 10-VII-76. J.G. Palacios col.

The following species are new records for Distrito Federal: *Mesaphorura krausbaueri*, *Onychiurus armatus*, O. cf. *folsoni*, *Xenylla* cf. *humicola*, *Folsomides americanus*, *F. angularis*, *Entomobrya* cf. *sinelloides*, *Orchesella* sp. nov. near *zebra*, *Pseudosinella* sp. nov. near *sexoculata*, *Janetschekbrya* sp., *Arrhopalites* sp. near *diversus*, *Sminthurinus elegans* and *Sphyrotheca* sp. near *confusa*. Of them, only *M. krausbaueri* and *Janetschekbrya* sp., were previously cited for México. The description of the new species will be published in the future.

ACKNOWLEDGMENTS

The author wishes to express his gratitude to Dr. Peter F. Bellinger, California State University, Northridge, California for his help and advice.

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NEW GEOGRAPHICAL RECORDS FOR SOME FLEAS (SIPHONAPTERA) FROM THE BLACK HILLS OF SOUTH DAKOTA^{1,2}

Emmett R. Easton³

ABSTRACT: New state records for South Dakota and ecological data are presented for the flea species *Megabothris quirini* (Roth) and *Peromyscopsylla catatina* (Jordan). New county records are included for *Hystrihopsylla dippei* (Roth) and *Thrassis stanfordi* Wagner.

Our knowledge of ectoparasites in the Black Hills of South Dakota and Wyoming consists of fragmented records in the literature. Turner (1974) listed 11 species of fleas occurring there in his study of the mammals. The new records supplied here constitute a portion of a more comprehensive study (to be published) of fleas collected from live trapped small mammals during the years 1977, 1978, and 1979. All specimens are in the author's personal collection.

Megabothris quirini (Rothschild)

2♂♂, 17 June 1977, EE20a; 1♂, 18 June 1977, EE21; 5♀♀, 17 July 1977, EE35a; 2♀♀, 17 Sept. 1977, EE68; 1♀, 27 May 1978, EE87; 5♂♂, 3♀♀, 29 May 1978, EE95. Ex. *Zapus hudsonicus*, Spearfish Canyon, 9 miles south of Spearfish along Spearfish Creek, Lawrence County, South Dakota.

M. Quirini was only found on *Zapus* jumping mice in this area even though 12 species of small mammals were examined. According to Holland (1958) this is the only flea species found to regularly occur on *Zapus* and *Napaeozapus* mice, but Whitaker (1979) failed to mention *M. quirini* in his study of *Zapus* ectoparasites in North America. Holland (1949) listed other rodents as hosts such as *Clethrionomys*, *Microtus* and *Peromyscus* as well as the sciurids *Eutamias* and *Tamiasciurus*. The occurrence of *M. quirini* in Bottineau and Grand Forks Counties of central and eastern North Dakota (Woods & Larson, 1969) suggests that with further collecting it will probably be found more widespread in South Dakota.

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³Plant Science Department, South Dakota State University, Brookings, SD 57007.

Peromyscopsylla catatina (Jordan)

1♀, 18 July 1977, EE40; 1♂, 1♀, 30 July 1978, EE119; 1♀, 18 Sept. 1978, EE78. ex. *Microtus pennsylvanicus*, Spearfish Canyon, 9 miles south of Spearfish, Lawrence County, South Dakota.

A species believed to be confined to the eastern United States and Canada from *Microtus*, *Clethrionomys* and *Napaeozapus* mice (Holland, 1949). The occurrence of this species in the Black Hills of southeastern South Dakota is a definite western extension of its known range. The Black Hills, considered an isolated portion of the Rocky Mountains, contains fauna characteristic of the western United States, even though eastern forms regularly occur.

Thrassis stanfordi Wagner

6♂♂, 5♀♀, 5 May 1979, EE148. Ex. *Marmota flaviventris* 1 mile north of Deadwood; 1♀, 5 May 1979, EE 147, Ex. *Tamiasciurus hudsonicus*, 10 miles southeast of Pluma, Lawrence County, South Dakota.

In the western United States *T. stanfordi* is continuously distributed from Montana through eastern Wyoming and Utah and the western half of Colorado. According to Stark (1970) isolated pockets of this species are found in northern New Mexico and western South Dakota where *M. flaviventris*, its principle host also occurs in disjunct populations. The record of 11 fleas from Lawrence County in the northern Black Hills (this study) along with records from Custer County in the southern Black Hills (Stark op cit) provides evidence that *T. stanfordi* occurs throughout the range (even though isolated) of the yellow bellied marmot in South Dakota.

Hystrihopsylla dippiei spp. (Rothschild)

1♀, 18 Sept. 1977, EE734; 1♀, 5 May 1979, EE779; Spearfish Canyon, 9 miles south of Spearfish, Lawrence County. 1♂, 5♀♀, 13 Oct. 1979, EE228, Ex. *Peromyscus maniculatus*, Spearfish Canyon, 5 miles south of Spearfish, Lawrence County.

1♂, 17 June 1979, EE179, 1♀, 3 May 1980, EE244, Ex. *Microtus pennsylvanicus*, Spearfish Canyon, 5 miles south Spearfish; 1♀, 5 May 1979, EE 147 Ex. *Tamiasciurus hudsonicus* 10 miles south of Pluma, Lawrence County, South Dakota.

H. d. dippiei was earlier reported (1♀) from Custer County in the southern Black Hills by Holland (1957) even though female fleas in the genus *Hystrihopsylla* are difficult to specifically determine. The males of *H. dippiei* collected in this study are more closely related to *H. d. truncata*

as small tubercles are present on the inner angle of sternum IX, a character lacking in *H. d. dippiei* according to Holland.

ACKNOWLEDGEMENT

The author wishes to thank Dr. William L. Jellison (USPHS, retired, Hamilton, Montana) for the identification of *M. quirini* and to Dr. Omer R. Larson (Univ. of N. Dakota, Grand Forks) for the identity of the other species.

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BOOKS RECEIVED AND BRIEFLY NOTED

(Continued from page 37)

DISCRIMINATION OF GENERA OF EUPLECTINI OF NORTH & CENTRAL AMERICA (COLEOPTERA: PSELAPHIDAE). A.A. Grigarick & R.O. Schuster. 1980. Vol. 87. 56 pp. 79 pl. \$14.00.

BEHAVIOR & TAXONOMY OF THE *EPICAUTA MACULATA* GROUP (COLEOPTERA: MELOIDAE). J.D. Pinto. 1980. Vol. 89. 111 pp. 141 figs. \$12.00.

NESTING BIOLOGY & ASSOCIATES OF *MELITOMA* (HYMENOPTERA: ANTHOPHORIDAE). E.G. Linsley, J.W. MacSwain, C.D. Michener. 1980. Vol. 90. 45 pp. 8 figs. \$6.00.

ADULT & IMMATURE TABANIDAE (DIPTERA) OF CALIFORNIA. W.W. Middlekauff, R.S. Lane. 1980. Bull. of the Calif. Insect Survey, Vol. 22. Univ. of Calif. Press. Berkeley. 99 pp. 133 figs. \$10.50.

BOOK REVIEW

CALIFORNIA INSECTS: Jerry A. Powell and Charles L. Hogue, pages 1-388, 458 line drawings, 16 color plates. *California Natural History Guides: 44.* University of California Press, Berkeley. \$15.95.

The purpose of this book is to serve as a compact introduction to the identification and biology of the California insects. It is a small-sized book (20 cm x 12 cm) in soft-back, well bound and easily held in the hand. Its design is suitable for carrying in large pocket or rucksack. With more than 28,000 insect species estimated to be in California in a variety of habitats more diverse than encountered in many countries twice its size, the authors had a formidable task to accomplish.

The book begins with a very brief introduction concerning the physiology of insects and abruptly moves to a lengthy chapter on diversity and topography. A discussion of life zones is included with reasoning given why the authors prefer the scheme proposed by Alden Miller for birds. A map of California with the life zones outlined should prove interesting to most naturalists. There is a brief section listing 20 common microhabitats of insects. The next chapter is entitled "Structure and Classification" and contains a concise but better-than-average explanation of the binomial system of nomenclature. An innovative approach to structure follows with the orders listed phylogenetically with a small marginal drawing accompanying a synoptic description. At least 2 orders are covered in a single page. The audience to which the book is directed will not be overwhelmed by detailed morphology and terms but will learn enough to be able to identify insects in the following pages. The systematic treatment then follows. This consumes the bulk of the 388 pages of the book. Insects are treated order by order. Within each order there is a brief resume of the bionomics of the group and the major families with important species highlighted and illustrated and synoptically described. Each species is numbered and its number corresponds with that of its illustration. Some 600 species are treated in this way. Those selected were based on the kinds of insects most often brought in by the public to the Los Angeles County Museum (C.D. Hogue) or the species most often collected by students in field course of the Entomology Department, University of California, Berkeley (J. A. Powell). I can find no glaring omissions of common California insects. I think naturalists should be able to identify, at least to family, most of the common insects seen on the average outing.

My biggest criticism of the book concerns the line drawings of which over 450 are provided. As an example I cite those dealing with the Orthoptera. Figures 52, 58, 59 are drawn considerably out of proportion, the others less so. The head, pronotum and tip of abdomen of the creosote bush katydid, figure 39, are not accurately depicted. This may be the result of studying distorted pinned specimens. The ant cricket in figure 63 has the hind femur appearing to be attached to the tip of the abdomen. In contrast are the color photographs both on the front cover, and those bound together in the centre of the book. They are superb, those of the cover have exceptionally good color rendition.

The book concludes with a chapter "Learning more about insects", which contains useful lists of reference books and periodicals for those who want to extend their experiences with insects. There is a brief account concerning collecting and preserving insects. The book contains a glossary of terms and an index.

The authors have successfully accomplished their goal. Not only will the book appeal to naturalists but old-hand Californian entomologists will find it difficult to put the book down because of the interesting ecological and factual statements made about so many species familiar to them. It will serve as a handy reference in office or field. The human population of California being what it is and the great interest in the out-of-doors held by most of its residents guarantee good sales for this book. Fortunately, it is one worthy of such acclaim.

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NEW RECORDS OF MOSQUITOES (DIPTERA: CULICIDAE) FROM NEW HAMPSHIRE^{1, 2}

John F. Burger³

ABSTRACT: Four species of mosquitoes, *Aedes dorsalis*, *Ae. taeniorhynchus*, *Culiseta minnesotae* and *Orthopodomyia signifera* are reported from New Hampshire for the first time.

Until 1975, mosquitoes in New Hampshire were relatively little-studied. Lowry (1929) reviewed the habits, distribution and general economic importance of mosquitoes in the state. Blickle (1952) reviewed the distribution of all species then known to occur in New Hampshire, stating that 37 species were known to be present.

Extensive mosquito surveys since 1975 in southeastern New Hampshire by Jonathan Tucker, Betsy Whalen and the author resulted in the discovery of 4 species not previously recorded from the state: *Aedes dorsalis* (Meigen), *Ae. taeniorhynchus* (Wiedemann), *Culiseta minnesotae*⁴ Barr and *Orthopodomyia signifera* (Coquillett). Determinations were confirmed by the author.

Five females of *Aedes dorsalis* were collected from Rockingham County in 1977 from CO₂-baited CDC light traps. Two females were collected in North Hampton on 19 May, 1 female from Hampton Falls on 6 October and 2 females were collected from Seabrook on 19 July.

Six females of *Aedes taeniorhynchus* were collected from Rockingham County in 1977 in CO₂-baited CDC light traps, 2 from North Hampton on 14 July, 2 from Seabrook on 19 July, 1 from Rye on 11 August and 1 from Greenland on 18 August. One female voucher specimen has been deposited in the University of New Hampshire collection.

Three females and 18 larvae of *Culiseta minnesotae* were collected from Rockingham County in 1977. One female each was collected from a CO₂-baited light trap in Londonderry on 22 July, Hampton on 28 July and

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⁴*Cs. minnesotae* is listed as a subspecies of *Cs. silvestris* (Shingarev) by Knight and Stone (1977), but Wood et al. (1979), following recent Russian workers, stated that the name *silvestris* was unrecognizable. Until the status of the name is clarified, *minnesotae* is retained as a distinct species.

Newton on 4 August. Larvae were collected from Kingston (1) on 6 June, Chester (1) on 22 June, Fremont (2) on 29 June, Epping (5) on 26 July, Deerfield on 18 August (7), 1 September (1) and 16 September (1). All larvae were collected along the margins of freshwater cattail swamps created by beavers.

Fourteen females of the tree hole-breeding species, *Orthopodomyia signifera* were collected in Rockingham County in 1976 and 1977. All were collected in CO₂-baited CDC light traps. Seven females were collected in Epping, on 7 July 1976 (1) and 6 September 1977 (6), 1 female from Stratham on 4 August 1977, 1 female from Hampton Falls and 5 females from East Kingston on 1 September 1977. One female voucher specimen has been deposited in the University of New Hampshire collection.

The above new state records increases the number of mosquito species known to occur in New Hampshire to 43 in 8 genera.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

c/o BRITISH MUSEUM (NATURAL HISTORY) CROMWELL ROAD, LONDON, SW7 5BD

15 December, 1980

ITZN 59

The following Opinions have been published recently by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature*, Volume 37, part 4, 15 December, 1980.

Opinion No.

1160 (p. 216) *Tipula oleracea* Linnaeus, 1758 and related species (Insecta, Diptera): stabilisation by the use of the plenary powers.

1161 (p. 221) *Chaitophorus* C.L. Koch, 1854 (Insecta, Hemiptera): designation of a type species by use of the plenary powers.

The Commission regrets that it cannot supply separates of Opinions.

R.V. Melville, *Secretary*

The Entomologist's Record

To encourage the publication of concise and useful new distribution records, corrections of previously published erroneous records, misidentifications, short field notes, and current news items about Entomologists, amateur and professional, Entomology Departments and Museums, prompt publication is offered in this Department.

AMNESTUS RADIALIS FROESCHNER, 1960, SENIOR SYNONYM OF *A. SEXDENTATUS* FROESCHNER, 1960 (HEMIPTERA: CYDNIDAE)¹

Richard C. Froeschner²

In 1960 I described [Proc. U.S. National Museum, 111(3430)] two species of *Amnestus* separated by a character whose validity I questioned. Each was described from a single specimen: *Amnestus radialis* (ibid, p. 656) from a male from Martinique, W.I., and *A. sexdentatus* (ibid p. 657) from a female from Puerto Rico. The questionable character was the presence of six pegs (instead of the four regularly found in the genus) on the apex of the clypeus of the female. Now available is a series of 10 specimens from Puerto Rico associating females and males of one species. The males clearly represent *A. radialis* and the females have the usual four apical pegs on the clypeus. The facts that these females are definitely associated with males of *A. radialis*, are from the type island of Puerto Rico, have the normal number of four apical pegs on the clypeus, and are in no other way separable from *A. sexdentatus* convince me that my earlier suspicion of a developmental anomaly producing the two extra apical clypeal pegs was correct and that *A. sexdentatus* must be reduced to a junior synonym of *A. radialis*, new synonymy.

¹Received October 2, 1980.

²Department of Entomology, Stop 127, Smithsonian Institution, Washington, D.C., 20560.

BOOKS RECEIVED AND BRIEFLY NOTED

THE BUTTERFLIES OF OREGON. Ernest J. Dornfeld. 1980. Timber Press, P.O. Box 92, Forest Grove, Oregon 97116. 276 pp, 4 color pl, 48 bl. & wh. pl, 192 distrib. maps, 8¹/₂ x 11 format.

A comprehensive presentation and systematic account of all the known butterflies in Oregon, together with important introductory material on Oregon type localities, Oregon's physiography and butterfly distribution, and biology of butterflies.

THE WORLD OF THE TENT-MAKERS: A NATURAL HISTORY OF THE EASTERN TENT CATERPILLAR. V.G. Dethier. 1980. Univ. of Massachusetts Press, Amherst. 148 pp. \$12.50 cloth. \$5.95 paper.

Written in narrative style, this book explores the life cycle of a colony of eastern tent caterpillars and traces this insect's special life history within the total context of nature. The author follows the tent-makers through the seasons, looking at the problems of surviving temperature fluctuations, growth & development, synchronizing biological clocks, measuring time, navigating, following trails, and air conditioning, among other aspects of the tent caterpillar's life.

INSECT WORLDS. L.J. & M. Milne. 1980. Chas. Scribner's Sons, N.Y. 274 pp. \$12.95.

Beginning with a general description of insects, the authors cover such subjects as how insects make the most of their environment, information on their hunting habits, how they have managed to survive, their messages to find mates, and how their heritage is extended by parental care and social interaction. As the subtitle, *A Guide for Man on Making the Most of the Environment* implies, the authors also try to show that lessons can be learned by man from the ecological story of insects.

ARANEISM, WITH SPECIAL REFERENCE TO EUROPE. Z. Maratic & D. Lebez. 1979. Nolit Publ. House, Yugoslavia. Available through National Technical Information Service, PB 80-141104. 255 pp. \$15.00 U.S.A.; \$30.00 outside U.S.

A review of the natural history of spiders, especially of Europe, the anatomy of their venom apparatus, the nature of their venom, the clinical problem of spider venom poisoning, and the uses of spider venoms in medicine and biology.

INSECT PHOTOPERIODISM. 2nd ed. Stanley D. Beck. 1980. Academic Press, N.Y. 387 pp.

This text presents technical reviews of major aspects of the responses of insects to natural and experimental cycles of light and dark. Also discussed are daily rhythmic behaviors such as locomotion, feeding, mating and reproduction; circadian functions seen in the timing of developmental events and physiological circadian rhythms in metabolism, detoxification, neural and sensory functions, and hormonal functions.

ANIMAL IDENTIFICATION, A REFERENCE GUIDE. Vol. 3: INSECTS. D. Hollis, ed. 1980. British Museum (Natural History), London, & John Wiley & Sons, N.Y. 160 pp. \$36.50.

The main objective of this volume is to provide a list of primary references which will enable non-specialists to set about identifying insects from any part of the world.

ENTOMOLOGY. Cedric Gillott. 1980. Plenum Press, N.Y. 729 pp. \$49.50.

An entirely new textbook intended for senior undergraduates with an elementary knowledge of insects from general zoology but taking their first course in entomology. This text represents a departure from the traditional taxonomic approach to what the author believes is a more balanced treatment of the subject. Thus, although some time is devoted to taxonomy and identification, appropriate time is also given to discussions on evolution, development, physiology, and ecology of insects. Included in the latter category are the interactions between insects and man, stressing that these interactions follow normal ecological principles.

When submitting papers, all authors are requested to (1) provide the names of two qualified individuals who have critically reviewed the manuscript *before* it is submitted and (2) submit the names and addresses of two qualified authorities in the subject field to whom the manuscript can be referred by the editor for final review. All papers are submitted to recognized authorities for final review before acceptance.

Titles should be carefully composed to reflect the true contents of the article, and be kept as brief as possible. Classification as to order and family should be included in the title, except where not pertinent. Following the title there should be a short informative abstract (not a descriptive abstract) of not over 150 words. The abstract is the key to how an article is cited in abstracting journals and should be carefully written. The author's complete mailing address, including zip code number, should be given as a footnote to the article. All papers describing new taxa should include enough information to make them useful to the nonspecialist. Generally this requires a key and a short review or discussion of the group, plus references to existing revisions or monographs. Illustrations nearly always are needed. All measurements shall be given using the metric system or, if in the standard system, comparable equivalent metric values shall be included. Authors can be very helpful by indicating, in pencil in the margin of the manuscript, approximate desired locations within the text of accompanying figures, tables and other illustrations.

Illustrations: For maximum size and definition, *full page figures, including legends*, should be submitted as nearly as possible in a proportion of 4/6. Maximum size of printed illustration, including all legends, is 4½ x 6½ inches. Authors will be charged for all text figures and half-tones at the rate of \$6.00 each, regardless of size.

Books for review and book publication announcements should be sent to the editor, Howard P. Boyd. For address, see under "manuscripts" above. Literature notices, books received and short reviews will be published in The Entomologist's Library on books dealing with taxonomy, systematics, morphology, physiology ecology, behavior and similar aspects of insect life and related arthropods. Books on applied, economic and regulatory entomology, on toxicology and related subjects will not be considered.

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Advertisements of goods or services for sale are accepted at \$1.00 per line, payable in advance to the editor. Notices of wants and exchanges not exceeding three lines are free to subscribers. Positions open, and position wanted notices are included here and may be referred to by box numbers. All insertions are continued from month to month, the new ones are added at the end of the column, and, when necessary, the older ones at the top are discontinued.

Wanted. Adult specimens of worldwide, including U.S., Lucanidae, Carabidae, Cicindelidae, Coccinellidae, Scarabaeidae, Cerambycidae, Burprestidae, and Elateridae. State condition, variety, and price A.I.B., Spencer, 20 W. Virginia Ave., West Chester, PA. 19380.

For Sale: Lepidoptera livestock for private rearers and scientific study. Species for this fall include *Citheronia regalis* and *Antheraea pernyi* and many more. Write for prices. Brett Barrett, P.O. Box 107, Alvaton, Ky. 42122.

Butterflies for sale or exchange. Over 1200 species from Burma, Thailand, Malaysia, Laos, Ceylon, Indonesia, Sumatra and Borneo. Write to Sim Yam Seng, 21 Joon Hiang Road, Singapore 19.

Wanted: *Entomological News*, Vol. 45, No. 7 and Vol. 47, Nos. 1-8, or all of each volume. J.F. Schesser, Jr., RR 1, Box 15, Horton, Kansas 66439.

Books for Sale: ROMANOFF, N.M. *Memoires sur les Lepidopteres*, vol. 1-7 and 9, with 61 plain and 69 colored plates and 3 maps. Recent H. calf. The rarest work in modern literature of Lepidoptera, including contributions on Asian Lepidoptera by Romanoff, Grum-Grzhimailo, Staudinger, Christoph, Snellen, Heylarts, and others. Robert Fagen, R.D. #1 Box 24, Glen Mills, Pa. 19342 USA.

NEWSLETTER: Women in entomology/ideas, concerns, activities/send notes for inclusion, name and address for mailing list/\$1 to defray production June '81 (1) and Jan. '82 (2) issues welcome/Dr. Diane M. Calabrese, Dep't. Biol., Trinity College, Washington, D.C. 20017.

ENTOMOLOGICAL NEWS

- Commentaries in Cultural Entomology
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(Continued on inside of back cover)

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COMMENTARIES IN CULTURAL ENTOMOLOGY

2. THE MYTH OF THE LOUSE LINE

Charles L. Hogue¹

ABSTRACT: The 16th Century Spanish colonial chroniclers las Casas and Oviedo relate the curious departure and return of lice from voyagers to and from the New World. A supposed line of longitude, approximately 100 leagues west of the Azores, marked the place of occurrence of the phenomenon. The idea shortly became obscure and is apparently only a myth.

Afflictions and discomforts universally met European travelers and mariners bound for the New World in the 16th century. With all the tribulations of the journey to bear, it may have been a consolation for some to believe that, during the voyage, they would escape their usual body lice and be freed from the bites of fleas. That this could happen was assured them by two of the earliest chroniclers of natural history in the West Indies, who vouched that these insects miraculously and mercifully disappeared from westbound ships reaching a hundred leagues beyond the Azores. Conversely, these same parasites emerged from hiding in great numbers on the eastbound passage at precisely the same meridian.

Writing from the West Indies where he served as missionary and apostle to the Indians from 1500 to 1547, Fr. Bartolomé de las Casas described the phenomenon in these words:

... for the trip to these Indies we see a singular and notable thing: that up to the Canaries and a hundred leagues this side, or in the vicinity of the Azores, many lice breed, but from there to here they all begin to die and upon arriving at the first islands, there is no man breeding a single one; on the return to Castile all the ships and the people proceed clean of these creatures until arriving at said limit; from there onward, as if lying in wait, they return in great and bothersome numbers. (1)

Gonsalo Fernández de Oviedo, contemporary and adversary of las Casas and official historian of the period in the Spanish colonies, related the same story, and more sharply delineated the zone of decontamination:

... for after passing by the meridian where the compass needle indicates the change of the southwesterlies to the northeasterlies, which is in the vicinity of the Azores, and travelling on a short distance in the course of our voyage on the westwind, all the lice borne by Christians and breeding on their heads and bodies die and disappear . . . and it

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is notable also how Christian men, clean in head and body from this filthiness in the Indies, when returning to Europe and again arriving at the same place in the ocean where the plague ceased before, suddenly, as if the lice were lying in wait for them, are re-afflicted and not able to be free of them even though they change their shirts two or three times a day . . . This I have well verified, having made the trip four times myself. (2)

That these anecdotes were more than sea stories and with whom they actually originated is not known. The idea seems to have lost credence following its first accounting, since there appear to be almost no published verifications from the hundreds of subsequent sailing voyages made by other writers, historians and naturalists. Only a passage in a footnote in Sir Francis Drake's narrative of his circumnavigation of the world (1577-9), raises the issue again and provides us a clue as to how the myth of the "louse line" may have started:

Where unto also let me putt the third, a thing worthy the noting, that in our passing from our country, being winter, lice increased infinitely on the cloathes of our men, and were a great plague to many; but no sooner were wee com within the burning zone, but they all dyed and consumed away of themselves, so that till wee came beyond the southerly tropic to Braesilia, there was not to be found one among us. (3)

The louse (*Pediculus humanus*) is extremely susceptible to increases in temperature over the optimum provided by the normal heat of the human body. It is conceivable that the clothing and supradermal temperatures of voyagers to the tropics might easily rise above normal body temperature a critical 4 degrees F (2.2 degrees C) (4) and cause the demise of these ectoparasites. Clothing may have been shed also, reducing suitable habitat, the overall result being decrease in the louse population. That this would take place at a precise longitude, however, is fantasy.

Since the time of Drake, the myth seems to have eluded almost all further attention except for brief, relatively modern references in entomological works, all traceable to Oviedo's account (5,6,7). The treatment by las Casas appears to have escaped notice by entomologists, although it is well known to historians (8). We do not know if the original "observations" by las Casas and Oviedo were, in fact, independent and original. Both may have been repeating a sailor's tale, although both claim to be relating personal experience.

Another delightful, though oblique, literary allusion to the "louse line" occurs in Cervantes' famous novel, *Don Quixote*. During their ill-fated adventure on the "enchanted bark," when Sancho Panza asks how close they had come to the Equator, the errant knight replies:

The Spaniards, said he, and all those that Embark at Cadiz for the East-Indies, to know whether they have pass'd the Equinoctial-Line, according to an Observation that has been often experienc'd, need do no more than look whether there be any Lice left alive

among the Ship's Crew: for if they have pass'd it, not a Louse is to be found in the Ship, though they would give his weight in Gold for him.(9)

A final irresistible reflection on the myth derives from the fact that the place of parting between louse and man corresponded approximately to the first line of demarcation drawn through the Atlantic Ocean to separate the territorial claims of Spain (to the west) and Portugal (to the east). The particular meridian was suggested by Columbus and granted to the kings of the two countries in a Papal Bull dated 4 May 1493. Was the famous navigator really the first to discover the "louse line" and, owing his allegiance to Ferdinand and Isabella, to make sure that competing Portugal got the lousy side of the world?

ACKNOWLEDGMENT

I wish to acknowledge the assistance with historical sources kindly extended to me by Drs. Harry Kelsey and Janet Fireman of the Anthropology and History Division, Natural History Museum, Los Angeles County.

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- (8) Samuel Eliot Morison, *The European Discovery of America, The Southern Voyages A.D. 1492-1616* (New York, 1974), pp. 97-98.
- (9) Miguel de Cervantes Saavdra, *El ingenioso hildago don Quijote de la Mancha*, Part 2 (Madrid, 1615) — Original source in Castillian. Author's quote from Random House Modern Library College English edition (New York, 1950), pp. 633-634.

*The format use in the literature citations above is consistent with the historical nature of this paper — Ed.

RECORDS OF KENTUCKY TABANIDAE (DIPTERA) INCLUDING SPECIES NEW TO THE STATE FAUNA¹

Alta M. Burnett, Charles V. Covell, Jr., L.L. Pechuman²

ABSTRACT: Collecting data are reported for 28 species of Tabanidae from Kentucky, including 6 new state records which increase the known state tabanid fauna to 60 species.

A revised annotated checklist of 54 species of Tabanidae from Kentucky, including 13 new state records, was published recently (Burnett *et al.* 1978). The following information is an addendum to that list and includes six new state records. With one exception which is noted, all of the county records reported here are new. New seasonal records for those previously reported species which are listed here are italicized. The name of the collector when known concludes each entry.

The records presented here are based upon specimens in the University of Louisville, the Illinois Natural History Survey and the University of Kentucky collections.

Again the arrangement of genera and species follows that of Philip *in* Stone *et al.* (1965). Thus species are listed alphabetically within each genus, not in any presumed phylogenetic order.

SUBFAMILY CHRYSOPINAE

Genus *Chrysops* Meigen

Chrysops callidus Osten Sacken. Ballard Co., 3 km NW of Barlow, 27 July 1978, D.W. Webb; Edmonson Co., Bylew Creek, 5 mi NE of Brownsville, 28-30 May 1978, E.A. Lisowski; Hart Co., Munfordville, 14 May 1979, E.A. Lisowski; Warren Co., 1 mi SE of Anna, 27 May 1979, E.A. Lisowski. The county listed for the Lake Sympton entry in our initial paper was in error. The entry stands corrected as follows: Nelson Co., vic. Lake Sympton, 7 July 1972, C.V. Covell, Jr.

Chrysops calvus Pechuman and Teskey. NEW STATE RECORD. Edmonson Co., Bylew Creek, 5 mi NE of Brownsville, 28-30 May 1978, E.A. Lisowski.

Chrysops cincticornis Walker. NEW STATE RECORD. Hart Co., Munfordville, 14 May 1979, E.A. Lisowski.

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Chrysops flavidus Wiedemann. Christian Co., Pennyrile Forest State Resort Park, 18 June 1979, C.C. Cornett.

Chrysops impunctus Krober. Menifee Co., Red River Gorge, 20 July 1979, T. Johnson.

Chrysops macquarti Philip. Bullitt Co., Bernheim Forest, 2 June 1977, S. Reigler; Warren Co., 1 mi SE of Anna, 27 May 1979, E.A. Lisowski.

Chrysops niger Macquart. Mercer Co., 4 May 1951.

Chrysops pikei Whitney. Ballard Co., 3 km NW of Barlow, 27 July 1978, D.W. Webb; Warren Co., 1 mi SE of Anna, 27 May 1979, E.A. Lisowski.

Chrysops reicherti Fairchild. NEW STATE RECORD. Ballard Co., 3 km NW of Barlow, 27 July 1978, D.W. Webb.

Chrysops sequax tau Philip. NEW STATE RECORD. Shelby Co., 9 Sept. 1977, L.E. McCoy.

Chrysops upsilon Philip. Fulton Co., Reelfoot National Wildlife Refuge, 16 Sept. 1979, C.V. Covell, Jr.

Chrysops vittatus Wiedemann. Bullitt Co., Bernheim Forest, 27-31 July 1977, Malaise trap.

SUBFAMILY TABANINAE

Genus *Chlorotabanus* Lutz

Chlorotabanus crepuscularis (Bequaert). NEW STATE RECORD. Trigg Co., Land Between the Lakes, 24 June 1971, P.H. Freytag and G. Leppert.

Genus *Tabanus* Linnaeus

Tabanus atratus Fabricius. Casey Co., Liberty, 1 May 1957; Taylor Co., Campbellsville, 7 Oct. 1953.

Tabanus calens Linnaeus. Rockcastle Co., Rockcastle River, 1 mi E of Bilows, 15 Aug. 1978, L.M. Page.

Tabanus exilipalpis Stone. NEW STATE RECORD. Edmonson Co., Bylew Creek, 5 mi NE of Brownsville, 28-30 May 1978, E.A. Lisowski.

Tabanus fulvulus Wiedemann. Edmonson Co., Mammoth Cave National Park, 8 mi E of Brownsville, 8 June 1978, E.A. Lisowski; Menifee Co., Red River Gorge, 21 July 1979, T. Johnson; Nelson Co., Gethsemane, 9 July 1966.

Tabanus molestus molestus Say. Edmonson Co., Mammoth Cave National Park, 8 mi E of Brownsville, 8 June 1978, E.A. Lisowski; Henry Co., 25 Sept. 1977, P.D. Barker.

Tabanus pallidescens Philip. Edmonson Co., Mammoth Cave National Park, 8 mi E of Brownsville, 8 June 1978, E.A. Lisowski; Fayette Co., Lexington, 11 Oct. 1965, L.H. Townsend.

Tabanus quinquevittatus Wiedemann. Bullitt Co., Bernheim Forest, 27-31 July 1977. Malaise trap.

Tabanus sackeni Fairchild. Hardin Co., Vertrees, Route 920, 5 Aug. 1974, M.E. Kral; Jefferson Co., Louisville, 8 Sept. 1976 and 11 Sept. 1977, J.A. Long and C.F. Yates; Meade Co., Otter Creek Park, 27 July and 10 and 17 Aug. 1979, T. Johnson and C.V. Covell, Jr.; Menifee Co., Red River Gorge, 21 July 1979, T. Johnson; Rockcastle Co., Rockcastle River, 1 mi E of Bilows, 15 Aug. 1978, L.M. Page; Russell Co., Lake Cumberland State Resort Park, 14 Aug. 1979, C.C. Cornett.

Tabanus sparus Whitney. Bullitt Co., Bernheim Forest, 2 June 1977, S. Reigler.

Tabanus sublongus Stone. Bullitt Co., Bernheim Forest, 27-31 July and 1-14 Aug. 1977. Malaise trap; Jefferson Co., Louisville, 8 Sept. 1976, J.A. Long.

Tabanus subsimilis Bellardi. Clark Co., Winchester, 20 May 1951; Meade Co., Otter Creek Park, 10, 17 Aug. 1979, T. Johnson; Nelson Co., Gethsemane, 9 July 1966; Shelby Co., Shelbyville, 2 June 1966.

Tabanus sp., nr. *sulcifrons* Macquart. Hopkins Co., Madisonville, 7 Oct. 1977, E. DiBlasi.

Tabanus turbidus Wiedemann. Edmonson Co., Mammoth Cave National Park, 8 mi E of Brownsville, 8 June 1978, E.A. Lisowski (not new county record); Hart Co., E of Mammoth Cave National Park, 2 mi SW of Northtown, 4 Aug. 1979, E.A. Lisowski.

Genus *Hybomitra* Enderlein

Hybomitra difficilis (Wiedemann). Edmonson Co., Mammoth Cave National Park, 27 May 1979, E.A. Lisowski; Warren Co., 1 mi SE of Anna, 27 May 1979, E.A. Lisowski.

Hybomitra lasiophthalma (Macquart). Edmonson Co., Bylew Creek, 5 mi NE of Brownsville, 28-30 May 1978, E.A. Lisowski; Hart Co., 1 mi SSE of Rowletts, 11-14 May 1979, E.A. Lisowski; Russell Co., Fonthill, 12 May 1957.

ACKNOWLEDGMENTS

We thank Rozenna Carr for curatorial assistance, Donald W. Webb for the loan of Illinois Natural History Survey specimens and Paul H. Freytag for providing data from the University of Kentucky tabanid collection.

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TAXONOMIC AND DISTRIBUTIONAL NOTES ON SOME FUNGUS-FEEDING NORTH AMERICAN *DROSOPHILA* (DIPTERA, DROSOPHILIDAE)¹

Robert C. Lacy²

ABSTRACT: Comparison of type specimens and examination of variation in natural populations indicates *Drosophila ordinaria* Coquillett, *D. melanderi* Sturtevant, and *D. magnafumosa* Stalker and Spencer to be synonymous species designations. *Drosophila recens*, previously known only from northern states, is reported to be present in the Great Smoky Mts., Tennessee. The known distribution of *D. chagrinensis* is also extended, with the report of a specimen collected in Ithaca, New York.

During recent studies of fungus-feeding Drosophilidae in eastern North America, it became apparent that three species names, *Drosophila ordinaria*, *D. melanderi* and *D. magnafumosa*, might be synonymous. Below are the formal synonymy, a discussion of the evidence which led to this taxonomic revision, and a more complete description of the species. Also given are notes extending the known distributions of *Drosophila recens*, and *D. chagrinensis*. Extensive lists of the host fungi of the mycophagous drosophilid fauna of eastern North America will be published later in papers dealing with the ecology of these flies.

Drosophila ordinaria

Drosophila ordinaria Coquillett 1904, Proc. Ent. Soc. Wash. 6:190, female. Type locality: White Mountains, New Hampshire. Type in USNM.

Drosophila melanderi Sturtevant, 1916, Ann. Ent. Soc. Amer. 9:337, female type and paratype. Type locality: Tacoma, Washington State. Type in USNM. *Syn. nov.*

Drosophila magnafumosa Stalker and Spencer, 1939, Ann. Ent. Soc. Amer. 32:112, male. Type locality: Great Smoky Mountains National Park, Tennessee. Type in USNM. *Syn. nov.*

BASIS FOR THE SYNONYMY. The lack of characteristics for clearly distinguishing among flies of the *melanderi* group and the possible synonymy of the American species has been noted in the past by Marshall R. Wheeler (personal communication to Peter F. Brussard). The published differences are slight, and are fully encompassed by the range of variability within populations that I have sampled in Tompkins County, New York and the Great Smoky Mountains, Tennessee. A study was therefore undertaken to compare specimens of *ordinaria*, *melanderi*, and *magnafumosa* for all morphological characters commonly used in *Drosophila* taxonomy. The

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type specimen of *magnafumosa* was kindly loaned by Harrison Stalker; specimens of larval, pupal and adult *melanderi* from Trinidad, California were supplied by Herman Spieth; the type and other specimens of *melanderi* and the type of *ordinaria* were made available by Don Davis of the USNM. No consistent differences were noted among these flies or the collections I made in New York and Tennessee. Some eggs, larvae and pupae were obtained during attempts to establish stocks of New York and Tennessee flies. Comparison with the *melanderi* larvae and pupae from California revealed no differences in mouth hook structure, puparium color or size, or spiracle morphology. Egg filaments appeared identical in the Tennessee and New York populations.

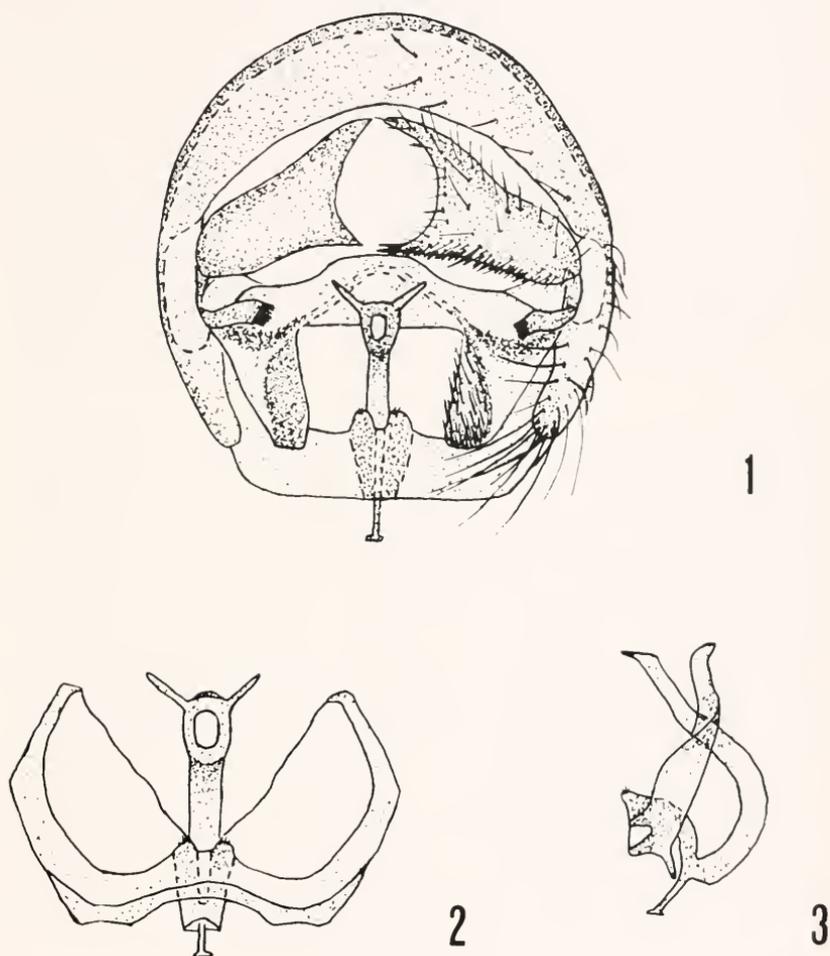
Drosophila ordinaria was known previously only from female specimens, while *magnafumosa* was described from a male specimen. Perhaps this hindered earlier attempts to verify the synonymy. *Ordinaria*-like females and *magnafumosa*-like males have been reared in my lab from single wild-caught females. Breeding tests comparing *melanderi* with the other forms have not been possible due to a lack of success in maintaining, for more than one generation, cultures from flies collected in New York and Tennessee. Spieth (pers. comm. to Peter F. Brussard) was similarly unsuccessful in retaining a culture of *melanderi* from California.

Preparations of the external male genitalia have been made from specimens collected in Tennessee, from specimens collected in New York, and from Spieth's specimens from California. The male genital region is found no differences in the genital morphology of flies from the different populations. Hsu (1949), however, illustrated differences in the male genitalia of *melanderi* and *magnafumosa*. *Melanderi* was shown as having two large teeth at the corner of the anal plate, while *magnafumosa* was stated as lacking these teeth. All specimens that I have examined, whether from Tennessee, New York or California, have the two larger bristles as shown in Hsu's figure of *melanderi* and in Fig. 1 of this paper. Hsu also stated that *melanderi* has 10 teeth on the secondary clasper (the stalked structure with a row of short, closely spaced teeth in Fig. 1), while *magnafumosa* has only seven. Each specimen I examined clearly has 8 teeth in the row.

Drosophila ordinaria

Female. Arista with about 5 branches above and one below, in addition to the terminal fork. Head and antennae brownish yellow. Front over one-third width of head. Only one prominent oral bristle (the vibrissa). Cheeks brownish yellow, their greatest width one-fourth the greatest diameter of the eyes. Eyes with sparse blond pile. Second orbital one-third size of the other two.

Acrostichal hairs in six rows. Anterior dorsocentrals close to posterior dorsocentrals. Mesonotum, scutellum, pleurae and legs brownish yellow. Mesonotum with a median darker stripe. Anterior scutellars parallel to divergent. Apical and preapical bristles on first and second tibia, preapicals on third.



Figures 1-3. Male genitalia of *Drosophila ordinaria* Coquillett. Specimen from Ithaca, N.Y. 1. The entire copulatory apparatus in semiventral view. 2. The penis apparatus in ventral view. 3. The penis apparatus in lateral view.

Abdomen brownish yellow. Each segment with a dark brown posterior band, widely interrupted medially. Banding widens to fill out lateral areas.

Wings clear. Only one large bristle at distal costal break. Costal index about 2.9; fourth vein index about 1.4; 5x index about 1.4; 4c index about 0.8. Heavy bristles on basal two-fifths of third costal section.

Length body 2.8 mm; wing 3.0 mm.

Male. Genital region dark brown and conspicuous. Thorax somewhat darker than in females. Abdominal banding darker and reaching closer to anterior edge of segments.

Egg. 0.6 mm long. Four filaments, each about 1/2 the length of the egg.

Puparium. Each anterior spiracle with about six branches, without definite stalk.

Distribution. Tacoma, Washington (A.L. Melander); Mt. Constitution, Washington (A.L. Melander); Trinidad, California (H.T. Spieth); Montana, Minnesota (these two states listed by Strickberger, 1962, as being in the known geographic range of *melanderi*); St. John's Co., Quebec (C.W. Johnson); White Mountains, New Hampshire (H.K. Morrison, type material); Chester, Massachusetts (C.W. Johnson); Ithaca, New York, elevation 1050 ft. (R.C. Lacy); Six-Mile Creek, Dryden-Caroline, New York, elev. 1370 ft. (R.C. Lacy); Great Smoky Mountains National Park, Tennessee, elev. 4000 ft. (W.P. Spencer); Great Smoky Mountains National Park, Tennessee: elev. 4500 ft., Cosby Creek; Clingman's Dome Road, elev. 6000 ft., Walker Prong, elev. 3150 ft., Husky Brook, elev. 2550 ft., Elkmont area, elev. 2100 ft., LeConte Creek, 1600 ft., Little Pigeon River, elev. 1550 ft. (R.C. Lacy). Specimens from New York and Tennessee have been deposited in the USNM and the Cornell University collections.

The species seems to be distributed across the northern United States, into southeastern Canada, and down the Appalachian Mountains. In the Smoky Mts. *ordinaria* is quite rare below 3000 feet, but common at the higher elevations where the climate and vegetation resemble that found in the more northerly part of its range. Other primarily northern *Drosophila*, *D. athabasca* Sturtevant and Dobzhansky, *D. algonquin* Sturtevant and Dobzhansky (both in the *affinis* species group), and *D. recens* (see below) show similar patterns of distribution in the eastern United States.

The *melanderi* species group, which also contains several Palearctic species, *D. makinoi* Okada in Japan, and *D. cameraria* Haliday in Europe, Iran, Azores, Madeira and Canary Islands, should perhaps now be labelled as the *ordinaria* species group.

Drosophila ordinaria have been raised from 16 genera of Basidiomycete fungi collected in New York and Tennessee, including all species of fleshy fungi that were reasonably well sampled.

EXTENSION OF THE KNOWN RANGES OF *DROSOPHILA RECENS* AND *D. CHAGRINENSIS*

Drosophila recens Wheeler has been reported to be a rare species of the *quinaria* species group, distributed from New England, across the northern United States and southern Canada, as far west as North Dakota. I here report that *recens* is a fairly common mycophagous fly in the Great Smoky Mountains, Tennessee. I collected many specimens in July and August of 1979 and 1980, at the sites listed above for *ordinaria*. Like *ordinaria*, *recens* is found primarily at the higher elevations, above 3000 feet.

Drosophila chagrinensis Stalker and Spencer is a quite rare species of the subgenus *Hirtodrosophila*, only a few specimens of which have been reported from Ohio, Wisconsin and Iowa (Strickberger, 1962). In September 1980 I reared a single female *chagrinensis* from a jelly fungus (*Tremella* sp.) that was collected along Six-Mile Creek, Dryden-Caroline, New York, elev. 1370 ft.

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I thank the National Park Service and especially Dr. Gary Larson of the Uplands Field Research Lab, Great Smoky Mountains National Park, for the opportunity to conduct field research in the park. Dr. William L. Brown, Jr. offered valuable advice on the preparation of the manuscript. An anonymous reviewer pointed out the discrepancy with Hsu (1949), and suggested the discussion of the distribution of the *ordinaria* species group. I thank Steven Sierigk for preparing initial illustrations, which I modified slightly to produce Figs. 1-3. This research was conducted while I was an NSF Predoctoral Fellow, and was supported in part by NSF Grant DEB-7922141 to Dr. Peter F. Brussard.

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FLIES OF THE NEARCTIC REGION. Graham C.D. Griffiths, ed. 1980. E. Schweizerbart'sche Verlagsbuchhandlung (Nägele u. Obermiller), Stuttgart. Available in USA from Lubrecht & Cramer, RFD 1, Box 227, Monticello, N.Y. 12701.

A new series of definitive reference works intended to be a counterpart to the Palaearctic series. This new series is planned to consolidate the achievements of No. American dipterology during the present century and provide a sound basis for continuing progress during the next. It is hoped the work can be completed by the year 2000.

FLIES OF THE NEARCTIC REGION. Vol. I, Part 1. HISTORY OF NEARCTIC DIPTEROLOGY. Alan Stone. 1980. 62 pp. \$38.80.

A very appropriate and interesting handbook to introduce the new series. Section headings include: 1. Introduction, 2. Major Entomological Publications (a review), 3. History of the Families of Diptera, (with references cited), 4. The Generic Names of Meigen, and 5. Some Leading Specialists, containing brief biographical sketches of 56 authors who have proposed more than 100 names for Nearctic Diptera. (with references cited).

FLIES OF THE NEARCTIC REGION, Vol. V, Part 13. BOMBYLIIDAE. No. 1. Jack C. Hall & Neil L. Evenhuis. 1980. 96 pp. \$44.40

This No. 1 volume deals entirely with a systematic review of the genus *Bombylius*, with a key to nearctic species.

TREEHOPPERS (HOMOPTERA:MEMBRACIDAE) COLLECTED AT MULTIPLE LEVELS IN A DECIDUOUS WOODLOT IN DELAWARE^{1,2}

Charles E. Mason³, Jenella E. Loye⁴

ABSTRACT: Fifty-five species of Membracidae were collected by handpicking, sweeping and sticky-cylinder trapping. The latter occurred at levels ranging from 1-27 m above ground level and produced 82% of the species collected. Most species (53) were taken at levels of 3 m or less by the combination of methods. Some species were collected most abundantly at levels of 6-27 m.

Other than Bray and Triplehorn (1953), little attention has been given to the treehopper fauna of Delaware until recently. Bray and Triplehorn (1953) found 9 species of treehoppers in their survey of red and pin oak. Mason and Loye (1981) listed 61 species in the state and reported on a number of plant associations.

This study was initiated to survey the membracid species in a deciduous woodlot located at the University of Delaware. It was decided that some trapping should be done at a range of levels extending from the ground to the forest canopy. This was to ensure that tree dwelling species would be represented in the survey.

We are not aware of any publications on the systematic collection of treehoppers at various heights in wooded habitats. Kopp and Yonke (1970) reported on treehopper species collected by various methods, including sticky-boards placed in trees at unspecified heights as well as near ground level, but no separation was made between species taken near ground level and in trees.

METHODS AND MATERIALS

The study was conducted from May to October, 1978, and May to August, 1979, at the Department of Entomology and Applied Ecology woodlot located on the University of Delaware Agricultural Research

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Farm in Newark, DE. The woodlot is a 40 acre densely wooded area with *Liriodendron tulipifera*, *Acer rubrum*, *Liquidambar styraciflua*, and *Quercus* sp. as the predominant species.

Sticky-cylinder traps were maintained at several locations representing as many different plant associations as practical. The traps were placed at various heights and kept at these levels throughout the study, except when being serviced. The number of traps at each height was as follows: 9 traps at 1 m; 5 traps at each level of 3 m, 6 m, and 9 m; and 2 traps at each level of 12 m, 15 m, 18 m, 21 m, 24 m, and 27 m. The traps at 21 m, 24 m, and 27 m were added in 1979.

Cylindrical sticky traps were selected since Adlerz (1976) found no difference between this type and vertical sticky boards for numbers of aphid species captured. Each cylinder consisted of a 30 cm length of 10 cm diameter Crestline[®] plastic drain pipe. The outer surface of each drain pipe was painted with Krylon[®] fluorescent yellow spray paint. A piece of transparent Teflar[®] plastic, cut to fit the outer surface of the cylinder, was attached to the cylinder with paper clips and then coated with Tanglefoot[®] adhesive. Sticky-cylinder traps were secured to wooden stakes at the 1 m level. At levels from 3-27 m, the traps were attached to ropes which were suspended from pulleys affixed to tree branches. The ropes were maintained from the pulleys so that the traps could be raised to the desired height for the trapping period and lowered for servicing. The end of the portion of rope attached to the trap was tied so that the trap was maintained in a vertical position. The free portion of the rope was tied at an angle to keep it from contacting the sticky surface of the trap.

The sticky-cylinder traps were serviced by removing treehoppers and recoating with adhesive. Adhesive was removed from specimens by washing them in xylene. Servicing was conducted each week during 1978. Because specimens and adhesive were retained in excellent condition for a longer period, servicing was performed at two week intervals in 1979.

Additional collections were made from low level vegetation by sweeping with a standard 30 cm insect net and by handpicking specimens directly from the plant.

Membracid specimens were preserved in alcohol or pinned, identified and placed in the Entomological Collection at the University of Delaware.

RESULTS AND DISCUSSION

A total of 55 membracid species was collected in this study. The species are listed in Table 1 along with the total number of adults taken at each level of sticky-cylinder traps and those captured by handpicking and sweeping from vegetation near ground level. The number of species taken in our study is analogous with that of Dennis and Dicke (1953) where 50 species were collected in a 150-200 acre arboretum in Wisconsin.

Of the total species collected, 82% were taken by sticky-cylinder traps. Of this category, 64% of the species were trapped within the levels of 6-27 m. Also, 82% of the trapped species were taken at the single level of 1 m.

More species (85%) were collected by handpicking and sweeping than all sticky traps combined. Similarly, Kopp and Yonke (1970) found sweeping and handpicking to be the most productive collecting method.

Only two species, *Glossonotus crataegi* (Fitch) and *Telamona westcottii* Goding, involving three specimens, were taken solely within the levels of 6-27 m. Given sufficient numbers of each species, it may be concluded that nearly all treehopper species can be collected in the 0-3 m space of a wooded area.

When considering the species collected most abundantly on sticky-cylinder traps (Table 2), three distinct patterns of height can be seen. *Entylia carinata* (Forster), *Acutalis tartarea* (Say) and *Micrutalis calva* (Say) were most abundant at the 1 m level. *Telamona decorata* Ball and *T. monticola* (F.) were most frequently taken from traps at high levels of 6-27 m. *Cyrtolobus tuberosus* (Fairmaire) and *C. dixianus* Woodruff were spread across levels of 1-15 m.

This study has shown that, when surveying for treehopper species in a wooded area by handpicking, sweeping and sticky-cylinder trapping, few additional species may be gained by placing sticky-cylinder traps 6 m or higher above the ground. However, some tree dwelling species can be more abundantly collected at the higher levels, which gives an indication of population stratification in a deciduous forest.

ACKNOWLEDGEMENTS

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Species	Hand-Picking/ Sweeping	Sticky-cylinder traps									
		1m	3m	6m	9m	12m	15m	18m	21m	24m	27m
<i>Telamona ampelopsidis</i> (Harris)	2	2		1							
<i>T. collina</i> (Walker)	1										
<i>T. decorata</i> Ball	3	4	1	21	24	17	23	1	2	7	2
<i>T. extrema</i> Ball	3							1	1		
<i>T. monticola</i> (F.)	19	3		29	8	5	13	5	1	1	1
<i>T. tiliae</i> Ball	5										
<i>T. unicolor</i> Fitch	3	2			3	1	7	1		1	
<i>T. westcotti</i> Goding							1				1
<i>Phelia bimaculata</i> (F.)	2										
<i>Vanduzeeea arquata</i> (Say)	28										
<i>Xantholobus intermedius</i> (Emmons)	1										
<i>X. lateralis</i> VanDuzee	1	2	4	1							
<i>X. muticus</i> (F.)	14	1	8	15	1						

Table 2. Most abundantly captured treehopper species on sticky-cylinder traps for the duration of the study in the University of Delaware Woodlot during 1978-79.

Species	Total of all Traps	Mean number of treehoppers per trap									
		1m	3m	6m	9m	12m	15m	18m	21m	24m	27m
<i>Entylia carinata</i>	194	21.1	0.2	0.6							
<i>Acutalis tartarea</i>	132	14.7									
<i>Telamona decorata</i>	102	0.4	0.2	4.2	4.8	8.5	11.5	0.5	1.0	3.5	1.0
<i>Micrualis calva</i>	89	9.9									
<i>Cyrtolobus tuberosus</i>	71	1.2	6.4	3.8	1.6		0.5				
<i>Telamona monticola</i>	66	0.3		5.8	1.6	2.5	6.5	2.5	0.5	0.5	0.5
<i>Cyrtolobus dixianus</i>	56	1.3	2.6	4.0	0.6	3.0	1.0				

DIPTERA LARVAE (EMPIDIDAE AND CHIRONOMIDAE) IN TRICHOPTERA PUPAL CASES (GLOSSOSOMATIDAE AND LIMNEPHILIDAE)¹

William S. Vinikour², Richard V. Anderson³

ABSTRACT: Larvae of Empididae and Chironomidae (Diptera) were collected from pupal cases of the Trichoptera species *Glossosoma intermedium*, *Hesperophylax designatus*, and *Neophylax concinnus*. Partially consumed caddisflies within several cases containing empidids verifies implications in the literature that dance flies feed upon immature caddisflies (ectoparasitism). *Eukiefferiella* was the most frequently encountered midge within trichopteran pupal cases, with *Corynoneura*, *Cricotopus*, and *Polypedilum* also observed. It was concluded that the midges occupied the cases to obtain detrital food and to escape current and/or predators, rather than to prey upon the caddisflies (inquilinism). These interactions, particularly when parasitic, may contribute to the regulation of caddisfly populations.

Direct relationships between Diptera and Trichoptera are poorly known. Published reports suggest inquilinism, sometimes accompanied by ectoparasitism, with either Chironomidae (Gallepp, 1974; Parker and Voshell, 1979) or Empididae (Knutson and Flint, 1971; 1979) occurring within Trichoptera pupal cases. Our studies support these findings and add to the list of chironomid inhabitants and infested trichopteran species.

STUDY SITE AND METHODS

Trichoptera were collected from two spring and seepage-fed brooks at Trout Park Nature Preserve (Elgin Botanical Garden), Elgin, Illinois, USA, which is a 10.5-hectare tract along the east bluff of the Fox River. Brook widths ranged from <0.3 to 2 m with depths from <5.0 cm to ~ 1.0 m. Water temperatures at the springs were ~ 11.0 C. Sampling dates were April 7, April 25, and May 6, 1980. Trichoptera were collected by hand and stored individually in vials with 70% ethyl alcohol. The pupal cases were opened under a dissecting microscope. The caddisflies were classified as prepupae (here including true prepupae and pupal stages prior to larval-pupal ecdysis) or pupae (period beginning with larval-pupal ecdysis) (see Wiggins, 1977). Occurrence of dipterans in the cases were noted, and midges mounted for identifications. Identification followed Hilsenhoff (1975) (Diptera) and Ross (1944) (Trichoptera).

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RESULTS AND DISCUSSION

On April 7, 1980, two of 24 pupal cases of *Hesperophylax designatus* (Trichoptera: Limnephilidae) and two of 32 cases of *Glossosoma intermedium* (Trichoptera: Glossosomatidae) contained an Empididae larva. The empidid larvae were within decomposed remains of *H. designatus* but outside of the intact pupal cocoons in *G. intermedium*. Two sediment-laden *Glossosoma* pupal cases (without the caddisfly) contained a larva of *Cricotopus* (Chironomidae) in one case and *Eukiefferiella* (Chironomidae) in the other. Flint (1980, personal communication) stated that it is not uncommon to observe Chironomidae inhabiting sediment-filled trichopteran cases that have been abandoned by the caddisfly. Our findings prompted a more intensive search for dipterans inhabiting pupal cases of these two trichopteran species. A total of 42 prepupae and 66 pupae of *G. intermedium* and 25 prepupae and 38 pupae of *H. designatus* were collected from the brooks, April 25, 1980.

Occurrence of Diptera within the caddisfly pupal cases are summarized in Tables 1 (for *Glossosoma*) and 2 (for *Hesperophylax*). Chironomids were encountered more frequently than empidids, with *Glossosoma*

Table 1. Occurrence of Diptera within pupal cases of *Glossosoma intermedium*.

Stream	Cases Containing Chironomidae	Cases Containing Empididae	Total Cases Examined	% Infestation
Prepupae				
1	12	2	32	43.8
2	1	0	11	9.1
Pupae				
1	8	7*	20	70.0
2	15	0	46	32.6

*One case with an empidid and a chironomid.

Table 2. Occurrence of Diptera within pupal cases of *Hesperophylax designatus*.

Stream	Cases Containing Chironomidae	Cases Containing Empididae	Total Cases Examined	% Infestation
Prepupae				
1	0	0	8	0.0
2	0	0	17	0.0
Pupae				
1	8	1	24	37.5
2	7	0	14	50.0

generally having a higher rate of infestation than *Hesperophylax*. The latter observation is due in part to the greater ease of penetration between stones (or under the sides) of *Glossosoma* cases compared to those of *Hesperophylax*. Additionally, *Glossosoma* were collected on the tops or sides of cobble in the main stream where Diptera would more likely seek trichopteran cases to escape the current. In contrast, *Hesperophylax* was collected from crevices on the undersides of wood debris (areas already protected from main current velocities). Complete closure of the *Hesperophylax* case in preparation for pupation would also increase the difficulty of case entry by dipterans.

Glossosoma prepupae and pupae from Stream 1 had a higher percentage of infestation than did those from Stream 2 (Table 1). The major environmental difference between the two streams was that Stream 1 had a large quantity of watercress and fallen logs which allowed pools containing finely deposited sediments to develop. Larger populations of dipterans could inhabit these pooled areas in comparison to the normally encountered, fast-flowing riffle areas. From each respective stream, *Glossosoma* cases containing pupae had a higher percentage of infestation than did those containing prepupae. Time lapsed between development from prepupae to pupae (age-factor) would allow for an increased potential for case invasion by the dipterans. Similarly, no *Hesperophylax* prepupae were infested, while 37.5 and 50.0% of the pupae from Stream 1 and Stream 2 respectively, contained dipterans (Table 2).

Empidids were only encountered in pupal cases collected from Stream 1. Historically, this stream has received the greatest disturbance due to storm sewer runoff (Unzicker and Sanderson, 1974). Impacts have included erosion and subsequent tree fall which have created pooled areas, decreased sediment size, and increased amounts of filamentous algae and wood debris in the stream. These conditions provide preferred habitats for larval empidids (see Merritt and Cummins, 1978). During drift or random movement, the empidids can encounter and infest trichopteran cases. Empidids may also enter glossosomatid cases in search of midges as a food source. The high infestation rates of *Glossosoma* cases by midges, accompanied by high densities of *Glossosoma*, could provide an abundant food resource for the empidids. The midges are easier to prey upon than the glossosomatids, as the empidid would have to penetrate the sheath of the pupal cocoon to feed on the caddisfly. In most instances when empidids were found, the sheath of the glossosomatid cocoon was intact. Only once were two empidids found in a *Glossosoma* case. In one instance an empidid was associated with a larval *Glossosoma* within a case from which the ventral strap had been removed in preparation for pupation. Therefore, the potential exists for empidid predation upon larval caddisflies in the field, a fact that has been observed in the laboratory by Sommerman (1962).

The observation of several partially consumed caddisfly specimens in *Hesperophylax* pupal cases containing empidids confirms Knutson and Flints' findings (1971, 1979) that empidids do feed upon Trichoptera. Their observations of pupal empidids within the cocoons of glossosomatid and rhyacophilid pupal cases leads to speculation as to whether the Trichoptera died from crowding or from predation. The small size of the empidid larva relative to both the pupal and case size of *H. designatus* (e.g. empidid larval length <3.0 mm and *Hesperophylax* larval and pupal lengths > 15.0 mm) would preclude the crowding option in favor of predation (ectoparasitism), at least for this species of Trichoptera.

Of midges collected from pupal caddisfly cases, *Eukiefferiella* was most prevalent, with *Corynoneura* encountered in two cases from each trichopteran species (Table 3). A *Polypedilum* and a *Cricotopus* were each collected from separate *Glossosoma* cases. In most instances only one midge was found in a case. However, on April 25 over 10% of the cases contained more than one midge (five glossosomatid cases contained two to three midges and two *Hesperophylax* cases contained two midges). The caddisflies in cases occupied by midges were seldom injured or dead. This may be due to the smaller instar or species sizes of the midges usually encountered. Gallepp (1974) found *Brachycentrus occidentalis* pupae to be seldom damaged when cases contained early instar *Eukiefferiella*. Given adequate development time the *Eukiefferiella* could result in the death of the host trichopteran (particularly *Glossosoma*) by crowding in the manner reported by Gallepp (1974). Considering the algal and detrital food preferences for the collected midges (Roback, 1953; Darby, 1962; Oliver, 1971), it would appear that the midges entered the trichopteran cases to escape the current or predators and/or to obtain non-trichopteran food resources rather than to prey upon the caddisfly. This is supported by our observations of diatoms in the gut contents of some of the midges and by the apparent lack of damage to most of the caddisfly specimens.

Further support of the inquilinous nature of midge larvae was obtained on May 6, 1980. *Glossosoma* pupal cases were again found to contain

Table 3. Chironomidae within Pupal Cases of *G. intermedium* and *H. designatus*.

Trichoptera	Chironomidae (Percentage)			
	Stream 1		Stream 2	
<i>Glossosoma intermedium</i>	<i>Eukiefferiella</i>	(95.0)	<i>Eukiefferiella</i>	(81.3)
	<i>Cricotopus</i>	(5.0)	<i>Corynoneura</i>	(12.5)
			<i>Polypedilum</i>	(6.2)
<i>Hesperophylax designatus</i>	<i>Eukiefferiella</i>	(87.5)	<i>Eukiefferiella</i>	(85.7)
	<i>Corynoneura</i>	(12.5)	<i>Corynoneura</i>	(14.3)

Eukiefferiella. However, an empty, sediment-laden case collected from a different area contained three *Cricotopus* larvae. In this are *Cricotopus* was the dominant midge found in the substrate. In all other areas, especially where the April collections were made, *Eukiefferiella* dominated. In addition, on May 6, two prepupal *Neophylax concinnus* were found, each containing a *Eukiefferiella*. These were the only *N. concinnus* cases out of 61 prepupae that contained midges. The compact nature of *Neophylax* within its case, as well as the tightly bound structure of the case, would make this case more difficult to enter and inhabit. However, once entered it would appear that a midge could more readily crowd the caddisfly, and this could lead to its death. Considering that mode *Neophylax* final instar larvae diapause for up to several months (Wiggins, 1977), adequate time could pass for midge growth to occur allowing for crowding by the midge larvae. This could ultimately interfere with or inhibit the respiration of the caddisfly.

Thus, the symbiotic midge-caddisfly interrelationship is a case of inquilinism without accompanying ectoparasitism, being similar to that observed by Gallepp (1974). The interaction between *Cardiocladius* and Hydropsychidae reported by Parker and Voshell (1979) was both inquilinism and ectoparasitism, as are the interactions of empidids and trichopterans observed by Knutson and Flint (1971, 1979) and us. We also observed apparent inquilinism involving unidentifiable, immature tubificid worms and *Glossosoma*, these worms being found in several cases also containing midges.

To date the occurrence of Diptera within Trichoptera pupal cases has been seldom reported. However, considering the geographical range of the reports, i.e. South America (Knutson and Flint, 1971; 1979), Wisconsin (Gallepp, 1974), Virginia (Parker and Voshell, 1979), and Illinois (present study), it would appear that symbiotic relationships between these two orders commonly occur but are often overlooked in collections. Considering the percentage of pupal caddisflies infested, i.e. 32% (Gallepp, 1974), as much as 61% (Parker and Voshell, 1979), and up to 75% in our study, these interactions may significantly affect the numbers of caddisflies reaching maturity. Therefore, dipterans may play an important role in regulation of trichopteran population sizes, especially in a situation such as that present at Trout Park where populations of large predatory insects and fish are low (Vinikour and Anderson, 1980).

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THE IDENTITY AND STATUS OF *CAMBALA WASHINGTONENSIS* CAUSEY (DIPLOPODA: SPIROSTREPTIDA: CAMBALIDAE)¹

Rowland M. Shelley²

ABSTRACT: The recent examination of a mature male, near topotype of *Cambala washingtonensis* Causey from Whitman County, Washington, resolves the long standing problems of the status and identity of this nominal species. It is definitely referable to *Cambala* and is sufficiently distinct from the six known species in the eastern and central United States to be accorded full specific rank. The posterior gonopod of *washingtonensis* is closest in form to that of *C. speobia* (Chamberlin), of Texas and adjacent states. However, the two species are distinguished by size of telopodite, apical configuration of the anterior coxal lobe, and relative lengths of the anterior and posterior coxal lobes. Forms of *speobia* in southern Colorado differ from those in Texas in having a reduced telopodite and more nearly equal anterior and posterior coxal lobes, suggesting a geographical trend toward *washingtonensis* character states in a northwesterly direction. A third locality for *washingtonensis* is confirmed in southwestern Oregon.

The identity of *Cambala washingtonensis* has been unknown since 1954, when Causey described the milliped from a female specimen. The type locality is Wilma, Whitman County, Washington (erroneously reported by Causey as being in Garfield County). Although the holotype is a female and the male gonopods have never been illustrated or described, puzzling statements about the identity of *washingtonensis* have appeared in the literature. For example, Causey (1964) diagnosed *C. reddelli*, now considered a synonym of *C. speobia* (Chamberlin), as being "a polytypic species near *C. washingtonensis* in the form of the gonopods," and later in this paper reiterated that there was very little difference between the gonopods of the two species. Since the configuration of the posterior gonopods of males is the only reliable character for specific identifications (Shelley 1979), the basis for these early statements is obscure. In the same paper, Causey reported the genus from western Washington and northern Idaho. Since no Idaho localities have ever been recorded for any species of *Cambala*, however, one must assume that this citation was based on the presence of *washingtonensis* in a neighboring part of Washington.

In 1979 I summarized the confusion surrounding *washingtonensis* and decided that, although its identity was unknown, it was probably referable to *Cambala*. Chamberlin and Hoffman (1958) had earlier suggested that *washingtonensis* might not be congeneric with the eastern species of

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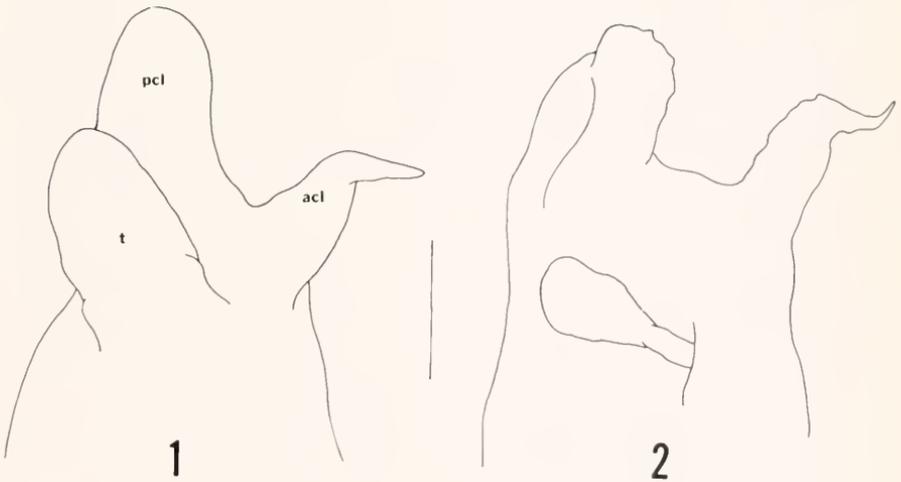
Cambala, but gave no reason for this supposition. My conclusion was based on a small sample of crested male cambaloids from Drain, Douglas County, Oregon, whose external ornamentation was very similar to that of such eastern species as *C. minor* Bollman and *C. ochra* Chamberlin, and whose posterior gonopods were similar in configuration to those of *speobia*. This material, from southwestern Oregon, suggested that *washingtonensis*, in southeastern Washington, might be a species of *Cambala* and that it might even be a synonym of *speobia*. However, since no specimens were available from southeastern Washington, the only recourse was to retain *washingtonensis* as a valid species of *Cambala* until topotypical or near topotypical males could be collected. At that time the type of *washingtonensis* was absent from its published repository, the American Museum of Natural History (AMNH), and no material identified as *washingtonensis* was available in the Causey material donated in 1976 to the Florida State Collection of Arthropods (FSCA).

Dr. Causey died in October 1979, and the remainder of her collection, which she had retained, has been transferred to the FSCA. I recently sorted this additional material and discovered both the holotype of *washingtonensis* and a male specimen from Albion, Whitman County, Washington, labeled "Male Homeotype, fide Causey 1964." The latter millipede was undissected, and the gonopods were recessed within the 7th segment, their normal position. Hence, this male could not have supported her published comments of 1964 about the similarities between the gonopods of *washingtonensis* and *reddelli*, and the basis for these remarks remains a mystery. Since it was identified by Causey, the author of the species, this individual is a metatype rather than a homeotype. Its collection from Albion, 46 km (37 mi) N Wilma, is close enough to the type locality to satisfy the near topotypical requirement, considering how little sampling has been done in this region. Consequently, the identity and status of *washingtonensis* can now be resolved, some 26 years after the species' description.

Figures 1 and 2 illustrate lateral views of the left posterior gonopods of a male of *speobia* from Texas, and the metatype of *washingtonensis*, respectively. As can be seen, the telopodite (t) of *washingtonensis* is much smaller than that of *speobia* and the length of the anterior coxal lobe (acl) of *washingtonensis* is subequal to that of the posterior coxal lobe (pcl), whereas in *speobia* the acl is shorter. Furthermore, the acl of *washingtonensis* is apically curved and directed submediad, whereas that of *speobia* is straight and points more anteriorly. These illustrations leave no doubt that *washingtonensis* is indeed referable to *Cambala*, and it also is sufficiently different from *speobia* to warrant full specific rank. The males from Drain, Oregon, agree closely with the metatype, and this site can now be confirmed as the third known locality for the species. The range of

washingtonensis therefore extends from southwestern Oregon to southeastern Washington; its occurrence in Idaho awaits verification.

Despite the aforementioned differences between *washingtonensis* and *speobia*, they could be geographic races of a single species with a wide distribution in the central and western United States. A sample of *speobia* from Huerfano County, Colorado, differs from that illustrated in figure 1 in having a reduced telopodite and more nearly equivalent coxal lobes, suggesting a geographical trend toward *washingtonensis* character states in a northwesterly direction. More material must be collected from intervening locations between Washington and Texas, however, before such a determination can be made. The central Rocky Mountains in particular should be thoroughly investigated to ascertain the distribution and identity of its cambaloid forms. A sample containing only females in the North Carolina State Museum (NCSM) collection from Custer County, Colorado, adjacent to Huerfano County, suggests that *Cambala* may be common in the southern mountains of that state. Complete data citations for known localities of *washingtonensis* and the new Colorado ones for *speobia* are listed below.



Figs. 1-2. 1, left posterior gonopod of *Cambala speobia* from Sonora, Sutton Co., TX, lateral view. 2, left posterior gonopod of metatype male of *C. washingtonensis*, lateral view. Setation omitted from both figures. acl, anterior coxal lobe; pcl, posterior coxal lobe; t, telopodite. Scale line = 0.1 mm.

Cambala washingtonensis Causey

WASHINGTON: *Whitman Co.*, Wilma, F. 22 April 1935, M. H. Hatch (AMNH)³
TYPE LOCALITY; and Albion, M. 11 October 1950, D. Johnson (FSCA).
OREGON: *Douglas Co.*, Drain, 2M. 4 March 1967, V. Roth (AMNH).

Cambala speobia (Chamberlin)

COLORADO: *Huerfano Co.*, 38.4 km (24 mi) W Walsenburg, several MM and FF, 22 August 1959, C. C. Hoff (AMNH). *Custer Co.*, South Hardscrabble Creek, 6.2 km (3.9 mi) E CO hwy. 165, 2F, 24 May 1979, S. K. Wu (NCSM A3069).

ACKNOWLEDGEMENTS

I am grateful to Howard V. Weems, Jr., Curator of the FSCA, for the opportunity to peruse the Causey collection now under his care and for the loan of the metatype specimen. Thanks are also extended to Norma I. Platnick, AMNH, for loan of the material from Oregon and Huerfano County, Colorado; and to Shi Kuei Wu, University of Colorado Museum, Boulder, who kindly sent me the sample from Custer County, Colorado. John E. Cooper, N.C. State Museum, critically reviewed a preliminary draft of the manuscript. This research was supported in part by NSF Grant No. DEB 7702596.

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³The holotype of *washingtonensis* and those of other species in the Causey collection whose published repository is the AMNH will be transferred there from the FSCA as soon as feasible.

MYIASIS IN AN AMAZONIAN PORCUPINE¹

Lawrence A. Lacey,² Timothy K. George³

ABSTRACT: Myiasis in an Amazonian porcupine, *Coendou prehensilis prehensilis* (Linnaeus), is reported for the first time. The authors found a mature female procupine in the Amazon National Park near Uruá, Pará, Brazil. The subject was heavily infested with the primary screwworm, *Cochliomyia hominivorax* (Coquerel) and *Sarcophaga* sp. Although the nose and nasal cavities were the most affected tissues, there was also infestation below the scalp as well as ocular involvement.

While participating in the faunistic survey of the Amazon National Park, Tapajós, Brazil on December 15, 1978, the authors encountered an adult female porcupine, *Coendou prehensilis prehensilis* (Linnaeus) (Rodentia: Erethizontidae) in secondary growth at the edge of primary forest just south of Uruá, Pará (Km 65 Trans-Amazon Highway). The animal was aware of our presence but made no attempt to escape. Upon closer examination, the subject was apparently partially blind and suffering from an advanced case of nasal myiasis and maggots were observed exiting from the nose and scalp. The porcupine was then killed and the affected areas were examined at close range and dissected. Externally, most of the tissue of the rostrum had been eaten away, one eye was destroyed and the cornea of the other eye was opaque. There were four openings in the scalp and the skull was clearly visible. The affected areas had a strong smell of rotten meat. The entire nasal cavity was infested with muscoid maggots of various sizes. These were collected from the tissues and as they exited the nares and placed in 70% alcohol for future determination. Additionally, the scalp was undermined by maggots almost as far as the occiput.

Two species of flies were removed from the porcupine: third instars of the primary screwworm, *Cochliomyia hominivorax* (Coquerel) (Calliphoridae) and variously aged instars of *Sarcophaga* sp. (Sarcophagidae). The screwworm was probably the first of the two species to infest the porcupine. *C. hominivorax* requires a surface wound in order to gain access (Hall, 1974) or in the case of nasal myiasis, a pre-existing pathological condition of the nose (Taylor, 1950). The secondary invader, *Sarcophaga* sp., may have been attracted due to the fetid nature of the wound. The various sizes of *Sarcophaga* sp. in the tissues indicated that larviposition was by more than one female and over a few days.

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Several families of Calyptrate muscoid flies cause myiasis in a variety of vertebrate hosts. The Cuterebridae, Gastereophilidae and Oestridae are obligatory larval parasites of mammals and the majority of the species are host specific (Zumpt, 1973). Although *C. hominivorax* and *Wohlfahrtia* spp. (Sarcophagidae) are obligate parasites, most cases of myiasis caused by other calliphorids and sarcophagids are facultative or accidental. *Sarcophaga* spp. are found in a multitude of niches ranging from scavenging to parasitism of warm-blooded animals (Aldrich, 1916) including facultative parasitism of man (James, 1947). *C. hominivorax* attacks a wide range of mammalian hosts including domestic and sylvatic animals (Lindquist, 1937; McLean, 1941; Murray and Thompson, 1976; cited by Snow, 1980) as well as man (Aubertin and Buxton, 1934; James, 1947; Scott, 1964) and death due to untreated advanced cases is common. A significant portion of the cases recorded in man involve invasion of the nasal cavities (Brown, 1945).

Although several sylvatic hosts are recorded for the primary screw-worm, this is the first report of *C. hominivorax* and *Sarcophaga* in *Coendou*.

ACKNOWLEDGMENT

We are grateful to Dr. R.J. Gagné, Systematic Entomology Laboratory, USDA, U.S. National Museum, for determining the fly larvae. We also thank Dr. H. de Souza Lopes, Academia Brasileira de Ciências, Rio de Janeiro for useful information and comments, and Ms. Barbara Gibbs for typing the manuscript.

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THE GENUS *MICROPHADNUS* CAMERON IN AUSTRALIA (HYMENOPTERA: POMPILIDAE)¹

Howard E. Evans²

ABSTRACT: *Microphadnus* Cameron is recorded for the first time from Australia, where it is represented by a single known species, *antipodes* n. sp. (Queensland and New South Wales).

Microphadnus Cameron (1905) is a poorly known genus containing several species of very small wasps having narrow wings with slightly reduced venation as well as fine striae on the posterior part of the propodeum. *M. pumilus* Costa is widely distributed in southern parts of the Palearctic region, while *M. bicolor* Cameron occurs in South Africa. For several years I have been aware that the genus is represented in Australia, and it is the purpose of this paper to record its occurrence on that continent and to describe the single known species. *Microphadnus* belongs in the tribe Pompilini, not far, I believe, from *Pompilus*. *Plagioceps* Haupt (1930) is a synonym.

M. antipodes n. sp. is very similar to both *pumilus* and *bicolor*, differing from the former in having the sides of the propodeal slope much more prominent and ridge-like and the third discoidal cell of the fore wing somewhat wider. In these respects it is more like *bicolor*, but that species has the legs partly rufous and the distance between the eyes considerably greater than in *antipodes*. I am not aware that the male terminalia of any species of *Microphadnus* have previously been described, so those of *antipodes* are described and figured here.

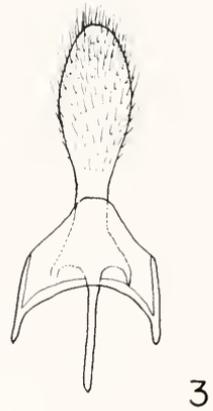
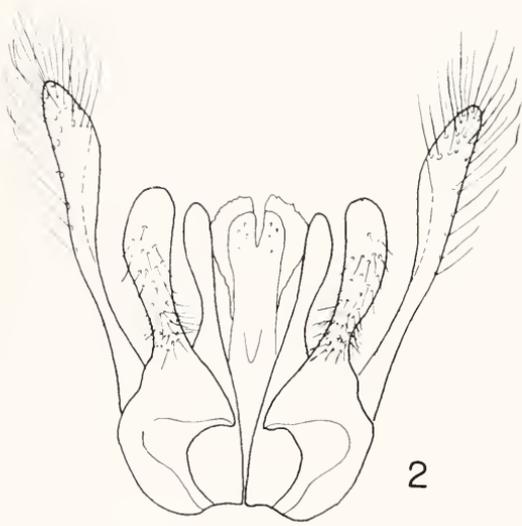
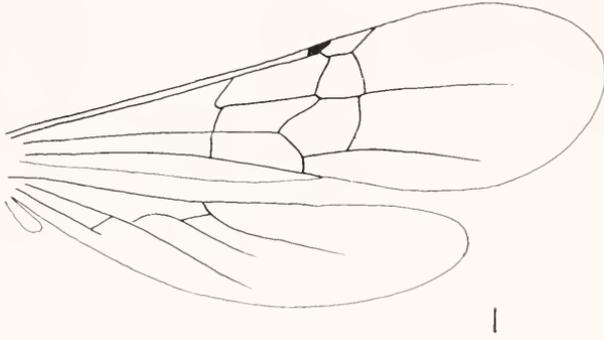
Microphadnus antipodes n.sp. (Figs. 1-3)

Female. Length 5 mm; fore wing 4.5 mm. Black, body covered in considerable part with silvery pubescence; head and thorax silvery except pubescence brownish on upper front, vertex, and much of dorsum of thorax and propodeum; legs silvery basally; gaster with prominent silvery bands at apices of tergites 1-3, sternites 1 and 2 mostly silvery. Body devoid of erect setae except for a few bristles on clypeus and mandibles as well as several strong setae on apical segments of gaster. Wings subhyaline, fore wing with a broad dark band over apical third, extending as far as tip of marginal cell.

Head 1.25 X as wide as high; front narrow, its greatest width 0.51 X that of head; clypeus 2.2 X as wide as high, truncate apically; postocellar line 1.3 X ocello-ocular line; vertex passing straight across between tops of eyes. First four antennal segments in a ratio of 4:2:5:5.

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²Department of Zoology and Entomology, Colorado State University, Fort Collins, Colorado 80523. This research was conducted while the author held a research fellowship at the University of Queensland, St. Lucia, Queensland, Australia.



Figs. 1-3. *Microphadnus antipodes* n.sp. 1, wings of ♀; 2, ♂ genitalia, ventral aspect; 3, ♂ subgenital plate, ventral aspect.

segment 3 equal to 0.8 X distance between eyes at top. Pronotum elongate, its slope low and even, posterior margin broadly arcuate, weakly angulate at midline; postnotum narrowly exposed medially, otherwise essentially absent; propodeum elongate, with a shallow median sulcus on basal two-thirds, its posterior angles prominent, ridge-like; posterior slope of propodeum with delicate, rather widely spaced striae. Tibiae and tarsi spinose, but fore tarsus without a pecten; ultimate tarsal segments each with some weak spines latero-ventrally. Wing venation as figured.

Male. Length 4.8 mm; fore wing 3.4 mm. Coloration as well as distribution of silvery pubescence much as in female: as in that sex, tergites 1-3 have apical silvery bands, but tergites 5 and 6 also have weaker bands, and ventrally sternite 1 is mostly silvery, sternite 2 has an apical silvery band, and sternite 3 has an incomplete band. Aside from a few bristles on the mandibles, the body has no erect setae whatever. Wing color and venation as in female. Head 1.12 X as wide as high; greatest width of front 0.59 X head width; clypeus 2.2 X as wide as high, not quite as wide as closest approximation of eyes near bottom, apical clypeal margin truncate; postocellar line slightly exceeding ocello-ocular line. Features of thorax and propodeum essentially as in female. Gaster very slender; subgenital plate slender, especially basally; genitalia without basal hooklets, parameres much exceeding volsellae and aedeagus, as figured.

Holotype ♀, allotype ♂, 3 paratype ♀♀ and 2 paratype ♂♂: Eungella National Park, 80 km NW Mackay, Queensland, 16-19 October 1979 (H.E. and M.A. Evans and A. Hook). Paratype ♂: Isaacs River, 100 km NE Clermont, Queensland, 20 October 1979 (H.E. and M.A. Evans and A. Hook). Paratype ♀: 17 km SW Bourke, New South Wales, 14 December 1976 (E.M. Exley and T. Low, on weeds). Holotype and allotype in Queensland Museum, Brisbane; paratypes at University of Queensland, St. Lucia; Australian National Insect Collections, Canberra; and British Museum (Natural History), London.

Remarks

The type, allotype, and five paratypes were taken in a field adjacent to montane rain forest. The remaining two specimens were taken at lower elevations and in areas of much lower rainfall. In spite of this, little variation is evident, although the male from Isaacs River is quite small (fore wing 2.8 mm). The occurrence of the species in semidesert areas of New South Wales suggests that it is widely distributed and broadly adapted ecologically. That this is not a ground-nester is suggested by the absence of a pecten on the fore tarsi of the female. Ferton (1897) found that the Palaearctic species *pumilus* (= *Evagetes laboriosus* Ferton, according to Haupt, 1930) nests in hollow twigs lying on the ground or in empty snail shells, closing off its cells with small stones and bits of debris. The prey of *pumilus* consists of immature Lycosidae and Salticidae.

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BEEKEEPING IN THE UNITED STATES. E.C. Martin, E. Oertel, N.P. Nye, & others. 1980. U.S. Dep't Agric., Agric. Hnbk. No. 335 (Rev.). 193 pp. Illus.

Some topics included are life history of honey bee, bee behavior, breeding & genetics, queens, packaged bees & nuclei, managing colonies, diseases & pests, effects of pesticides, organizations and statistics.

TAXONOMISTS' GLOSSARY OF MOSQUITO ANATOMY. Ralph E. Harbach & Kenneth L. Knight. 1980. Plexus Publ., Box 550, Marlton, N.J. 08053. 415 pp. 83 pl., 365 figs. \$24.95 plus \$2.00 p. & h. in U.S.

A comprehensive treatment, including complete descriptive terminology, of the nomenclature of the sclerotized anatomy of mosquitoes. Terminology is treated under 5 headings: adult, egg, larva, pupa, and vestiture.

INSECT BIOLOGY IN THE FUTURE. Michael Locke & David S. Smith, eds. 1980. Academic Press. 977 pp. \$50.00

A compilation of 43 papers or "essays" on various aspects of insect biology by 53 authors, "presented to Sir Vincent" Wigglesworth.

INSECT THERMOREGULATION. Bernd Heinrich, ed. 1981. John Wiley & Sons, N.Y. 328 pp. \$35.00

Seven papers originally presented as a symposium, Amer. Soc. of Zoologists, Annual Meeting, Dec. 27-30, 1978. This volume is intended to be an up to date summary and review of the field of insect thermoregulation from a diversity of perspectives.

FLEAS. R. Traub & H. Starcke, eds. 1980. A.A. Balkema, Rotterdam. 420 pp. \$48.00

Proceedings of 1st International Conference on Fleas held in Peterborough, England, June 21-25, 1977. Contains 37 papers under headings: Taxonomy, Evolution & Zoogeography, Medical & Veterinary, Physiology & Morphology, and Ecology and Faunistics.

SYSTEMATICS OF THE COLLETIDAE BASED ON MATURE LARVAE WITH PHENETIC ANALYSIS OF APOID LARVAE (Hymenoptera: Apoidea). Ronald J. McGinley. 1981. Univ. of California Press, Berkeley, CA. 307 pp. \$14.50

The mature larvae of 30 colletid species are described, with a generic key and diagnoses provided for identification.

REVIEW OF THE NO. AMERICAN and CENTRAL AMERICAN SPECIES OF PARAVILLA (Diptera: Bombyliidae). Jack C. Hall. 1981. Univ. of Calif. Press, Berkeley, CA. 200 pp. \$10.00

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(Continued on inside of back cover)

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LARVAL AND PUPAL DESCRIPTIONS OF *DOLOPHILODES (FUMONTA) MAJOR* (BANKS) (TRICHOPTERA: PHILOPOTAMIDAE)^{1,2}

John S. Weaver, III³, John A. Wojtowicz⁴, David A. Etnier⁴

ABSTRACT: The larva and pupa of *Dolophilodes (Fumonta) major* (Banks) are described and figured. The immatures are indigenous to seepage springs. Records show that this species occurs throughout the central and southern Appalachian Mountains of Georgia, North Carolina, South Carolina, Tennessee, and Virginia.

Dolophilodes Ulmer

The genus *Dolophilodes* is composed of seven subgenera (Ross 1956). The larvae of four of these are described. Cowley (1978) described the larvae of *D. (Hydrobiosella) stenocerus* Tillyard and *D. (Hydeobiosella) mixtus* Cowley. Barnard (1934) made known the larva of *D. (Thylakion) urceolus* (Barnard). For a description of *D. (Dolophilodes) distinctus* (Walker) see Wiggins (1977). The larval description of *D. (Fumonta) major* (Banks) is given herein. All of these larvae share the character state of having an extended fingerlike foreleg trochantin. Among other philopotamid genera for which larvae are known, only *Philopotamus* shares this characteristic (c.f. Hickin [1967], for the larval description of *P. montanus* [Donovan]). In other genera, the foreleg trochantin is reduced as in larvae of *Wormaldia* and *Chimarra* (Wiggins 1977).

Because the larva of *D. major* has a notch in the anterior margin of the frontoclypeus, which is also typical of many *Chimarra* species, existing larval keys for the Philopotamidae of North America cannot rely solely on characters pertaining to the anterior margin of the frontoclypeus. Thus, for identification purposes, emphasis also should be placed on the characteristic of the foreleg trochantin, since all known Nearctic larvae which have the foreleg trochantin greatly extended as a fingerlike process are *Dolophilodes*. This genus is represented by nine species in North America.

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²Technical Contribution No. 1847 of the South Carolina Agricultural Experiment Station, Clemson University.

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Dolophilodes (Fumonta) major (Banks)

The larva of this species may be distinguished from that of *D. distinctus* by the shape of the anterior margin of the frontoclypeus. In *D. major* it has a deep right notch, as in many species of *Chimarra*, whereas in *D. distinctus* it is only slightly asymmetrical. It can be distinguished from *Chimarra* larvae on the basis of having an extended fingerlike foreleg trochantin and lacking a seta-bearing process on the foreleg coxa. The ventral head seta #18 (*sensu* Wiggins, 1977) in *Chimarra* is adjacent to the posterior edge of the ventral apotome; in *D. major* this seta is near the midlength position of the ventral ecdysial line. This seta is more stout in *D. major* than in *D. distinctus*.

The pupa of *D. major* has mandibles similar to those of *D. distinctus*, but differs by having a small pair of dorsal hook plates on abdominal segment VIII. Also the labrum of *D. distinctus* is rounded distally, whereas that of *D. major* is truncated. The male genitalia of *D. major* are illustrated by Ross (1956: fig. 29 A, B, C.).

LARVA — (Figures 1 A, B, C, D; 2). Overall length of final instar approximately 15.0 mm. Head: head capsule chestnut brown; some individuals immaculate, others with a few faint muscle scars mesally and posteriorly; lateral margins slightly curved; length 2.0, width 1.3 mm; maximum length of frontoclypeal sclerite subequal to the width of head; anterior margin of frontoclypeus asymmetrical with a deep right notch; antenna bifercate, resembling two separate fingerlike projections which are separate basally and evidently converge internally from the surface of the cuticle. This type of larval antenna is unique among Trichoptera larvae of the Philopotomidae and Stenopsychidae, (Hickin, 1967: fig. 258), (Nielsen, 1942: fig. 36 A, B), (Ulmer, 1957: fig. 299, 326), and (Wiggins, 1977: fig. 13.3 B). The ventral head seta #18 is located near the middle of the ventral ecdysal line. A sensory pit is located anterior to seta #18. Thorax: foreleg trochantin robust and freely extended as a fingerlike process; trochanter, femur, and tibia each bearing a pair of ventral spines; femur longer than tibia; tibia longer than tarsus.

PUPA — (Figure 3 A, B, C). Overall length approximately 12 mm, color light orange-brown. Head: labrum is truncated distally; mandibles each with four evenly spaced apical teeth. Abdomen: anterior dorsal hook plates on segment III-VIII; posterior dorsal hook plates on segment V; terminal processes membranous. The claspers occupy a pair of large membranous lobes extending well beyond the tip of the abdomen (fig. 3A). Such lobes would not be found in the female pupa.

Distribution and Habitat

The range of this species includes the Appalachian Mountains of Georgia, North Carolina, South Carolina, Tennessee, and Virginia. The habitat of *D. major* is shallow seeps which trickle over steep areas along the banks of streams. This unusual aquatic habitat explains why the immatures of this relatively common species are rarely collected.

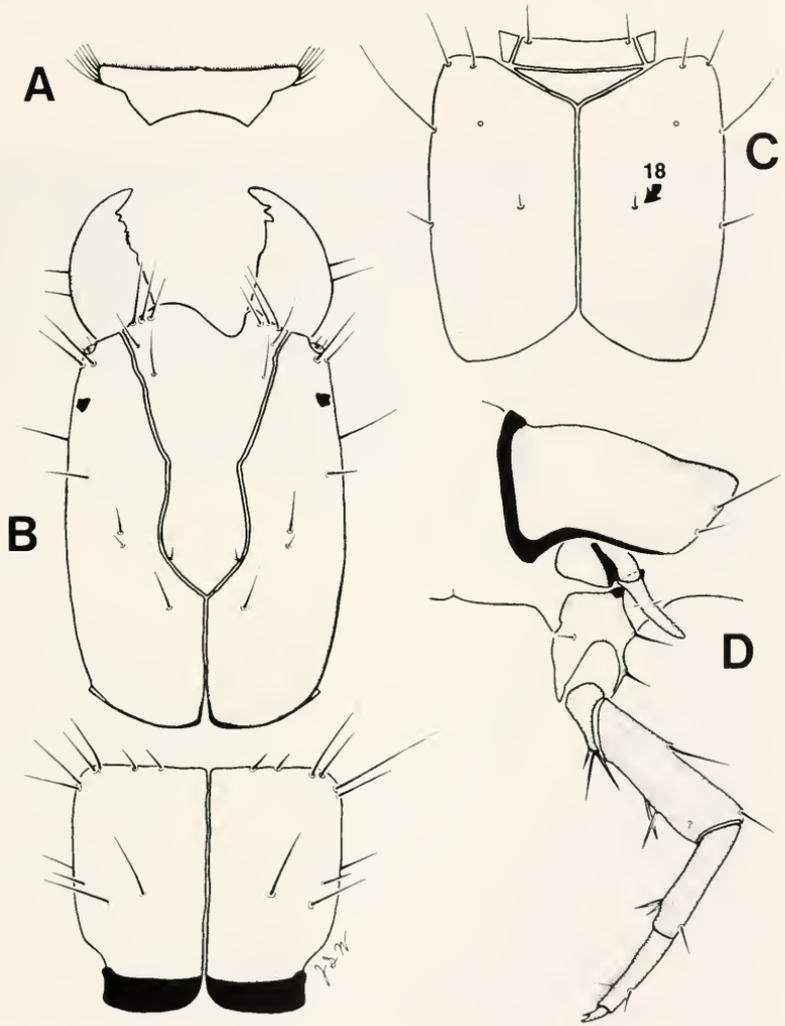


Figure 1. *Dolophilodes major* (Banks). Larva: A) labrum; B) head and pronotum, dorsal view; C) head, ventral view; D) foreleg and prothorax, lateral view.

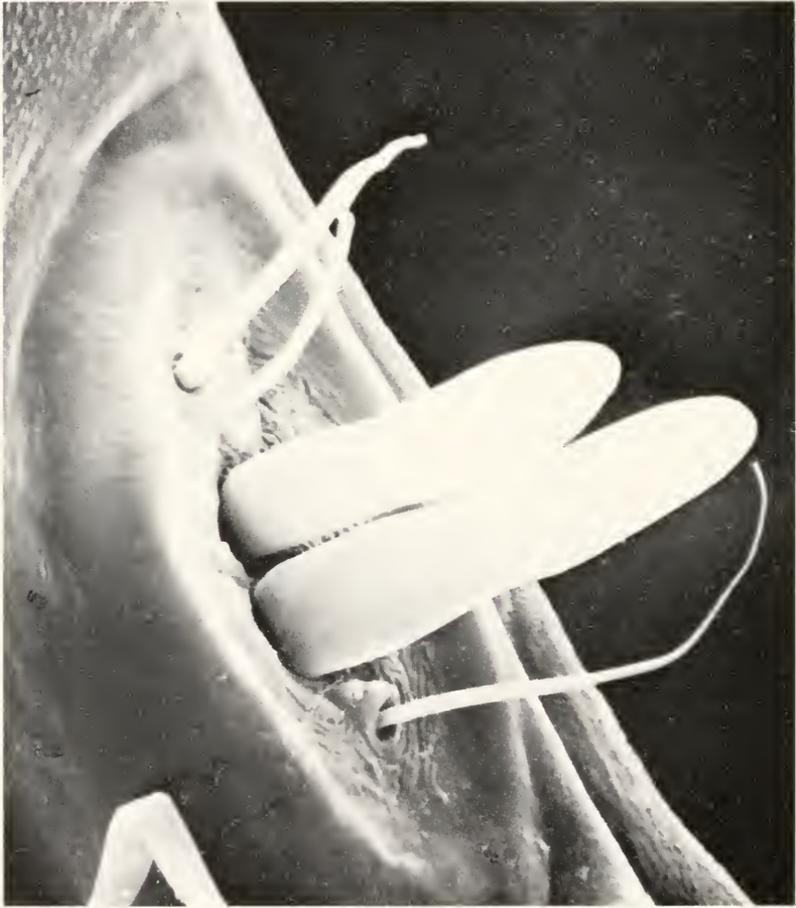


Figure 2. *Dolophilodes major* (Banks), Larval antenna, SEM micrograph, right lateral view of head at 1000 X.

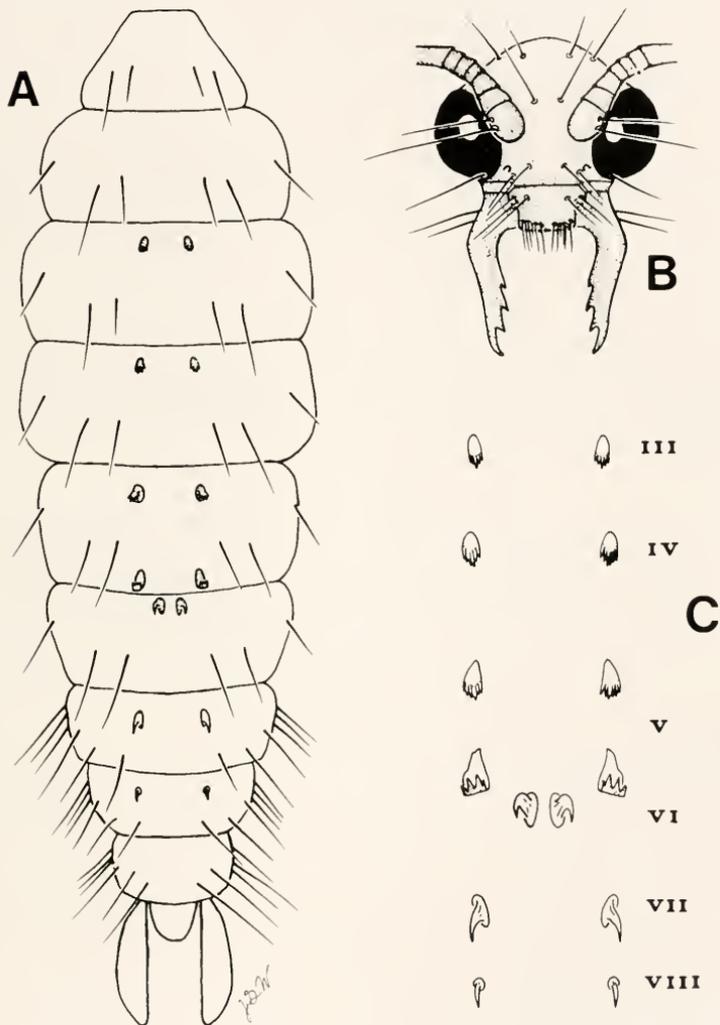


Figure 3. *Dolophilodes major* (Banks), Pupa: A) abdomen, dorsal view; B) head; C) abdomen, dorsal hook plates.

Material Examined

GA: Union Co.: Vogel State Park, Wolf Creek, 30-31 May 1980, 6♂, 1♀, light trap, coll. J.C. Morse *et al.*, NC: Swain Co.: Great Smokey Mountain National Park, Deep Creek Campground, 1.5 mi. N Bryson City, 21 May 1970, 4♂, coll. O.S. Flint, SC: Pickins Co.: Wildcat Creek, 5 mi NW Clemson, 5-6 May 1979, 2♂, 2♀, light trap, coll. T.R. White and J.S. Weaver III; Rocky Bottom, Reedy Cove Creek, 6 September 1979, 1 larva, coll. J.C. Morse; Table Rock State Park, Carrick Creek, 21 May 1969, 1♂, coll. J.C. Morse. Oconee Co.: Small springbrook above Wash Branch of Towns Creek, 5 mi., NW Tamassee, elev. 2200 ft., 2-3 June 1980, 1♂, coll. E.M. McEwan and J.S. Weaver III. TENN: Carter Co.: Roan Mountain State Park, Small tributary of Dave Miller Hollow Branch, 7 May 1977, 1 larva, coll. J.A. Wojtowicz, R.L. Jones, and W.H. Redmond; Twin Springs on Roan Mountain, 5.8 mi. S. Roan Mountain (town), elev. 4200 ft., 6 May 1977, 1 larva, coll. J.A. Wojtowicz, R.L. Jones, and W.H. Redmond. Monroe Co.: seep at wooden low water bridge, South Fork Citico Creek, 5 April 1970, 1 larva, coll. J.A. Wojtowicz and R.L. Jones; 11 May 1979 1♂, 2♀ pupae, coll. J.A. Wojtowicz, D.A. Etnier *et al.* Sevier Co.: Great Smokey Mountain National Park, Walker Prong, elev. 4500 ft. small seep near West Prong Little Pigeon River, 4 July 1979, 1♂ pupa, 1♀ pupa, coll. J.S. Weaver III; LeConte Creek 4 mi. SE Gatlinburg, 5 June 1973, 1♂, coll. D.A. Etnier, VA: Shenandoah National Park, Lewis Falls, 29 June 1958, 1♂, coll. G.W. Byers; Grayson Co., Fox Creek, 1.7 mi. W Trout Dale, 12 June 1979, 1♂, 1♀, coll. C.M. and O.S. Flint; Rapahannock Co., Washington, 24 July, 1♂, 1♀, coll. J.H. Roberts.

ACKNOWLEDGEMENTS

We wish to thank Mrs. JoAn Hudson and Mr. Clyde B. Moore, Clemson University, who provided help with the scanning electron microscopy. We express our sincere gratitude to Dr. O.S. Flint, U.S. National Museum, Washington, D.C., who provided additional records. We are also grateful to Drs. E.W. King and J.C. Morse, Clemson University, whose encouragement and advice were most helpful during this study.

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LEUCTRA SZCZYTKOI, A NEW STONEFLY FROM LOUISIANA (PLECOPTERA:LEUCTRIDAE)^{1,2}

Bill P. Stark³, Kenneth W. Stewart⁴

ABSTRACT: *Leuctra szczytkoi*, n. sp. is described from Louisiana and a holotype male is designated. The male is distinguished from some others in the *ferruginea* (Walker) complex.

We have recently acquired a male *Leuctra*, collected at an isolated spring in Jackson Parish, Louisiana, which is an undescribed member of the *ferruginea* complex. Since that complex was recently reviewed by James (1976), we are herein providing a comparative description of this species.

Leuctra szczytkoi, n. sp.

Male — Forewing length 7 mm; body length 5 mm. Head dark brown with indistinct rugosities. Pronotum with faint dark mid-dorsal line separating broad light areas; areas of dark rugosities laterad to light strip. Tergum 7 with small oval thickening on mid-anterodorsal line; tergum 8 with basal sclerotized band expanded into pointed triangular area on mid-dorsal line; mesal field unsclerotized (Fig. 2). Specillum with apical spine twice as long as wide. Paraprocts subequal to specillum in length, slender, sinuate and apically acute (Fig. 1).

Type — Holotype ♂ (# 76749) from Louisiana, Jackson Par., Schoolhouse Springs, nr. Indian Village, 30-III-73, J. Morse & J. Louton. Holotype deposited in United States National Museum.

Diagnosis — This species can be separated from others in the complex by the prominent specillum spine, the long paraprocts and by the acute process of tergum 8. Both *rickeri* James and *ferruginea* (Walker) typically have a rounded process on tergum 8, and in both species the specillum is longer than the paraprocts.

Etymology. — This species is named in honor of Dr. Stanley W. Szczytko.

ACKNOWLEDGEMENTS

We thank Dr. W.E. Ricker for providing the holotype specimen for our study, and Dr. K. Manuel for loan of *L. rickeri* and *L. alabama* paratypes. Dr. O.S. Flint, Jr., and Dr. R.W. Baumann provided helpful comments during review of the manuscript.

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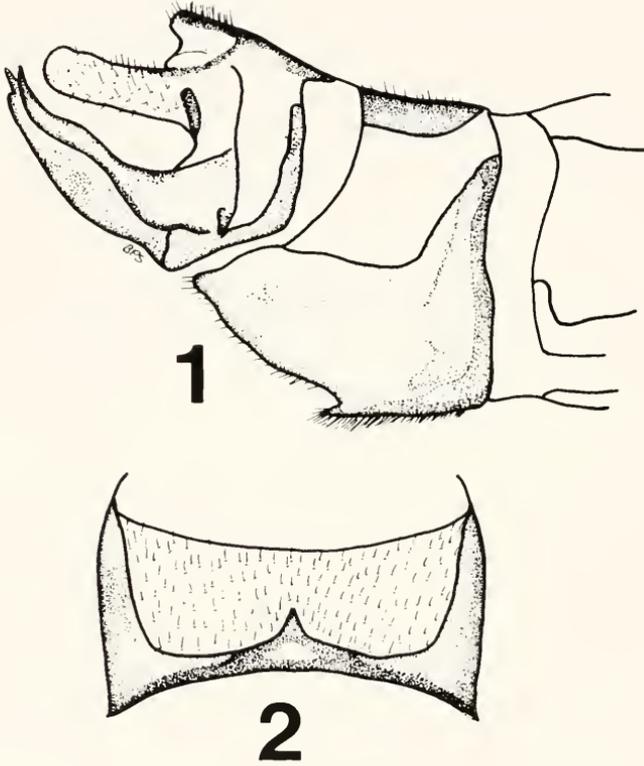
²Study supported in part by National Science Foundation Grant #DEB-79-20445 and the Faculty Research Fund of NTSU.

³Department of Biology, Mississippi College, Clinton, MS 39058.

⁴Department of Biological Sciences, North Texas State University, Denton, TX 76203.

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James, A. 1976. Two new species of *Leuctra*, with notes on the *ferruginea* group (Plecoptera:Leuctridae). Ann. Entomol. Soc. Amer. 69:882-884.



Figs. 1-2. *Leuctra szczykoi*. . Male terminalia, lateral. 2. Male tergum 8.

***BOURLETIELLA (BOURLETIELLA) GIBBONSI,*
A NEW SPECIES FROM SOUTH CAROLINA
(COLLEMBOLA: SMINTHURIDAE)^{1,2}**

Richard J. Snider^{3,4}

ABSTRACT: A new species, *Bourletiella (Bourletiella) gibboni* Snider, is described from South Carolina. This species is closely allied to *Bourletiella (Bourletiella) rustica* Maynard, but can be separated on the basis of color pattern, presence of an outer tooth on the unguis and subapical needle on the unguiculus. The type locality is the Savannah River Plant, U.S. Department of Energy, Aiken, South Carolina. The collection was made in short grass on a bright, hot day.

During a visit to the University of Georgia's Savannah River Ecology Laboratory, near Aiken, South Carolina, I had the opportunity to make collections of Collembola. In particular, several species of sminthurids were taken by using a white enamel pan for sweeping grass and an aspirator for collecting. In a later paper the new additions to the faunal list for South Carolina will be presented. The purpose of the present report is to describe a previously unnamed species.

***Bourletiella (Bourletiella) gibboni* n. sp.**

Color Description

Antenna purple, first segment uniformly dark, segments II and III darker distally, segment IV dark throughout. Head with light and dark purple mosaics forming two bands originating behind head, extending through eyepatches and converging between antennae forming a "V", a yellow-orange mosaic pattern above the intersection of the "V"; another band formed midway between eyepatches and mouthparts, with three dark mosaics creating a broken line of dots on frons; the three mosaics and base of "V" pattern above, constitute a triangular pattern; lower frons with light purple dusting. Thorax with paramedial lines broken. Abdomen with paramedial and lateral lines converging on dorsum of segment V; segment VI with dorsal maculae; bothriotrichium D surrounded with purple; parafurcular lobe with inverted crescent-shaped macula. Leg beyond trochanter with light dusting of purple, darkest distally on each segment. Bases of dentes purple. Body cream colored, becoming light yellow dorsally. Male color pattern same as female, except ground color more intense yellow (fig. 1 and 2).

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²Publication support was provided by the Savannah River Ecology Laboratory of the University of Georgia at Aiken, South Carolina.

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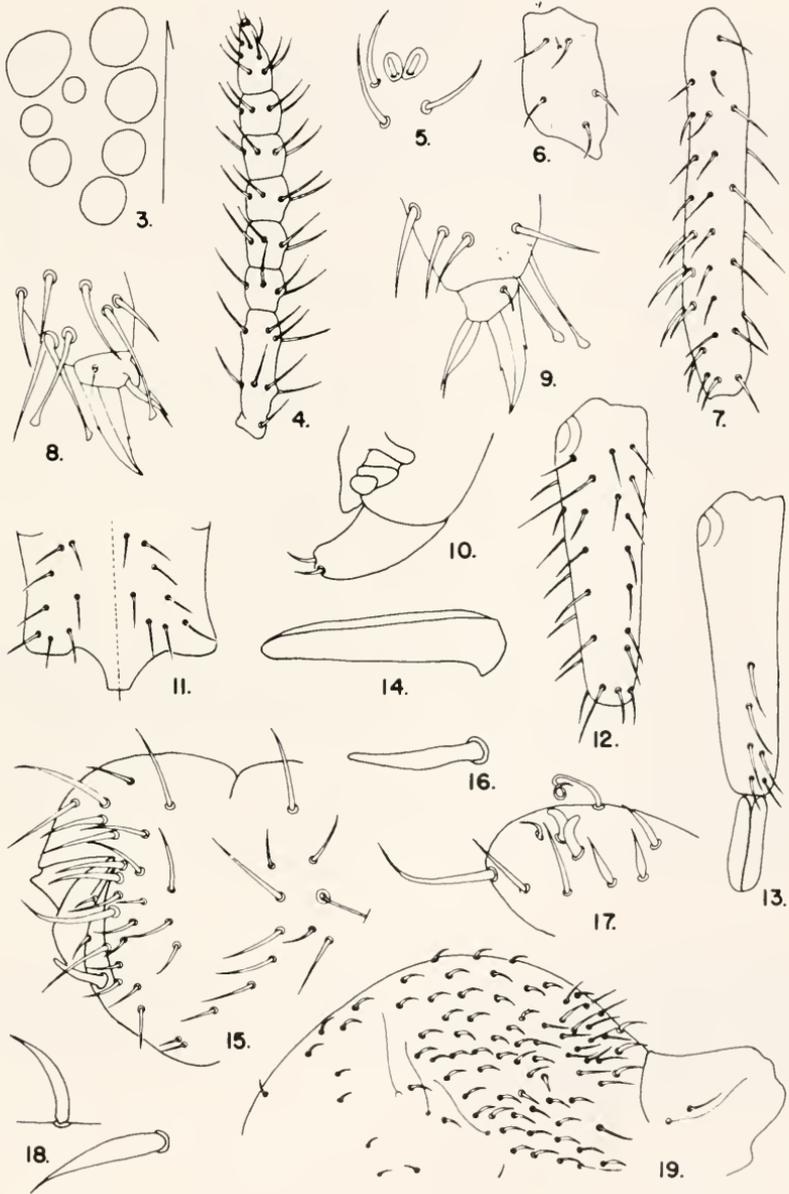


Bourletiella (Bourletiella) gibbonsi n. sp. Fig. 1. Dorsal view, habitus, Fig. 2. Lateral view, habitus.

Morphological Description

Eyes 8 + 8 on dark patches; ocellus C two thirds diameter of H, D smaller than H (fig. 3). Antennal segment ration 1:2:3:6; ANT IV with five intermediates, apical bulb present (fig. 4); ANT III without spine-like setae, sense organ with two blunt setae lying in shallow depressions (fig. 5). Thoracic segmentation indistinct. Metatrochanter with oval organs; setal pattern typical, five anterior and one posterior (fig. 6). Metafemur with posterior setula. Distal half of tibia with strong inner setae (fig. 7); tibiotarsus of pro- and mesolegs with three heavy, appressed, clavate tenent hairs (fig. 8); metatibiotarsus with two tenent hairs. Pretarsus with anterior setula; unguis curving sublanceolate with basal outer tooth and weak inner tooth one-half to three-quarters distant from base; unguiculus tapering, without corner tooth, with short subapical needle less than one quarter of its length (fig. 9). Sacs of ventral tube warty. Rami of tenaculum tridentate; anterior corpus with two setae (fig. 10). Manubrium with 16 dorsal setae (fig. 11). Dental setae Ve_3 longer than interval between Ve_3 and Ve_2 (fig. 13), seven internal lateral setae (fig. 12). Mucro spoon-shaped, with rachis fused to lateral lamellae (fig. 14). Female anal papilla with a few heavy circumanal setae (fig. 15), subanal appendage setiform in lateral and truncate in ventral view (fig. 16). Male anal papilla with dorsal crest; anterior spines setiform, slightly curving, anterior lateral spine curved forward and posterior spine curved backward; tendril present (fig. 17). Body setae of female short, curving, longer on posterior; male with short heavy, curving setae (fig. 18) on posterior half, a patch of longer, normal setae anterior of ABD V (fig. 19). Bothriotrichia in an oblique straight line, typical for genus. Length: males 0.5 — 0.6 mm and females 0.8 — 0.9 mm.

Bourletiella (Bourletiella) gibbonsi n. sp. Fig. 3 Ocellar pattern, holotype, Fig. 4. Antenna, Fig. 5. Antennal segment III, sense organ, Fig. 6. Anterior view of metatrochanter, Fig. 7. Anterior view of metatibia, Fig. 8. Claw of proleg, posterior surface, Fig. 9. Claw of metaleg, anterior surface, Fig. 10. Retinaculum, allotype, Fig. 11. Dorsal surface of manubrium, Fig. 12. Dens, ventral view, Fig. 13. Dens, dorsal view, Fig. 14. Lateral view of mucro, allotype Fig. 15. Female anal papilla, allotype, Fig. 16. Female subanal appendage, ventral view, Fig. 17. Male dorsal crest, holotype, Fig. 18. Dorsal abdominal setae of male, Fig. 19. Abdomen of male.



Diagnosis

Bourletiella gibbonsi keys out to *Bourletiella rustica* Maynard in Stach (1956); his description is based upon the original by Maynard (1951). In Christiansen and Bellinger (1980-81), it also keys to *rustica*. When a comparison is made of the original description and illustrations (1951, figs. 373, 568-574), separation of the species is as follows:

<i>rustica</i>	<i>gibbonsi</i>
Pigment brown and tan lateral lines broad, irregular	Pigment dark purple, lateral lines narrow, regular
unguis without outer tooth	unguis with outer tooth
unguiculus without subapical needle	unguiculus with needle
tendril of male subequal to anterior spines	tendril almost twice length of anterior spines
female subanal appendage blade-like (ventral view)	subanal appendage thick, blunt (ventral view)

The two species are similar in pigment pattern of head and anal papilla. Both have antennal segmentation in ratio of 1:2:3:6 and ANT IV with five intermediates. The general shape of the female subanal appendage is the same, *gibbonsi* is slightly thicker. The female circumanal setae form a similar pattern in both species. The male dorsal crest of *gibbonsi* more closely resembles that of *Bourletiella hortensis* (Fitch). However, the number of tenacular setae is two for *hortensis* and three for *gibbonsi*. In addition, color pattern should separate the two species.

Types

Holotype (male), allotype (female), two male and one female paratype on slides; 94 paratypes in alcohol. Holotype, allotype and 84 paratypes deposited in the Entomology Museum, Michigan State University; 10 paratypes deposited in the Entomology Museum, the University of Georgia at Athens. All specimens were collected in South Carolina, Barnwell County, Savannah River Plant, U.S. Department of Energy, near Aiken, on roadside grass, August 25, 1980, R.J. Snider, collector.

Remarks

This species was collected on a bright, hot (31 C) day. The habitat was mowed grass growing on the side of paved road within the Savannah River Plant boundaries. The grass was approximately 150 centimeters high and grown in full sunlight. The number of males and females was about equal. It is my pleasure to name this colorful species for my long-time friend, Dr. J. Whitfield Gibbons, Associate Director of the Savannah River Ecology Laboratory of the University of Georgia.

ACKNOWLEDGEMENTS

Special thanks are offered to the Department of Entomology, University of Georgia and Dr. D.A. Crossley, Jr. for the use of facilities and aid in manuscript preparation. Field collecting was carried out under the auspices of Contract DE-AC09-76SR00819 between the U.S. Department of Energy and the University of Georgia.

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NORTHERN RANGE EXTENSION OF *ACANALONIA CONICA* (HOMOPTERA: ACANALONIIDAE)¹

L.L. Pechuman,² A.G. Wheeler, Jr.³

ABSTRACT: The acanaloniid planthopper *Acanalonia conica* (Say) is newly recorded from Connecticut, New York, and Pennsylvania. This northern extension of the known distribution is attributed to natural dispersal of more southern populations.

Acanalonia conica (Say), a common fulgoroid in much of the eastern United States, ranges south into Central America. The northernmost records, as cited in the catalogue of Homoptera (Metcalf 1954), are from Delaware, Maryland, and Ohio. In this paper we are giving new records from Connecticut, New York, and Pennsylvania and suggesting that populations of *A. conica* have moved northward in recent years.

The following distribution records are based on personal collecting and specimens in the insect collections of the American Museum of Natural History, New York (AMNH); Cornell University, Ithaca, NY (CU); Pennsylvania State University, University Park (PSU); Pennsylvania Department of Agriculture, Harrisburg (PDA); State Univ. New York, College Environ. Sci. & For., Syracuse (SUNY-ESF); and U.S. National Museum, Washington, DC (USNM). Complete data are cited for all specimens except the large numbers collected by students at Ithaca and Syracuse, NY, and State College, PA; for those localities only the earliest date of collection is listed, plus the range of collection dates for additional specimens. We also checked the collections of the Carnegie Museum of Natural History, Pittsburgh, PA, Connecticut Agricultural Experiment Station, New Haven, and the New York State Museum, Albany, for possible northern records of *A. conica*, but no specimens pertinent to this study were found.

CONNECTICUT. Fairfield Co., Westport, 6 Sept. 1967, M.A. Deyrup.

NEW YORK. Madison Co., Cazenovia, 27 Aug. 1975. Monroe Co., Rochester, 3 Sept. 1972, B. Hughes. Nassau Co., Hicksville, 14 Aug. 1974, M. O'Brien. Onondaga Co., Collamer, 8 Oct. 1972; Jamesville, 8 Oct. 1972, J. Blake; Syracuse, 17 Sept. 1968, D. Hoover; same date, G. Kelly, and 49 collections, from 28 July-20 Oct. 1968-79; Tully, 13 Oct. 1971, S. Bosch. Ontario Co., Geneva, 4 Sept. 1973, H. Tashiro. St. Lawrence Co., Cranberry Lake, 1 Sept. 1955. Suffolk Co., 1 Aug. 1972, G. Licata; Caumsett State Park, 21

¹Received December 13, 1980.

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³Bureau of Plant Industry, Pennsylvania Department of Agriculture, Harrisburg, PA 17110.

Aug. 1977, G.C. Eickwort. Tompkins Co., Ithaca, 6 Sept. 1956, H.E. Evans, and numerous student collections, from 5 Aug.-24 Sept. 1966-79; Ludlowville, 5-6 Sept., 1971, L.L. Pechuman, and several collections 1974-80. Ulster Co., Walker Valley, Aug. 1955. Wayne Co., Sodus, 18 Aug. 1974.

PENNSYLVANIA. Bucks Co., Feasterville, 10 Sept. 1956 and 24 July 1967, E.E. Simons. Butler Co., Butler, 18 Aug. 1971, A.G. Wheeler, Jr. Centre Co., Benner Springs, 4 Sept. 1978, J.O. Pepper; State College, 28 July 1949, S.W. Frost, and 6 collections, from 21 July-6 Oct. 1977-79. Chester Co., Seven Stars, 20 Aug. 1974, T.J. Henry and A.G. Wheeler, Jr. Dauphin Co., Harrisburg, 25 July 1958, E.U. Balsbaugh, Jr. Delaware Co., Oakmont, 14 Oct. 1932, G.B. Slesman; Swarthmore, 31 July, 6 Aug. 1960 and 12 Aug. 1961, R.G. Beard. Franklin Co., Blue Ridge Summit, Aug. 1915. J.A. Hyslop. Lancaster Co., Ephrata, 3 Sept. 1971, A.G. Wheeler, Jr.; Manheim, 17 July 1979. A.G. Wheeler, Jr. Lebanon Co., Lebanon, 18 July 1979, S. Royer. Lehigh Co., Allentown, 22 Aug. 1973, L. Signorovitz; Orefield, 19 July 1972, J. Spirk. Montgomery Co., Conshohocken, 20 July 1939, L. Stannard. Northampton Co., Easton, 13, 15 Aug. 1973, J. Spirk. Philadelphia Co., Morris Arboretum, 11 July 1979, A.G. Wheeler, Jr. Washington Co., McMurray, 6 Aug. 1973, D. Trelka. York Co., Manchester 16 Aug. 1973, W.E. Blosser.

The first known Pennsylvania record — 1915 from Blue Ridge Summit on the Maryland state line — hardly represents a range extension; a northward shift in populations of *A. conica*, as reflected by museum specimens, is not apparent until the 1930's. Records from various collections show a progressive movement: southeastern Pennsylvania (1930's), central portions of the state (1940's and 50's), and New York at Ithaca (1956) and Syracuse (1968). An earlier, more northern record (Cranberry Lake, NY, 1955) may represent merely a fortuitous collection. Only in the last 10-12 years have students in introductory entomology courses at Cornell and SUNY-Syracuse collected large numbers of specimens. In 1974 this fulgoroid was represented in about 50 to 100 collections made by Cornell students.

Available evidence suggests that *A. conica* has moved northward in recent years. This species was not recorded in the lists of western Pennsylvania Hemiptera (Wirtner 1904), Homoptera of New York's Cranberry Lake region (Osborn 1922), New York insects (Leonard 1928), or Connecticut Homoptera (Van Duzee 1923); nor was it among the fulgoroids found associated with ornamental plants in Connecticut (Walden 1922, 1927). We also feel that Roy Latham, a well-known naturalist who by the 1960's had assembled an extensive collection of Long Island insects (Pechuman 1969), would not have overlooked this distinctive, gregarious species that often congregates on stems of woody plants.

The known distribution of *A. conica* now has been brought nearly to Lake Ontario in western New York (Sodus) and to the Adirondacks in northeastern New York (Cranberry Lake). Changing faunal ranges often involve artificial spread with man's commerce or long-distance movement with convective air currents. Although we cannot dismiss these factors, we

feel that the influx of this fulgoroid into Pennsylvania, New York, and Connecticut represents a relatively recent natural and progressive dispersal of more southern populations.

ACKNOWLEDGEMENTS

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TWO NEW PARASITE RECORDS AND NOTES ON
PETROVA ALBICAPITANA (BUSCK)
(LEPIDOPTERA: OLETHREUTIDAE) ON JACK
PINE, *PINUS BANKSIANA* LAMB. IN MAINE¹

Robert A. Tracy, Eben A. Osgood²

ABSTRACT: The distribution and some aspects of the natural control of *Petrova albicapitana* (Busck) were determined. Two parasites, *Hyssopus thymus* (Gir.) and *Phrynofrontina* prob. n. sp. were reared for the first time from this host.

The pitch nodule maker, *Petrova albicapitana* (Busck) bores into pine shoots and causes pitch blisters on twigs of jack pine, *Pinus banksiana* Lamb., Scots pine, *P. sylvestris* L. and lodgepole pine, *P. contorta* Dougl. Severe deformation may result when branches and terminal shoots are girdled and killed. This insect attacks trees of varying ages, and populations may be heavy on trees from 0.3 to 1.5 meters in height and in mature (50 to 60 year) stands (Turnock 1953, McLeod and Tostowaryk 1971).

The life history and ecology of *P. albicapitana* in Manitoba and Saskatchewan was studied by Turnock (1953). *P. albicapitana* has a two-year life cycle. Eggs are laid from early June to mid-July on tips of the new growth. During the remainder of the summer, larvae feed at this site, making small blisters of pitch and silk on the stems. Larvae overwinter within these pitch blisters and feed in them for a short time the following spring. They then migrate down the branch to a crotch and construct a large nodule of pitch, frass and silk, where they feed throughout the second year. Larvae spend the second winter in this nodule which becomes hard and darkened in winter. Larvae continue feeding the second spring and fresh pitch appears adjacent to the old pitch nodule. In May, larvae pupate in a chamber constructed within the nodule. One end of this chamber is covered by a very thin layer of pitch and silk and adults emerge through this exit in June. This species has two broods which emerge in alternate years. One brood is usually much smaller than the other. Turnock (1953) reported that 12 species of parasites attack this host.

There have been no previous studies of *P. albicapitana* in the eastern United States. The present study was undertaken to determine the distribu-

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tion of *P. albicapitana* in Maine and the parasites and other mortality factors affecting it.

Methods

In 1979, all areas known to contain jack pine were checked to determine the distribution of *P. albicapitana* in the state. At this time a visual estimation of population density was made.

The area selected for study was located in Deblois. On June 2, 1978, branches from several large (25 year old) trees, which contained 117 pitch masses of the 1977-79 brood, were collected for parasite rearing and mortality studies. An additional 157 masses were collected from both large and small trees on June 2 and 4 to obtain additional parasites. *P. albicapitana* was in the pupal stage at this time. In July 1979, the number of pitch masses of *P. albicapitana* were counted on 100 small trees (0.6 — 3 meters in height) to determine the relative abundance of each brood.

Twigs with pitch masses were kept at room temperature on 0.5 liter, airtight plastic containers. Needles were removed to prevent excess moisture and fungal growth. Containers were checked twice daily and emerging insects were killed by freezing. Since *P. mafica* Miller (Miller 1978) has previously been reared with *P. albicapitana* from blister-bearing twigs on jack pine (McLeod and Tostoworyk 1971), all emerging moths were examined to confirm their identity. Pitch masses, from which no insects emerged, were dissected to determine the number of dead hosts and parasites.

The amount of new pitch produced on the pitch mass in the spring of pupation was thought to be an indicator of larval health. Therefore, the diameter of new pitch produced in the spring was measured. If masses were not spherical, diameters were calculated from the average of several measurements.

Results and Discussion

Distribution and Abundance

P. albicapitana was found in five localities in central Maine (Fig. 1). Many trees from .3 - 8 meters in height contained a pitch mass at nearly every crotch on the main stems and branches at the study area in Deblois. Much lighter infestations were found in a 44 year old plantation on the University Forest in Orono, in natural jack pine up to 5 meters in height near Debsconeag Deadwater (Twp. 2, Range 9), in a 25 year old Twp. 30 plantation, and on a second 25 year old plantation in Deblois. None were found in an 80 year old stand of jack pine in Lake Parlin (Somerset County).



Fig. 1. Distribution of *P. albicapitana* in Maine.

In the Deblois study area the 1977-79 brood was much larger than the 1979-80 brood. All of the 146 pitch masses found on the 100 small sample trees belonged to the 1977-79 brood. Only one 1978-80 brood pitch mass was found after examination of several hundred trees.

All specimens of *Petrova* reared in this study were those of *P. albicapitana*.

Natural Control

Mortality encountered in the sample of 117 pitch masses from known and unknown causes was as follows. Sixteen pitch masses (13.7%) were destroyed by breakage of twigs by wind or other causes. Twenty-four masses (20.5%) contained dead larvae; 19 having died before the resumption of feeding in the spring. The remaining five contained mature larvae in the feeding chamber, which was filled with pitch. Twenty-one (17.9%) died in the pupal state, and 8 (6.8%) as moths during emergence. Parasitism accounted for the remaining mortality of 10.3%. Thirty-six moths (30.8%) emerged successfully.

The amount of new pitch was found to an indicator of larval health. Seventy-nine percent of the 24 pitch masses with dead larvae had no new pitch, and 100% mortality occurred in masses which contained less than 5 mm of new pitch. Moths emerged from pitch masses with a mean diameter of 12 mm of new pitch.

Table 1 shows the relative abundance of four species of parasites reared from a total of 274 pitch masses of *P. albicapitana*. Turnock (1953) reported that parasitism rates were generally low. He theorized that since parasites had a one-year life cycle and attacked only year old migrating host larvae, the smallest of the two broods limited the parasite population and protected the larger brood from heavy parasitism. The low parasitism rate of 6.9% in the present study was expected since one brood was much larger than the other.

Table 1. Parasites reared in the laboratory from 274 pitch masses of *P. albicapitana* in Maine.

Species:	Number of <i>P. albicapitana</i> parasitized
<i>Phrynofrontina</i> prob. n. sp. (Tachinidae)	5
<i>Apanteles petrovae</i> (Braconidae)	1
<i>Exeristes comstockii</i> (Ichneumonidae)	1
<i>Hyssopus thymus</i> (Eulophidae)	12

Phrynofrontina prob. n. sp. emerged from pitch masses which were of normal size and contained normal amounts of new pitch. These solitary larval parasites left the host and pupated near the exit. *Phrynofrontina* sp. was reared from larvae of *Petrova metallica* (Busck) in the Canadian Rockies (Stark 1957), but the genus had not been previously reported from *P. albicapitana*.

One specimen of *Apanteles petrovae* Walley emerged from a pitch mass which had no fresh pitch present, and a single specimen of *Exeristes comstockii* (Cr.) emerged from a mass with little new pitch. Turnock (1953) reported these species emerging from pupae of *P. albicapitana* in Canada.

Hyssopus thymus Girault emerged during June 10-13. From one to 12 individuals emerged from each of the four pitch masses containing normal amounts of new pitch. Remains of dead and emerged *H. thymus* were found in eight additional masses containing no new pitch. Miller (1955) reared this parasite from *P. comstockiana* (Fernald) and reported than an overwintering generation emerges in April and a summer generation from late May to early June. Thus, it seems that masses containing no new pitch were parasitized by the overwintering generation, and parasites emerging in June might have been second generation parasites. It should be noted that

high populations of *P. comstockiana* exist in coastal areas approximately 10 miles from the study area. *H. thymus* has not been previously reported from *P. albicapitana*.

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INSECT COLONIZATION OF DRILLED TREE HOLES^{1,2}

Jerry W. Heaps³

ABSTRACT: Beginning in 1978 January, and continuing over a 18 month period, 30 drilled holes in the West Virginia University Forest, Coopers Rock State Park, Morgantown, West Virginia were sampled to determine species of colonizing insects. Insect colonizers included four species of Culicidae, one species of Syrphidae, and undetermined species of Trichoceridae, Ceratopogonidae, and Helodidae. Numbers of individuals fluctuated widely both with time of year and from site to site. Colonization was typically initiated with retention of water or damp detritus material in a previously dry hole. Following moisture loss, insect habitation was very limited.

Tree holes provide a unique and specialized abode for breeding by many insects, other invertebrates and vertebrates. Competition for existing sites is intensive and environmental conditions may make some tree holes unavailable for use. Increasing the number of tree holes in an area could relieve some of this intra- and interspecific competition for existing breeding sites. The United States Forest Service is studying the effectiveness of drilled holes in three tree species to accelerate decay formation for various squirrel species (Sanderson & Michael, 1975)⁴. While some drilled holes were utilized by squirrels, a large number were retaining a high level of moisture making squirrel habitation impossible, but increasing probability of insect habitation. Tree holes vary from dry, to damp, to wet (standing water). Each habitat supports different, and sometimes predictable, insect colonizers which require specific habitats. Wood-boring insects are found in dry holes; fungus-feeding insects in damp, fungus-containing holes; and mosquito, syrphid and ceratopogonid larvae in wet tree holes. The insect families Culicidae and Ceratopogonidae include

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⁴Sanderson, H.R. and E.D. Michael, 1975. Informal publication. Study Abstract Sheet, Study No. FS-NE-1702-12. Northeastern Experiment Station, Morgantown, West Virginia.

many species that are annoying to man and livestock because of their bloodsucking habits. Some species of tree hole breeding mosquitoes are important disease vectors.

Among those who have studied the ecology and biology of tree holes are Kitching (1971) and Smith and Trimble (1973). Numerous reports are available on specific tree hole inhabitants, especially mosquitoes. Fairly complete information about the occurrence of mosquitoes in tree holes exists for many parts of the world and faunal lists have been produced.

Methods and Materials

The study area was a mixed stand of hardwoods, primarily oaks and maples, on a sloping ridge at an elevation of 788 meters. The site is located in the West Virginia University Forest at Coopers Rock, Monongalia County, West Virginia.

From 1975 September to 1976 December the U.S. Forest Service (USFS) drilled 192 (numbers 001-192) tree holes equally divided among *Acer rubrum* L. (red maple), *Quercus alba* L. (white oak) and *Q. rubra* L. (red oak). An electric drill powered by a portable generator was used to form a triangular cavity about 8 cm on a side and approximately 15 cm deep. Elevation of holes averages 7.7 meters above the forest floor.

Every fourth tree was selected to divide each tree species into four groups with relatively equal diameter at breast height distributions. Each group was randomly selected for treatment [drill only, drill plus glycerol (100 cc), drill plus fungus, and drill plus glycerol (50 cc) and fungus]. Glycerol was added as a substrate for fungal growth to determine if the tree hole decay could be accelerated.

Fungal cultures, obtained from Dr. F. Berry, Northeastern Forest Experiment Station, Delaware, OH. were tree species — specific as follows:

- red maple inoculations — *Inonotus* (= *Polyporus*) *glomeratus* (Pk.) Murr.
- northern red oak inoculations — *Phlebia chyrsocrea*
- white oak inoculations — *Polyporus compactus* Overh.

From the 192 trees drilled and otherwise treated by USFS personnel, 30 trees were randomly selected for insect sampling without regard to tree species or to the four treatments mentioned above. 192 paper slips, numbered 001-192, were placed in a circular bin, mixed, and 30 slips were chosen. The results produced 11 white oak, 4 red oak and 15 red maple tree holes to be monitored for insect activity. At the location of the drilled holes the tree trunks were approximately perpendicular to the ground. Tree holes were examined on each of the following dates: 12 May 1978, 24 August 1978, 14 November 1978 and 10-12 April 1979. The author attempted to

obtain a sample on a date that corresponded to each of the four seasons of a year.

Access to tree holes for sampling was obtained by use of two 3.4 meter sections of Swiss[®] ladders secured to the tree. A harness was used which provided safety and allowed freedom of movement during the sampling process. Collection equipment included suction pipettes, forceps, teaspoon, flashlight and several two dram vials placed in a shotgun shell belt secured around the waist. On each sampling date any liquid samples which contained insect larvae or any adult insects collected were returned to the laboratory for further examination.

Insect larvae removed from water-filled tree holes were returned to the laboratory intact in their aquatic media for rearing. Because of the fluctuating water levels in a tree hole during the year, only 10-15 ml of liquid was removed, so as not to hasten water loss within that hole. The sample liquid was mixed with 10-15 ml of distilled water and placed in a 50 ml beaker with finely ground Purina Lab-Chow[®] added as larval food. Plastic wrap secured over the beaker has a three-fold function: (1) prevented formation of a surface film that would hinder the respiration of surface-breathing larvae, (2) prevented evaporation and (3) maintains a constant internal temperature. Beakers were placed in an environmental chamber with a 12-12 hour photoperiod and at 28°C temperature.

Results and Discussion

Sampling results for each of the 30 tree holes utilized in this study are presented below. Trees of each of the three species are listed according to tree number (001-192) as designated by USFS researchers. Following the general results and discussion, each tree species will be discussed as to its suitability for insect habitation.

White Oak - *Quercus alba*

- #029 — cavity exposure (cav. exp.) WSW. No insect observed (NIAO) dry hole (DH).
- #035 — cav. exp. WSW. NIAO. DH.
- #131 — cav. exp. E. NIAO. DH.
- #173 — cav. exp. ESE. NIAO. DH.
- #41 — cav. exp. ESE NIAO. DH.
- #42 — cav. exp. ESE. NIAO. DH.
- #180 — cav. exp. ESE. 12 May: water in hole and *Aedes triseriatus* (Say) (Diptera: Culicidae) larvae were collected and reared. At other sampling periods the hole was dry and no additional insect species were present.
- #183 — cav. exp. ESE. NIAO. DH.
- #186 — cav. exp. SSE. NIAO. DH.
- #190 — cav. exp. NNW. NIAO. DH.
- #191 — cav. exp. W. NIAO. DH.

Red Oak – *Quercus rubra*

- #10 — cav. exp. SSE. No insect activity observed; dry hole.
#124 — cav. exp. NNW. No insect activity observed; dry hole.
#163 — cav. exp. SSW. 12 May: water was in the hole and several larvae of *Eristalis* spp. (Diptera: Syrphidae) were collected. Attempts to rear to adults failed. Further collection results were negative; the hole had dried up.
#34 — cav. exp. SSE. 12 May: *Eristalis* spp. were collected. On 10 April the hole was damp and larvae of Ceratopogonidae and Trichoceridae (Diptera) were collected.

Red Maple – *Acer rubrum*

- #14 — cav. exp. N.NIAO.DH.
#27 — cav. exp. SSW. 12 May: larvae of *Eristalis* spp. and *Ae. triseriatus* were collected. Further collection results were negative, the hole had dried out.
#107 — cav. exp. N. 14 Nov: the hole was filled with water and larvae of *Orthopodomyia alba* Baker (Diptera: Culicidae) were collected. This is the first time this mosquito species had been collected in the state of West Virginia (Heaps, 1980). On 12 April, the hole contained only damp detritus; a teaspoon of this was collected and re-hydrated with 30 ml of distilled water back in the laboratory. This detritus contained diapausing eggs of *Ae. hendersoni* Cockerell (Diptera: Culicidae). The dozen larvae that hatched from these eggs were reared. *Ae. hendersoni* is a rare species in West Virginia, only once previously collected Amrine & Butler, 1978).
#113 — cav. exp. SSE. 24 August; larvae of *Ae. triseriatus* and Ceratopogonidae were collected. 14 November: larvae of *Eristalis* spp., Ceratopogonidae and 3 adult helodid beetles (Coleoptera: Helodidae) were collected. 10 April: the hole was dry.
#125 — cav. exp. S. NIAO.DH.
#16 — cav. exp. SSW. NIAO.DH.
#148 — cav. exp. S. 24 August: larvae of *Eristalis* spp. and *Ae. triseriatus* were collected. On 10 April, the hole was inhabited by a flying squirrel thus preventing any further sampling.
#150 — cav. exp. SSW. 14 November: larvae of *Eristalis* spp. Ceratopogonidae and 2 adult helodid beetles were collected. Further collection results were negative.
#6 — cav. exp. W. 24 August: one adult female *Ae. triseriatus* was collected.
#112 — cav. exp. WSW. 24 August: larvae of *Anopheles barberi* Coquillett (Diptera: Culicidae) and Ceratopogonidae were collected.
#134 — cav. exp. WSW. NIAO.DH.
#135 — cav. exp. SSW. NIAO.DH.
#138 — cav. exp. S.NIAO.DH.
#139 — cav. exp. SSW. 24 August: 2 larvae of *An. barberi* were collected and reared.
#145 — cav. exp. S. 24 August: 4 larvae of *Ae. triseriatus* were collected and reared.

Kitching (1971) defines a tree hole as any cavity or depression existing in or on a tree and divides them into two distinct categories. First, there are those tree holes which continually maintain an unbroken tree lining and secondly, those which lack this lining and penetrate through to the sapwood and, ultimately, to the heartwood of the tree. The first of these categories may be referred to as "pans" and the second as "rot holes".

Rot holes require some external agent for their initiation. For this reason, the tree holes used in this study fall into this category. Initial damage to the bark was made by drilling of the holes. If environmental conditions allow fungal growth, a subsequent enlargement of the hole by rotting occurs.

Within the current study area three distinct types of tree hole habitats were found. they are: (1) dry holes and dry detritus, (2) holes containing damp detritus but no standing water and, (3) holes with standing water plus detritus. Insect activity was most evident in water-filled tree holes as they served as insect larval habitats; activity is much more limited in drier holes.

Of the tree species studied, red maple is most suitable for insect habitation. The following species of mosquito larvae were found in red maple tree holes during the study: *Aedes triseriatus*, (Say), *Ae. hendersoni* Cockerell, *Anopheles barberi* Coquillet and *Orthopodomyia alba* Baker. No tree hole was found to contain more than one mosquito species at any one time or more than three species of colonizers. Also collected from red maple tree holes were larvae of *Eristalis* spp. and Ceratopogonidae, and adults from the coleopteran family Helodidae.

In this study red maples held water more efficiently than either white or red oaks. However, any one of the three species could provide the necessary requirements for insect habitation if the moisture level remained sufficient for the time needed for the insect to complete its life cycle. Some factors which limit this moisture level in a tree hole are: cavity exposure, inclination of the tree from vertical, rainfall, temperature and the ability of the tree to resist internal and external cracking. The height of the tree hole above the forest floor may influence the composition of the insect fauna present. Common forest floor insects with limited locomotion would have difficulty gaining access to higher tree holes.

The results indicate that holes should not be drilled in red maple in an attempt to increase and accelerate den formation for various squirrel species. Red maple tree holes accumulate water for extended periods of time making vertebrate habitation impossible. Oak trees, especially white, would be an acceptable alternative as a solution to this problem.

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THE FRENULUM OF MOTHS^{1,2}

A. Glenn Richards³

ABSTRACT: The frenulum of most female moths is a cluster of very large acanthae, commonly 3 in number. The frenulum of the male is a multicellular bristle formed by the adhesion or partial fusion of a group of several dozen acanthae. New is the finding that acanthae can combine into a multicellular bristle of unique structure.

Recently, in sorting my large reprint collection, I came upon an old report that appears to have been missed by Zoological Record and other bibliographic sources. In this, Marshall (1922) described the development of the frenulum, a large bristle or hook at the base of the anterior margin of the metathoracic wings of most moths. It serves to hold the wings together to act in unison in flight. First described by DeGeer in 1752, it has been mentioned by numerous entomologists but Marshall's study is the only significant one.

On the basis of stained serial sections of pupal wings of *Galleria mellonella* L. examined by light microscopy, Marshall (1922) reported that the frenulum of males is formed from protuberances of a group of a dozen or somewhat more cells which become joined together into a single large bristle, but that the frenulum of the female is formed from 2 or 3 larger cells which are spaced a little apart from one another. The result is that the male has a single compound bristle whereas the female has several simple bristles of the sort we have recently termed acanthae (Richards and Richards 1969, 1979). Why this sexual difference exists is not known but it is widely recognized by moth taxonomists that one can readily determine the sex of any individual of most moth families by examination of the frenulum. Additionally, Marshall noticed that the number of units in the frenulum of females was not constant in *G. mellonella*. He examined 897 females. Of these, 456 (51 %) had 3 bristles on each wing, 319 (36 %) had 2 on one wing and 3 on the other, 121 (13 %) had 2 on each wing, and a single female had only 1 bristle on each wing.

I have reexamined the situation with ordinary light microscopy, polarized light microscopy and electron microscopy. There is no trace of a socket or of innervation. Therefore these are acanthae with the frenulum of

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males being unusual in that a dozen or several dozen cells combine to produce a single bristle which reveals its multicellular origin by incompleteness of the fusion (Figs. 1, 4, 5). The difference between males and females, then, is in the number of cells involved, the size of the trichogen cells, and the crowding together of these trichogens. The eventual formation of 1 vs several bristles is secondary to the development differences.

The size of the frenulum is fairly well correlated to wing size within a family but not so well between families (relatively small, for instance, in sphingids). In *Galleria mellonella* the frenulum is about 2 mm long in both sexes but is 0.12 mm in basal diameter in the male in contrast to 0.05 mm in the female. In various microlepidoptera the frenulum can be less than 1 mm long. In large noctuid moths such as *Erebus odora* L. and *Thysania zenobia* Cramer I have measured lengths of 6-8 mm (0.25 mm diameter at base). In the occasional oversized specimens of *T. zenobia* (wing expanse about 30 cm) I would expect a length of 1 cm or slightly more. This is longer than any ordinary seta I have seen in insects but is approached by some hair pencils (which are modified setae). It is about the same length as some of the setae of giant tarantulas.

Cross sections of male frenula cut on an ultratome with a diamond knife show that there may be several dozen units in the noctuid moth *Cirphis unipuncta* Haw. (Fig. 4) but about double this number in the larger *Catocala amatrix* Hbn. (Fig. 5). Also the units in *C. unipuncta* fit snugly together and the cuticles seem to have fused whereas in *C. amatrix* intercellular or interacanthal spaces are common and the cuticles of individual acanthae commonly seem distinct though adherent.

In the females of various moths the details vary. I have seen examples ranging from 1 to 6 bristles. Single bristles are recorded for many Aegeriidae, some Pyralidae, some Pterophoridae and a few others. The ones I have examined microscopically (*Podosesia syringae* Harris, *Melittia cucurbitae* Harris, and *Cissuvora ampelopsis* Engle., all aegeriids) clearly showed the single bristles as multiple acanthae. That means it is identical to that of the male. There is no sexual differentiation in these cases. Three bristles seems to be the commonest number for female moths. I have seen only one case with 6 bristles; this was in the aegeriid moth *Aegeria apiformis* Clerck.

The separate bristles in the female are usually similar but not necessarily so. In the noctuid moth *Cirphis unipuncta* there are 2 large bristles and a third (basal) one that is shorter and much more slender.

After treatment with hot alkali frenula of both sexes give positive chitosan tests. They may or may not collapse depending on how sturdy the procuticular component is. Rather surprisingly, male frenula treated with alkali do not separate into the several dozen units from which they originate.

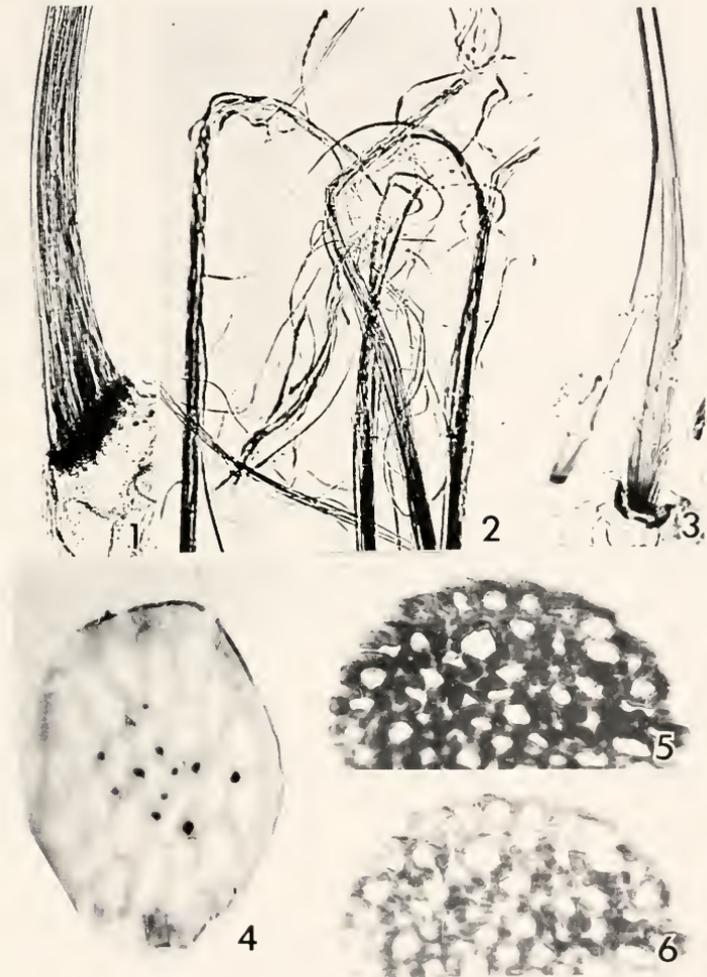


Fig. 1. Whole mount of the basal half of a frenalium from a male of *Galleria mellonella*. The linear striations are due to the walls of acanthal units. Fig. 2. Part of the tangle of threads resulting from teasing with fine needles a frenalium from a male of *G. mellonella*. Fig. 3. Whole mount of a frenalium of a female of *G. mellonella* after teasing with needles. Fig. 4. Cross section of a frenalium from a male of *Cirphis unipunta* (cleaned with hot 4% NaOH, then stained with aqueous OsO_4 before embedding in Durcupan). Fig. 5. Cross section of about half of the frenalium from a male of *Catocala amatrrix* [converted to chitosan with conc. KOH at 160° , then stained with aqueous OsO_4 before embedding.]. Fig. 6. Lighter print from same negative as preceding; to show distinctness of acantal cuticles at some places.

Since the trichogen cells do not fuse, each secretes a cuticle (Figs. 4-5) which one would expect to have an alkali-soluble epicuticle on its outer surface. Treatment with hot alkali (KOH or NaOH) should remove an epicuticle. Either the epicuticle is not the cement holding these units together or a secondary adhesion develops as an artifact of the treatment. The cross sections suggest that the procuticular walls of the units are fused.

If one teases a male frenulum with sharp needles (with or without pretreatment with alkali) it is easy to fray it into a mass of threads some of which may be acantal units but some of which are so slender they must be from a wall of an individual acantha (Fig. 2). This indicates a linear arrangement of chain molecules within the acanathal wall. A linear arrangement is also implied by the appearance in polarized light. The acanths of the female frenulum may also be split but not into such a mass of fine threads (Fig. 3).

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RECORDS OF PYRGOTIDAE FROM MISSISSIPPI,
WITH ADDITIONAL NOTES ON THE
DISTRIBUTION OF *SPHECOMYIELLA VALIDA*
(HARRIS) AND *PYRGOTA UNDATA* WIEDEMANN
(DIPTERA)¹

Paul K. Lago²

ABSTRACT: *Boreoethrinax maculipennis* (Macquart), *Pyrgota undata* Wiedemann and *Sphecomyiella valida* (Harris) are reported from Mississippi for the first time, and the flight period of each is noted. The known distribution of *S. valida* is extended to Arizona and North Dakota. *Pyrgota undata* is also recorded from North Dakota.

Pyrgotid flies, like their hosts the adult June beetles (Scarabaeidae), are generally nocturnal and, because of their parasitic activity, may reduce white grub population levels. Steyskal (1978) presented a key for the separation of the eight North American species and outlined the known distribution of each.

The nocturnal habit of the flies makes them somewhat difficult to collect, however they are attracted to light and may occasionally be collected in moderate numbers in light traps. Most of the specimens herein reported were taken at blacklight.

No species of pyrgotis have been previously recorded from Mississippi; however, extensive light trapping throughout the state during the last four years has revealed the presence of the following three species. Several records were obtained from the Mississippi Entomological Museum (MEM) at Mississippi State University and the personal collection of A.E. Zuccaro (AEZ). All other specimens are in the collections of the University of Mississippi (UM) or the author (PKL).

Mississippi Records

Boreoethrinax maculipennis (Macquart).

Adams Co. Natchez, 17 Apr. 1978, 3 May 1979, A.E. Zuccaro (AEZ); 5 mi. S. Natchez, 15 Apr. 1979, A.E. Zuccaro and P.K. Lago (UM).

Lee Co. Tupelo, 11 May 1970, J. Bryson (MEM). *Okibbeha Co.* Starkville, 6 records — 16 Apr. through 26 Apr. 1975 and 1976. W.H. Cross (MEM).

Union Co. No locality, 1 Apr. 1973, B.R. Jennings (UM). Specimens examined — 24.

¹Received February 3, 1981.

²Department of Biology, University of Mississippi, University, MS 38677

I have collected specimens of this species only once in Mississippi (Adams Co., 5 mi. S. Natchez). On that occasion a blacklight was set at dusk in an area of mixed hardwoods and pines near a recently cut-over site. Eight specimens of *B. maculipennis* were taken along with one specimen of *Pyrgota undata* Wiedemann and several *Serica*, *Diploptaxis* and *Phyllophaga* (Scarabaeidae). All were collected before midnight (CDT). The records indicate this species is active primarily in early spring.

***Pyrgota undata* Wiedemann.**

Adams Co. Natchez, 15 Apr. 1979, A.E. Zuccaro (AEZ); 5 mi. S. Natchez, 3, 5 July 1978, A.E. Zuccaro (AEZ), 15 Apr. 1979, A.E. Zuccaro and P.K. Lago (UM), Lafayette Co., Oxford, 8 July 1976, G. Lee (UM); 20, 21 June 1977, A.E. Zuccaro (UM); 24 June 1977, P.K. Lago (PKL); 15 June 1980, P.K. Lago (PKL). Lamar Co. Lumberton, 25 Apr. 1919, G.F. Arnold (MEM). Marion Co. No locality, 16 Apr. 1970, W.H. Cross, on saffron yellow stickem-coated trap (MEM). Okibbeha Co. Agricultural College (Mississippi St. Univ.), 1 May 1916, J.C. McKee (MEM), 1 May 1923, R.A. McKnight (MEM), 25 June 1924, no collector (MEM), Stone Co. No locality, 20 Apr. 1974, P.H. Darst (UM); Univ. of Mississippi forest lands (headquarters), 19 May 1978, 10 Apr. 1980, 22 May 1980, P.K. Lago (UM); 4 mi. S.E. Perkinston, P.K. Lago (UM). Specimens examined — 19.

This large, strikingly marked species is active for a longer period than is *B. maculipennis*. Specimens have been collected in the state from April through early July. One male, collected 4 miles southeast of Perkinston (Stone County), was taken mid-afternoon on a sunny day and was flying along the margin of a pasture bordered by pine forest. This is the only pyrgotid I have seen in flight during daylight hours.

***Sphecomyiella valida* (Harris).**

Adams Co. 5 mi. S. Natchez, 5 July 1978, A.E. Zuccaro (AEZ). Lafayette Co. Oxford, 5 May 1977, A.E. Zuccaro (UM), 26 June 1977, 4 July 1978, 27, 29 June 1980, 2 July 1980, P.K. Lago (UM). Lamar Co. 4 mi. N. Baxterville, 19 Apr. 1979, P.K. Lago (UM). Oktibbeha Co. Agricultural College (Mississippi St. Univ.) 28 Aug. 1905, G.W. Herrick; 7 May 1914, G.F. Arnold; 13 Apr. 1917, N.D. Peets; 7 Apr. 1922, E.W. Stafford; 3 May 1922, J.M. Wallace (MEM). Stone Co. Univ. of Mississippi forest lands (headquarters), 18 May 1978, P.K. Lago (UM). Tate Co. Senatobia, 6 Aug. 1921, F. East (MEM). Winston Co. Fearn Springs, May 1917, no collector (MEM). Specimens examined — 21.

Sphecomyiella valida has the widest temporal distribution of the three Mississippi species. Collection records are scattered from early April through August.

All three species herein reported are widely distributed in Mississippi (Figure 1) and in eastern North America. Steyskal (1978) defined the distribution of *B. maculipennis* as Maryland, Iowa, Arizona and southward, and that of both *P. undata* and *S. valida* as the eastern United States west to Minnesota and Texas. Although not recorded from west of Texas by

Steyskal (1978), Cole (1969) stated that *S. valida* "may come west to Arizona" and listed two records from that state. Coles' statement seems somewhat skeptical; however, the following records indicate that the range of *S. valida* does extend into Arizona. Also included are records for *P. undata* and *S. valida* from North Dakota which seem to represent the northwestern limit of both species. No pyrgotids were previously known from North Dakota.

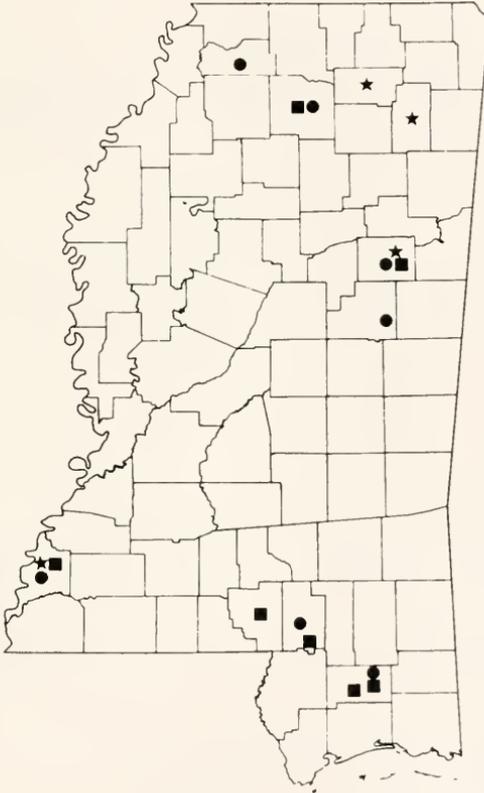


Figure 1. Distribution of pyrgotids in Mississippi.

- ★ — *Boreothrinax maculipennis*
- — *Pyrgota undata*
- — *Sphecomyiella valida*

Additional Records

Pyrgota undata.

NORTH DAKOTA, *Pembian Co.*, Goschke Dam, Tongue River Game Mang. Area, 27 June 1974, P.K. Lago (PKL). Specimens examined — 1.

Sphecomyiells valida.

ARIZONA, *Santa Cruz Co.* Madera Canyon lodge, 17 July 1980, P.K. Lago and A.E. Zuccaro, Pena Blanca Lake, 18 July 1980, P.K. Lago and A.E. Zuccaro, (PKL). Specimens examined — 21, NORTH DAKOTA, *Richland Co.* Walcott Dunes, 21 May 1974, 19 May 1975, P.K. Lago, (PKL). McLeod Prairie, 28 May 1975, P.K. Lago, (PKL). Specimens examined — 6.

ACKNOWLEDGEMENTS

I wish to thank Dr. W.B. Cross, Mississippi Entomological Museum, and A.E. Zuccaro for the loan of specimens; and S.C. Harris and B.P. Stark for their comments concerning this manuscript.

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A QUICK AND INEXPENSIVE METHOD FOR MAKING TEMPORARY SLIDES OF LARVAL CHIRONOMIDAE (DIPTERA)¹

Constance L. Russell, Annelle R. Sophonis²

ABSTRACT: Glycerine is used to mount chironomid larvae on slides, under separate cover slips, for rapid and accurate identification. Glycerine is an inexpensive substitute for water-based media such as CMC-10.

It is not unusual to collect hundreds or thousands of chironomid larvae during a study of rivers, lakes, or streams. Mounting great numbers of larvae on slides soon becomes expensive because of the time involved and the supplies needed: slides, cover slips, mounting media, and solvents. Here we describe a technique that is both fast and inexpensive, the glycerine method. This method is most suitable for tabulating species and instar data on known species, as in life history studies where larvae are routinely collected from the same habitats.

Many workers use resinous media, such as Canada balsam and Euparal, to mount chironomid larvae on slides. However, some workers are switching to water-based media because of the time involved in preparation of slides. Using water-based media also reduces the cost of supplies; no special solvents are needed, larvae can be mounted directly from water or alcohol, and slides and cover slips can be reused after washing. Glycerine (glycerol) is an inexpensive, easily obtainable substitute for commercial water-based media such as the popular CMC-10 (Klemm 1980). For an equivalent amount, lab grade glycerine costs less than half as much as CMC-10 and is available from several supply houses such as Carolina Biological Supply.

Although glycerine has been used for making temporary slides for many years (Peterson 1964), we are not aware that it has been used for slide-mounting chironomid larvae. Glycerine has the advantage of yielding clearly observable slide-mounts which are ready for immediate examination under the dry field microscope. It can easily be removed from slides, and glycerine goes a long way. If a single larva (1-4 mm in body length) can be mounted in one spot of glycerine, then at least 300 larvae can be mounted in 1 ml of glycerine. Disadvantages of glycerine are that slides must be examined within a couple of days after mounting and glycerine does not clear specimens. Heavily sclerotized, dark, or large larvae can be cleared by digesting them in hot or cold 10% KOH before mounting.

¹Received November 28, 1980.

²Department of Entomology, Florida A and M University, Tallahassee, Florida 32307.

Glycerine Method

We store larvae in vials containing 80% ethanol. Before we remove larvae from the vials, we draw off the ethanol with an eyedropper and fill the vial with distilled water. We then pour the larvae into a dish that contains distilled water. Next we put 6 to 8 spots of glycerine on a clean 3 x 1 in slide, pick up each larva with a dissecting pin, and place it in one spot. When the larva comes into contact with the glycerine, slight shriveling of the body occurs. Next we place a 10 or 12 mm circular cover slip (1½ thickness) on each larva, and apply slight pressure. Larvae are rotated into proper position by moving the cover slips.

Specimens can be examined immediately under the dry field microscope. Glycerine remains slippery unless dry, and before immersion oil can be used slides must be dried. Otherwise the larva will move under the pressure of the objective lens on the cover slip. Air drying slides takes about 48 hrs; oven drying at 45° C takes about 30-45 min. Specimens should be examined before the glycerine crystallizes, about 48 hrs. after drying.

Using this procedure we can slide-mount about 200 larvae in one hour. It's possible to slide-mount more larvae by placing several larvae under larger cover slips. However, this alteration may interfere with the identification of the larvae since it is difficult to properly orient more than one larva under a single cover slip.

Soaking slides in tap water for 24 hrs will clean the slides unless immersion oil has been used. Then, detergent should be added to the water. Slides are removed one by one, wiped with a soft cloth or brush, rinsed, and placed flat in paper towels to dry. We transfer cover slips to a small dish of clean water, then place them separately on paper towels to dry. Larvae are discarded with the wash water.

If we select larvae mounted in glycerine for inclusion in the reference slide collection, we mount them in Euparal according to the following procedure. Place a few drops of distilled water around the edge of the cover slip until the glycerine becomes slippery and the cover slip becomes loose. Lift off the cover slip; place the larva in distilled water for about 5 min; transfer the larva to 95% ethanol for about 5 min; mount the larva directly into a spot of Euparal on a slide. In the distilled water the body contents empty out of the larval body and the head capsule. Although this makes the specimen delicate, there is no need to clear the larva in KOH and an excellent slide is produced.

ACKNOWLEDGEMENTS

We thank J.H. Epler and M.D. Hubbard for helpful comments on the typescript. This research was supported by NSF (RIM78-17403) and SEA/CR, USDA (FLAX 79009).

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Peterson, A. 1964. Entomological Techniques. How To Work With Insects. 10th ed. Edwards Bros., Inc. Ann Arbor, Michigan 435 pp.

A COLLECTOR/MAILING CONTAINER FOR SHIPMENT OF LIVE INSECTS¹

James L. Krysan²

ABSTRACT: This paper describes a functionally complete dual purpose container for the collection and shipment of live insects. The container permits insertion of food through a large opening at one end and insertion of insects through a trap-like funnel opening at the other end.

For a project on population genetics, we needed to obtain live adult *Diabrotica* from many geographic localities. A simple, inexpensive container was devised so volunteers could readily collect the beetles and send them to our lab via U.S. mail. Convenience of handling by cooperators was a major concern in the design. Given the increase in studies involving live insects from diverse geographic areas, I thought that others might profit from the design. It should be readily adapted to use with other insects and foods.

The device (Fig. 1) serves both as a collecting container and mailer. Materials required are: (1) a mailing tube³ (we used a 2-inch by 12-inch size from the Chicago Paper Tube and Can Company, Inc., 925 West Jackson Boulevard, Chicago, Illinois 60607) with telescoping end caps, special ordered so neither end cap is glued in place; (2) a 4-oz plastic household funnel with the tip cut off and the flared part trimmed to fit snugly into the mailing tube (Fig. 1b); (3) a piece of hardware cloth, ¼-inch mesh; (4) nylon fiber tape, 1 inch wide; (5) silicone plastic bathtub sealer; and (6) optionally, Teflon[®] TFE fluorocarbon resin dispersion, type 30, (EI Dupont De Nemours and Company, Plastic Products and Resins Department, Wilmington, Delaware 19898).

The funnel is glued in place with bathtub sealer as shown in Fig. 1. The hardware cloth insert (outline in Fig. 1c) is folded to the shape shown in Fig. 1d and positioned in the tube as outlined in Fig. 1e to hold the food source firmly in place so the insects are not crushed during rough handling. The flexible hardware cloth allows the food to be secured firmly in place. The metal ends of each cap are perforated for ventilation. Both inner and outer funnel surfaces can be painted with the Teflon dispersion to reduce escape of insects during collection.

¹Received January 16, 1981.

²Northern Grain Insects Research Laboratory, AR, SEA, USDA, Brookings SD 57006.

³Mention of a proprietary product in this paper does not constitute an endorsement of this product by the USDA.

A length of nylon fiber tape is wrapped completely around the end caps in position 1, Fig. 1d. A second tape is wrapped over the first. In use, the cooperator removes the cap from the food end and, in the case of *Diabrotica*, inserts an immature ear of corn so it fits snugly in the food chamber. The cap is replaced and the second piece of tape moved from position 1 to position 2. Beetles are inserted in to the mailer through the funnel. Once filled, the cap is placed on the funnel end and fixed in place with tape as previously described.

The mailing tube should be porous, i.e., not waxed or otherwise treated to be impermeable to water. This prevents excess condensation.

A self-addressed stamped mailing label and appropriate shipping permits were affixed to the center of the tube along with the statement "perishable-live insects."

Use of a tube with both ends open is an important feature; it provides a large opening for the insertion of food at one end and a small funnel opening for the convenient insertion and temporary holding of insects at the other end. Insects can be placed in the container by knocking them into the funnel,

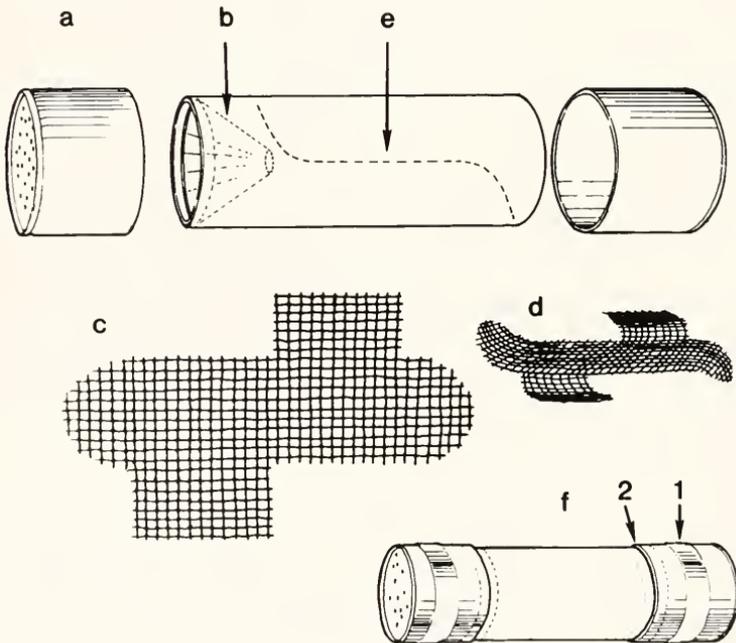


Fig. 1. A collector-mailing container for live insects.

or those collected with an aspirator can be blown into the container through the funnel. The complete unit with brief instructions on its use is mailed to the cooperator in an envelope. Cooperators should be urged to deposit the tube inside a post office rather than in an outdoor mail drop; the latter can get extremely hot. We made several hundred shipments via U.S. mail (special delivery) during the summer of 1980 and, although an occasional beetle died, most beetles in every shipment survived.

Editor's note: Because of the potential danger to agriculture of introducing new insect species or genotypes, there are federal and state regulations which cover interstate shipments of live insects. These usually require that live insect shipments be cleared in advance, and furnish permit labels for attachment to packages. Details can be obtained by contacting the state Department of Agriculture, or the nearest USDA-APHIS office.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL
NOMENCLATURE

c/o BRITISH MUSEUM (NATURAL HISTORY), CROMWELL ROAD, LONDON,
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4 March 1981

A.N.(S.) 117

The Commission hereby gives six months' notice of the possible use of its plenary powers in the following case, published in *Bull. Zool. Nom.*, Volume 38, part 1, 26 February 1981, and would welcome comments and advice on it from interested zoologists. Correspondence should be addressed to the Secretary at the above address, if possible within six months of the date of publication of this notice.

1437 *Xenocrepis* Foerster, 1856, (Hymenoptera: Chalcidoidea): proposed designation of a type species.

ITZN 59

The following Opinions have been published recently by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature*, Volume 38, part 1, 26 February 1981.

Opinion No.

- 1162 (p. 49) *Schizoneura meunieri* Heie, 1969 (Insecta: Hemiptera): conserved under the plenary powers.
- 1164 (p. 57) Refusal of request to suppress *Calomicrus taeniatus* Wollaston, 1867 (Insecta: Coleoptera).
- 1166 (p. 64) *Liparthrum* Wollaston, 1854 (Coleoptera, Scolytidae): conserved.
- 1167 (p. 67) *Phloeosinus* Chapuis, 1869 (Coleoptera, Scolytidae): conserved.

The Commission regrets that it cannot supply separates of Opinions.

R.V. Melville, Secretary.

When submitting papers, all authors are requested to (1) provide the names of two qualified individuals who have critically reviewed the manuscript *before* it is submitted and (2) submit the names and addresses of two qualified authorities in the subject field to whom the manuscript can be referred by the editor for final review. All papers are submitted to recognized authorities for final review before acceptance.

Titles should be carefully composed to reflect the true contents of the article, and be kept as brief as possible. Classification as to order and family should be included in the title, except where not pertinent. Following the title there should be a short informative abstract (not a descriptive abstract) of not over 150 words. The abstract is the key to how an article is cited in abstracting journals and should be carefully written. The author's complete mailing address, including zip code number, should be given as a footnote to the article. All papers describing new taxa should include enough information to make them useful to the nonspecialist. Generally this requires a key and a short review or discussion of the group, plus references to existing revisions or monographs. Illustrations nearly always are needed. All measurements shall be given using the metric system or, if in the standard system, comparable equivalent metric values shall be included. Authors can be very helpful by indicating, in pencil in the margin of the manuscript, approximate desired locations within the text of accompanying figures, tables and other illustrations.

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NEWSLETTER: Women in entomology/ideas, concerns, activities/send notes for inclusion, name and address for mailing list/\$1 to defray production June '81 (1) and Jan. '82 (2) issues welcome/Dr. Diane M. Calabrese, Dep't. Biol. Trinity College, Washington, DC. 20017.

Wanted: To purchase collections of identified leaf beetles (Chrysomelidae) from Europe and the tropical Americas, or exchange North American leaf beetles for leaf beetles from the above regions. Dr. Richard E. White, Systematic Entomology Laboratory, c/o U.S. National Museum of Natural History, Washington, DC 20560.

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ENTOMOLOGICAL NEWS

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(Continued on inside of back cover)

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ORTHOPTEROIDS OF SAND MOUNTAIN AND BLOW SAND MOUNTAINS, NEVADA¹

R.C. Bechtel², L.M. Hanks³, R.W. Rust³

ABSTRACT: Twenty-three species of orthopteroids were collected from Sand Mountain and Blow Sand Mountains, Nevada. One species, *Ammobaenetes lariversi* Strohecker, was the only sand obligate species obtained.

Sand Mountain and Blow Sand Mountains were visited 19 times in a 13 month period for the purpose of surveying selected groups of arthropods. Here we report on the orthopteroids collected during the study. Over 700 specimens were obtained. They represent 23 species in three orders and seven families. Only one, *Ammobaenetes lariversi* Strohecker, is a sand obligate species. No new species were obtained.

Study Areas

Sand Mountain dunes and Blow Sand Mountain dunes were sampled from June 1979 through July 1980. Sand Mountain is approximately 46Km ESE of Fallon, Churchill County, Nevada (39°20'N-118°20'W) and is about 1,250m in elevation. Blow Sand Mountains are approximately 52Km SE of Fallon, Nevada (39°10'N-118°35'W) and are about 1,400m in elevation. The dunes are separated by 25Km air distance. Sand Mountain is a star dune of approximately 3.2Km² while Blow Sand Mountains are complex star and linear dunes of approximately 9.2Km², however, both dunes result from the same eolian sand deposited during the Turupah and Fallon formations of about 4,000 years B.P. (Morrison and Frye 1965).

The floras of the two dunes were similar. The dominant vegetation was *Atriplex confertifolia* (Torr. & Frem.), *Tetradymia tetrameres* (Blake), *Chrysothamnus viscidiflorus* (Hookl), *Astragalus lentiginosus* Dougl., and *Psoralea lanceolata* Pursh. and at Sand Mountain only *Eriogonum kearneyi* Tidestr. and *Psorothamnus polyadenius* (Torr.). The common grass was *Oryzopsis hymenoides* (R. & S.).

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Methods and Materials

Several collecting techniques were used to obtain arthropod specimens. Permanent pitfall traps were 0.951 (11.5cm diameter) plastic cartons buried level with the sand surface and one-third to one-half filled with ethylene glycol (antifreeze). Traps were covered with a 13X13cm Masonite lid held 2cm above the surface. Six traps were placed 10 meters apart in a transect. Six transects were used at Sand Mountain and four at Blow Sand Mountains. Permanent pitfall traps were operative for 30 days between collecting periods. Temporary pitfall traps were 15cm diameter cereal bowls placed level with the sand surface. Twelve traps placed 10 meters apart represented a transect. Six transects were used at Sand Mountain and four at Blow Sand Mountains. Temporary pitfall traps were used for 12-18hr during a survey period. Trapping duration was determined by the length of the night. Two UV light traps were operated from dusk to dawn during the survey periods. November's light trap collections were so limited that UV light trapping was discontinued from December to March. Hand held UV lamps were used in searching the dunes for fluorescing arthropods ie. scorpions, and visible light was used for other nocturnal species. Sand was sifted through two screens of 12X12mm and 1.5X1.5mm mesh to recover subsurface arthropods. Surface sand to a depth of 0.4-0.5m both from beneath vegetation and open sand (non-vegetated areas) was sifted. General collecting involved the use of aerial nets, plant inspection and walking the dunes at night to obtain nocturnal specimens. During a survey period, four or five different sites on the dune were visited and sampled and the sites were varied each survey.

Data are presented in the following manner: For each species of orthopteroid its status, location, numbers obtained, dates of occurrence, plant host association and method of collection are given. Status is given as endemic (E), sand obligate (SO), widespread desert (WD), common (C), accidental (A) and questionable (?). Endemic means that the species is known only from Sand Mountain or Blow Sand Mountains. Sand obligate means that the species is restricted to sand habitats and may be found in other dunes in Western North American. Widespread desert indicates the species is found throughout the Great Basin deserts and other western deserts. A common species will be found over much of North America. Accidental means the species collected at the dunes is ecologically not a sand or desert species. Questionable means that not enough information is known about the species to place it in one of the other categories. Only representative specimens of common species were collected and only curated specimens were tabulated. All species were identified by R.C. Bechtel and all tabulated specimens are either in the insect collection of the Biology Department, University of Nevada, Reno or the Nevada State

Department of Agriculture.

Results

The rhabdophorid, *Ammobaenetes lariversi*, was the only sand obligate species collected from both dunes. This distinctive species is known only from sand dune habitats in Nevada and has been recorded from only two other locations in Nevada (La Rivers 1948). It is a nocturnal species that lives in burrows in the harder sand and it is reported to feed on dune vegetation and dried bodies of other dune insects (La Rivers 1948). We have seen it attack and consume antlion (Neuroptera: Myrmeleontidae) adults attracted to UV lights. *A. lariversi* was collected in every month at Sand Mountain and all but February and March at Blow Sand Mountains. Most individuals were obtained in July, August, September and October with over 12% being taken in each of these months. Nymphs were found in all months at Sand Mountain and all but February and March at Blow Sand Mountains. La Rivers (1948) reported *A. lariversi* as a common prey item of scorpions and we also found many individuals captured by the scorpions *Paruroctonus auratus* (Gertsch and Sologlad) and *Hadrurus spadix* Stahnke.

Two species of acridids, *Hesperotettix viridis* (Thomas) and *Melanoplus cinereus* Scudder, were extremely abundant at Blow Sand Mountains in the summer of 1979 with thousands of individuals being present in June, July, August and September. Three of the dune plants, including two shrubs were completely defoliated. *H. viridis* denuded *Chrysothamnus viscidiflorus* and *M. cinereus* defoliated and chewed the bark from *Tetradymia tetrameres* bushes. The latter species then consumed the entire above ground parts of *Psoralea lanceolata* before feeding sporadically on certain other plants in the area. Both species were present in 1980 but not in the numbers seen in 1979.

Two species, *Anconia caeruleipennis* Bruner, an acridid, and *Conocephalus fasciatus vicinus* (Morse), a tettigoniid, were represented by only one specimen each. Perhaps the other rarest orthopteroid was the cockroach *Arenivaga erratica* (Rehn).

Orthoptera

Acrididae

Anconia caeruleipennis Bruner (WD)

BSM - 1 specimen, Aug., general collecting

Coniana snowi Caudell (WD)

SM - 27 specimens, July, Aug., general collecting

BSM - 7 specimens, July, Aug., general collecting

Conozoa wallula (Scudder) (WD)

SM - 7 specimens, Aug., general collecting

Cordillacris occipitalis cinerea (Bruner) (WD)

SM - 14 specimens, May, June, July, general collecting

BSM - 4 specimens, June, July, Aug., general collecting

Hesperotettix viridis (Thomas) (WD)

BSM-101 specimens June, July, Aug., Sept., general collecting, pitfall, on *Chrysothamnus viscidiflorus*, defoliated in 1979

Ligurotettix coquilletti cantator Rehn (WD)

SM - 7 specimens, Aug., Sept., general collecting

Melanoplus cinereus Scudder (WD)

SM - 12 specimens, June, July, Aug., Sept., general collecting

BSM - 110 specimens, June, July, Aug., Sept., general collecting, pitfall, on *Psoralea lanceolata*, *Tetradymia tetrameres*, both defoliated in 1979.

Paropomala pallida Bruner (WD)

BSM - 9 specimens, July, Aug., Sept., general collecting

Poecilotettix sanguineus Scudder (WD)

SM - 10 specimens, June, July, Aug., Sept., general collecting

BMS - 10 specimens, June, July, Aug., Sept., general collecting

Trimerotropis bilobata Rehn and Hebard (WD)

SM - 9 specimens, June, July, Aug., general collecting

BSM - 7 specimens, June, July, Aug., general collecting

Trimerotropis pallidipennis (Burmeister) (WD)

BSM - 7 specimens, July, general collecting

Trimerotropis pseudofasciata Scudder (WD)

SM - 5 specimens, June, July, Aug., general collecting

BSM - 1 specimen, July, general collecting

Trimerotropis strenua McNeill (WD)

SM - 2 specimens, July, Aug., general collecting

BSM - 10 specimens, July, Aug., general collecting

Tettigoniidae

Capnobotes fuliginous (Thomas) (WD)

BSM - 15 specimens, Aug., general collecting

Conocephalus fasciatus vicinus (Morse) (WD)

SM - 1 specimen, Aug., general collecting

Plagiostira gillettei Caudell (WD)

SM - 27 specimens, June, July, Aug., general collecting

BSM - 35 specimens, June, July, Aug., general collecting

Rhaphidophoridae

Ammobaenetes lariversi Strohecker (SO)

SM - 237 specimens, all months, sifting sand, pitfall, UV light

BSM - 87 specimens, all months except Feb., Mar., sifting sand, pitfall, UV light

Stenopelmatidae

Stenopelmatius fuscus Haldeman (WD)

SM - 14 specimens, June, July, Aug., Sept., pitfall, general collecting

BSM - 9 specimens, June, July, Aug., pitfall, general collecting

Gryllidae*Allonemobius* species (?)

SM - 3 specimens, July, Aug., general collecting

Oecanthus argentinus Saussure (WD)

SM - 5 specimens, Aug., general collecting

BMS - 7 specimens, Aug., general collecting

Mantodea**Mantidae***Litaneutria minor* (Scudder) (WD)

BSM - 2 specimens, Aug., general collecting

Stagmomantis californica Rehn and Hebard (C)

SM - 2 specimens, Aug., general collecting

Blattodea**Polyphagidae***Arenivaga erratica* (Rehn) (WD)

BSM - 5 specimens, May, June, July, Aug., pitfall, UV light

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- Morrison, R.B., and J.C. Frye. 1965. Correlation of the middle and late quaternary successions of the Lake Lahontan, Lake Bonneville, Rocky Mountains (Wasatch Range), southern Great Plains, and eastern midwest areas. *Nevada Bureau Mines* 9: 1-45.

DR. HARRY W. ALLEN

Dr. H.W. Allen, a long-term supporter of this Society, died on August 20, 1981, at the age of 89. He earned his B.S. at the University of Massachusetts, the M.S. at Mississippi State College, and his Ph.D. at Ohio State University. Dr. Allen was on the staff of the Mississippi Agricultural and Mechanical College from 1922-26, before joining the USDA in 1926, where he served in various capacities until his retirement in 1958. He was in charge of the Oriental Fruit Moth Unit at the USDA Moorestown laboratory from ca. 1928 to 1957.

After retirement, Dr. Allen continued to work actively in entomology, publishing important contributions such as "Parasites of the Oriental Fruit Moth in the Eastern United States" (USDA Tech. Bul. 1265) in 1962, and "The Genus *Tiphia* of the Indian Subcontinent" (USDA Tech. Bul. 1509) in 1975.

Dr. Allen served on the governing Council of the American Entomological Society for many years, and was President during 1958, when he presided over the celebration of the Society's one hundredth anniversary. In addition, he authored a history of the American Entomological Society in 1960 (*Trans. Amer. Entomol. Soc.* 85: 335-372).

Dr. Allen is survived by his wife Margaret W., his son Richard W., eight grandchildren, and two great-grandchildren. His daughter, Dorothy L., preceded him in death.

W.H. Day

TWO NEW SPECIES OF *ALIENATES* (HEMIPTERA: ENICOCEPHALIDAE)¹

Gene Kritsky²

ABSTRACT: Two new species of *Alienates*, one from Cuba and one from Arizona, are described. A key to the males is also provided.

Barber (1953) erected the enicocephalid subfamily Alienatinae to accommodate the new genus *Alienates* and its only included species, *A. insularis*, described from the South Bimini Island, Bahamas. The Alienatinae can be separated from the other two enicocephalid subfamilies by a two-lobed pronotum and greatly reduced wing venation. Herein I describe the second and third known species of *Alienates*, which extend the distribution and illustrate some of the morphological adaptations of very small enicocephalids.

Genus *Alienates* Barber

Alienates Barber, 1953: Am. Mus. Novitates 1614:1 - 4. Type species *Alienates insularis* Barber, by original designation.

Male: length 1.25-1.50 mm. Head separated into three lobes by two transverse impressions, posterior lobe oblong, pressed against anterior lobe (Fig. 1). Eyes and ocelli large. Antenna incrassate, long. Pronotum smooth, divided into two lobes. Scutellum with three lobes. Foreleg stout, tibia with three long spines at apex and cleaning comb on side nearest body. Tarsus with two short claws without spines. Middle and hind tarsi each one segmented. Forewings with 2 - 4 veins. Genitalia with posterior apophysis arising below anus. Anus surrounded by the lateral and median sclerites.

Alienates millsii, new species

Length 1.49 mm. Body light brown, covered with short setae. Head 0.36 mm long with anterior lobe as wide or wider than posterior lobe. Eyes large, slightly longer than posterior lobe of head. Ocelli large, placed far apart. Antennae: I, length 0.06 mm; II, 0.15 mm; III, 0.12 mm; IV, 0.19 mm. Anterior margin of pronotum twice as long as anterior lobe. Forelegs stout; femur length to width ratio 2.60, tibia length to width ratio 2.38. Forewing costa (C) shorter than cubital (Cu) vein (Fig. 2).

Holotype: male; Cuba, Soledad, near Cienfuegos; June 2, 1950. Berlese sample, H.B. Mills. The type is deposited at the Illinois Natural History Survey, Urbana, IL.

Alienates barberi, new species

Length 1.25-1.46 mm. Body light brown, covered with short setae. Head 0.30 mm long with anterior lobe slightly narrower than posterior lobe (Fig. 1). Eyes large slightly longer than

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posterior lobe of the head. Ocelli large, placed farther apart than in *A. millsii*. Antennae, I, length 0.05 mm; II, 0.12 mm; III, 0.11 mm; IV, 0.18 mm. Anterior margin of pronotum as wide as posterior lobe of head. Posterior lobe of pronotum $2\frac{1}{2}$ times as long as anterior lobe. Foreleg more slender than *A. millsii*, femur length to width ratio 3.37, tibia length to width ratio 3.55. Forewing venation with C, Cu, r-m, and partial Cu_1 (Fig. 3).

Holotype: male, four male paratypes. U.S.A., Arizona, Boyce Thompson Arboretum, near Superior; October 3, 1949, at light, B.W. Benson. The holotype is deposited in the Illinois Natural History Survey, Urbana, IL.

Discussion

The presence of *Alienates barberi* in Arizona extends the range of the genus well beyond the Caribbean. Whether this indicates a disjunct distribution will depend on the results of future collecting in intervening areas.

The females of *Alienates insularis* are apterous. Unfortunately, no females of the two new species have been found.

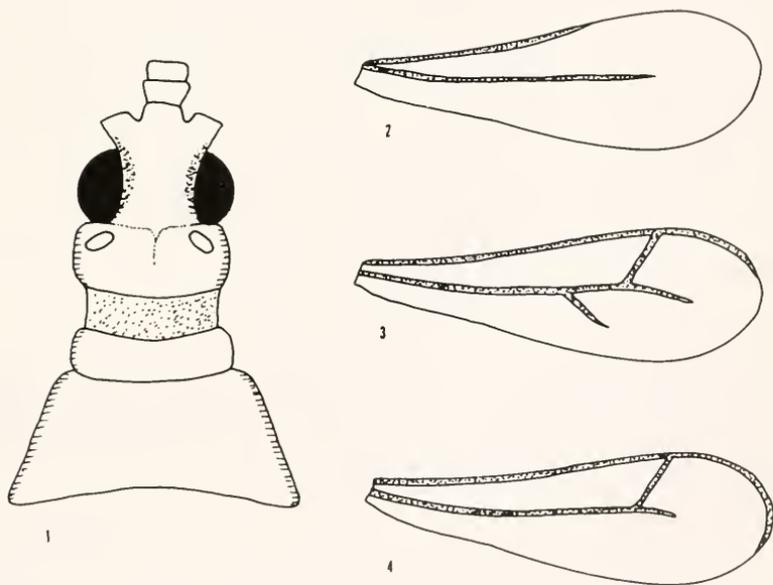


Fig. 1. *Alienates barberi* head and pronotum. Fig. 2. *A. millsii* forewing. Fig. 3. *A. barberi* forewing. Fig. 4. *A. insularis* forewing (drawn from paratype).

AN ANNOTATED CHECK LIST OF THE TREEHOPPERS (HOMOPTERA: MEMBRACIDAE) OF KENTUCKY^{1,2}

Paul H. Freytag, Charles V. Covell, Jr., Dennis D Kopp³

ABSTRACT: County records are reported for 53 species of Membracidae from Kentucky. This list includes 23 new state records.

This paper is the first listing of the treehopper fauna of Kentucky. Funkhouser (1927) listed 25 species for the state of Kentucky, and Kopp and Yonke (1973 a,b,c and 1974) recorded 5 additional species. We have added 23 state records to make a total of 53 species listed in this paper and expect further collecting will undoubtedly reveal more new records.

County records are given for each species, plus the earliest and latest collection dates, and all months that adults have been taken in Kentucky. Determinations were made by the third author. Records presented here are based primarily on specimens in the University of Kentucky and University of Louisville collections, unless otherwise noted.

The arrangement of this family follows Kopp and Yonke (1973 a,b,c and 1974).

SUBFAMILY CENTROTINAE

Genus *MICROCENTRUS* Stål

Nicrocentrus caryae (Fitch) NEW STATE RECORD. Fayette Co. Aug. 4-6.

SUBFAMILY HOPLOPHORIONINAE

Genus *PLATCOTIS* Stål

Platcotis vittata (Fabricius). Counties: Boyle, Breathitt, Bullitt, Fayette, Hardin, Harlan, Jefferson, Kenton, Knox, Pendleton, Powell, Rockcastle. April 28, June, Aug., Sept., Oct. 30.

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²The investigation reported in this paper (No. 81-7-2) is in connection with a project of the Kentucky Agricultural Experiment Station and is published with approval of the Director. University of Louisville Contributions in Biology No. 199 (New Series).

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SUBFAMILY MEMBRACINAE

Genus *CAMPYLENCHIA* Stål

Campylenchia latipes (Say). Counties: Boone, Breathitt, Bullitt, Butler, Caldwell, Fayette, Fulton, Graves, Hickman, Jefferson, Knott, Larue, Meade, Nelson, Nicholas, Oldham, Pendleton, Pulaski, Trigg. June 11, July, Aug., Sept., Nov. 18.

Genus *ENCHENOPA* Amyot & Serville

Enchenopa binotata (Say). Counties: Allen, Bell, Boyd, Boyle, Calloway, Fayette, Jefferson, Jessamine, Lyon, Mercer, Pendleton, Scott, Trigg. June 10, July, Aug., Sept., Oct. 15.

Genus *TYLOPETA* Fowler

Tylopelta americana (Goding). Nelson Co. May 11-June 10.

SUBFAMILY SMILIINAE

Tribe Acutalini

Genus *ACUTALIS* Fairmaire

Acutalis tartarea (Say). Counties: Barren, Boone, Bourbon, Breathitt, Bullitt, Calloway, Fayette, Grant, Hardin, Henderson, Hickman, Hopkins, Jefferson, Jessamine, Kenton, Mercer, Morgan, Muhlenberg, Pike, Powell, Wayne, Wolfe. June 11, July, Aug., Sept., Oct., Nov. 15.

Genus *MICRUTALIS* Fowler

Micrutalis calva (Say). Counties: Breathitt, Butler, Caldwell, Fayette, Franklin, Fulton, Grant, Hickman, Jefferson, Lyon, Marshall, Mercer, Nelson, Perry, Simpson, Spencer. May 25, June, Aug., Sept., Oct., Nov. 3.

Tribe Ceresini

Genus *HADROPHALLUS* Kopp & Yonke

Hadrophallus borealis (Fairmaire). Counties: Bell, Hart and Woodford. Aug.-Sept. All records of this species are from the U.S. National Museum.

Genus *SPISSISTILUS* Caldwell

Spissistilus festinus (Say). NEW STATE RECORD. Counties: Barren, Breathitt, Bullitt, Butler, Jefferson, Owsley, Perry, Powell, Taylor, Trigg. July 7, Aug., Sept., Oct. 9.

Genus *STICTOCEPHALA* Stål

Stictocephala albescens (Van Duzee). Jefferson Co. Sept. 23.

Stictocephala basalis (Walker). Reported from Kentucky by Kopp & Yonke (1973b). First recorded from Kentucky by Funkhouser (1927).

- Stictocephala bisonia* Kopp & Yonke. Counties: Ballard, Bath, Boone, Breckinridge, Bullitt, Crittenden, Fayette, Hancock, Henderson, Jefferson, Jessamine, Kenton, Nelson, Oldham, Owen, Pendleton, Powell, Scott, Wolfe. June 24, July, Aug., Sept., Oct., Nov. 9.
- Stictocephala brevicornis* (Fitch). Counties: Anderson, Barren, Boone, Bourbon, Fayette, Fleming, Grant. June 20, July, Aug., Sept., Oct. 20.
- Stictocephala brevis* (Walker). Reported from Kentucky by Kopp & Yonke (1973b). First recorded from Kentucky by Funkhouser (1923).
- Stictocephala brevitylus* (Van Duzee). Counties: Breathitt, Fleming, Fulton, Hardin, Henderson, Jefferson, Jessamine, Nelson, Oldham. April 24, May, June, July, Aug. 29.
- Stictocephala constans* (Walker). Reported from Kentucky by Kopp & Yonke (1973b). First recorded from Kentucky by Funkhouser (1927).
- Stictocephala diceros* (Say). Counties: Anderson, Fayette, Jefferson, Lyon, Owen. July 12, Aug., Sept., Oct. 18.
- Stictocephala lutea* (Walker). Counties: Breathitt, Boone, Bullitt, Christian, Hardin, Harlan, Henderson, Jefferson, Larue, Morgan, Nelson, Trigg, Wayne. May 22, June, July 26.
- Stictocephala palmeri* (Van Duzee). Counties: Bullitt, Hardin, Jefferson, Oldham. June 20, July, Aug., Sept., Oct. 18.
- Stictocephala taurina* (Fitch). Counties: Anderson, Bourbon, Fayette, Jefferson, Jessamine, Meade. June 10, July, Sept., Oct. 17.

Genus *TORTISTILUS* Caldwell

- Tortistilus inermis* (Fabricius). Counties: Boone, Bullitt, Fayette, Jefferson, Mercer, Oldham, Pendleton, Scott. April, May, June, July, Aug. 13.

Tribe Polyglyptini

Genus *ENTYLIA* Germar

- Entylia bactriana* Germar. Counties: Anderson, Bourbon, Bullitt, Fayette, Fleming, Glendale, Hickman, Jefferson, Jessamine, Lincoln, McLean, Meade, Morgan, Nelson, Scott, Wolfe. May 5, June, July, Aug., Sept. 6.

Genus *PUBLILIA* Stål

- Publilia concava* (Say). Counties: Adair, Boone, Breathitt, Carter, Fayette, Fleming, Jefferson, Lincoln, Morgan, Nelson, Oldham. May 8, June, July, Aug. 12.
- Publilia reticulata* Van Duzee. Counties: Breathitt, Carter, Fleming, Jefferson, Nelson, Oldham, Perry, Wayne, Wolfe. April 12, May, June, July, Sept. 7.

Genus *VANDUZEEA* Goding

- Vanduzeeea arquata* (Say). Counties: Bourbon, Breckinridge, Bullitt, Fayette, Jefferson, Jessamine, Mercer, Perry. June 4, July, Aug., Sept., Oct., Nov. 11.
- Vanduzeeea triguttata* (Burmeister). NEW STATE RECORD. Counties: Bullitt, Jefferson. July 16, Sept. 25.

Tribe Smiliini

Genus *ATYMNA* Stål

- Atymna querci* (Fitch). NEW STATE RECORD. Counties: Jackson, Jefferson, Madison. May 19, June, July, Aug. 4.

Genus *CYRTOLOBUS* Goding

Cyrtolobus fenestratus (Fitch). NEW STATE RECORD. Caldwell Co. June 8.

Cyrtolobus maculifrontis (Emmons). NEW STATE RECORD. Counties: Christian, Fayette, Jefferson. May 16, June, Aug. 7.

Cyrtolobus vau (Say). NEW STATE RECORD. Caldwell Co. June 7.

Genus *OPHIDERMA* Fairmaire

Ophiderma definita Woodruff. NEW STATE RECORD. Jefferson Co. May 21-22.

Ophiderma evelyna Woodruff. NEW STATE RECORD. Fayette Co. May 26-28.

Ophiderma pubescens (Emmons). NEW STATE RECORD. Nelson Co. June 6-10.

Ophiderma salamandra Fairmaire. NEW STATE RECORD. Jefferson Co. May 10-June 17.

Genus *SMILIA* Germar

Smilia camelus (Fabricius). NEW STATE RECORD. Counties: Breathitt, Jefferson. May 17-June 8.

Genus *XANTHOLOBUS* Van Duzee

Xantholobus lateralis Van Duzee. NEW STATE RECORD. Caldwell Co. June 18.

Xantholobus muticus (Fabricius). Counties: Fayette, Larue. May 5-June 6.

Tribe Telamonini

Genus *ARCHASIA* Stål

Archasia belfragei Stål. NEW STATE RECORD. Counties: Breathitt, Trigg. June 14, Aug. 14.

Genus *CARYNOTA* Fitch

Carynota marmorata (Say). NEW STATE RECORD. Powell Co. June 22.

Carynota mera (Say). Counties: Jessamine, Madison, Trigg, Wayne. May 14, June, July 15.

Genus *GLOSSONOTUS* Butler

Glossonotus univittatus (Harris). NEW STATE RECORD. Oldham Co. June 14-19.

Genus *HELIRIA* Stal

Heliria molaris (Butler). NEW STATE RECORD. Jefferson Co. June 19.

Heliria strombergi Goding. NEW STATE RECORD. Counties: Jessamine, Scott. July 13, Sept.

Genus *PALONICA* Ball

Palonica pyramidata (Uhler). Fayette Co. June 5, Aug., Sept. 25.

Palonica viridia (Ball). NEW STATE RECORD. Counties: Jefferson, Robertson. June 27, Sept. 20.

Genus *TELAMONA* Fitch

- Telamona ampelopsidis* (Harris). Jefferson Co. May 16.
Telamona collina (Walker). Counties: Breathitt, Fayette, Jefferson. May 10, June, Aug. 15.
Telamona decorata Ball. NEW STATE RECORD. Counties: Meade, Russell, Wayne. July 10-14.
Telamona maculata Van Duzee. NEW STATE RECORD. Counties: Caldwell, McCracken. June 18, Aug. 8.
Telamona monticola (Fabricius). Counties: Fayette, Jefferson. May 10, Aug. 9.
Telamona reclinata Fitch. NEW STATE RECORD. Pulaski Co. July 9.
Telamona unicolor Fitch. NEW STATE RECORD. Counties: Caldwell, Jefferson, Oldham. June 13-14, Sept. 21.

Genus *THELIA* Amyot & Serville

- Thelia bimaculata* (Fabricius). Counties: Boyle, Crittenden, Fayette, Jefferson, Jessamine, Mercer, Oldham, Owen, Pendleton. June 25, July, Aug., Sept., Oct., Dec. 1.

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Kopp, Dennis D. and Thomas R. Yonke. 1974. The Treehoppers of Missouri: Part 4. Subfamily Smiliinae; Tribe Telamonini (Homoptera: Membracidae). J. Kansas Entomol. Soc. 47(1) :80-130.

DISTINGUISHING LARVAE OF NORTH AMERICAN BAETIDAE FROM SIPHLONURIDAE (EPHEMEROPTERA)^{1,2}

W.P. McCafferty³

ABSTRACT: Previously published keys to North American families of Ephemeroptera do not adequately distinguish all larvae of Baetidae from those of Siphonuridae. A more efficient means of identifying larvae to one of these families by using caudal filaments and antennae is suggested.

Students of my Aquatic Entomology course historically have had some difficulties in separating mayfly larvae into either the family Baetidae or the closely related Siphonuridae when using available taxonomic keys. This, coupled with several recent inquiries from freshwater biologists in the eastern and midwestern United States concerning this dilemma, has prompted my writing this short paper.

For specialists who are acquainted with genera of these groups it is relatively easy to recognize larval baetids from siphonurids without the use of family keys; however, for nonspecialists who rely on family keys as a first step in identification, problems can arise. Morphological characters used to key larvae to one of these two families, such as those in the popular keys of Edmunds et al. (1976), Merritt and Cummins (1978), Hilsenhoff (1975), Pennak (1978), and Lehmkuhl (1979), do not always hold for certain species and regions of North America, and they can be especially difficult to apply to immature larvae.

The characters in the final key couplet leading to these families (which is the problematic couplet) have involved the length of the antennae relative to head width and the relative development of projections at the posterolateral corners of the distal abdominal segments. Most North American baetid larvae have antennae that are longer than twice the width of the head, but some (e.g., some *Pseudocloeon*) have much shorter antennae. The development of distal abdominal projections also varies among baetids — most lack projections, some have moderately developed projections, and a few have well-developed projections (some *Pseudocloeon* larvae have both short antennae and well-developed projections). All North American siphonurid larvae (the genus *Isonychia* now is excluded) possess short antennae,

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shorter than twice the width of the head, and although most have well-developed posterolateral projections on abdominal segments 8 and 9, such projections are very poorly developed in the genus *Ameletus*.

From the above it is clear that the antennal and abdominal characters, used either singly or in some combination, will not always work to distinguish the families. Supplementary characters appearing in some keys and involving mouthpart structures (Edmunds et al., 1976; Usinger, 1956) will not resolve the identification of larvae in all cases.

The larvae of Baetidae in North America that present problems in family identification because of their antennal and/or abdominal characters happen to all have a highly reduced median terminal filament. Therefore an easier and more effective means to distinguish the families would be to first consider whether larvae possess a developed median terminal filament: those that are "two-tailed" could immediately be placed in Baetidae (there are no "two-tailed" siphonurids); those with a developed median terminal filament ("three-tailed") could then be further examined for antennal length. All siphonurid larvae will have short antennae as described above, and all "three-tailed" baetid larvae will have long antennae as described above. The genus *Isonychia*, which until recently was classified in the Siphonuridae and was considered as such when all the previously mentioned keys were published, does contain larvae with long antennae. This does not present a problem, however, if it is remembered that *Isonychia*, although minnowlike and superficially similar as larvae to baetids and siphonurids, is presently classified in the family Oligoneuriidae (McCafferty and Edmunds, 1979) and can be distinguished from both baetids and siphonurids by the presence of a double row of long filtering setae of the inner surface of the fore legs.

Body size may be helpful when working with mature specimens, since baetid larvae in North America north of Mexico seldom exceed 10 mm (some *Callibaetis* being the major exception), and mature siphonurid larvae are commonly over 10 mm in length. Also, those baetid larvae that tend to be problematic have very small hind wing pads or lack hind wing pads entirely.

In conclusion, I would recommend using the following key couplet to separate baetid and siphonurid larvae (a simplified larval key to the families of Ephemeroptera appears in McCafferty, 1981).

Median terminal filament highly reduced, or if developed then antennae long, more than twice (and usually more than three times) the width of the head Baetidae
 Median terminal filament well developed, and antennae shorter than twice the width of the head. Siphonuridae

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INTERNATIONAL COMMISSION OF ZOOLOGICAL NOMENCLATURE

c/o BRITISH MUSEUM (NATURAL HISTORY), CROMWELL ROAD, LONDON,
SW7 5BD

A.N.(S.) 118

12 May, 1981

The Commission hereby gives six months' notice of the possible use of its plenary powers in the following cases, published in *Bull. zool. Nom.*, Volume 38, part 2, 30 April 1981, and would welcome comments and advice on them from interested zoologists. Correspondence should be addressed to the Secretary at the above address, if possible within six months of date of publication of this notice.

Case No.

- | | |
|------|---|
| 1450 | <i>Tyrophagus</i> Oudemans, 1924 (Acarina): proposals to clarify name of the type of species and to conserve name of an important pest species. |
| 2144 | <i>Nepa cinerea</i> Linnaeus, 1758 (Insecta, Heteroptera, Nepidae): proposed conservation. |
| 2125 | <i>Coccus</i> Linnaeus, 1758 and <i>Parthenolecanium</i> Sulc, 1908 (Insecta, Homoptera, Coccidae): proposed designation of type species. |
| 2290 | <i>Eutermes exitiosus</i> Hill, 1925 (Insecta, Isoptera): proposed conservation. |

I.T.Z.N. 59

The following Opinions have been published recently by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature*, Volume 38, part 2, 30 April, 1981.

Continued on Page 146

SIX NEW SPECIES OF BOLIVIAN *GYPONA* (HOMOPTERA: CICADELLIDAE)¹

Dwight M. DeLong², Donald R. Foster³

ABSTRACT: Six new species of Bolivian *Gypona*: *G. wakanka* n.sp., *G. colophaga* n.sp., *G. rusticana* n.sp., *G. clausula* n.sp., *G. trepida* n.sp., and *G. unduavia* n.sp. are described and illustrated.

The genus *Gypona* was described by Germar (1821). A synopsis of the genus by DeLong and Freytag (1964) treated 44 species. Additional species were described by DeLong & Martinson (1972), DeLong & Kolbe (1974) (1975), DeLong & Freytag (1975) and DeLong & Linnavuori (1977). Six new species are described in this paper. All types are in the DeLong collection, Ohio State University.

Gypona wakanka n.sp. (Figs. 1-5)

Length of male 8.5 mm, female unknown. Crown more than twice as wide between eyes at base as long at middle. Ocelli on disc equidistant from each other and eyes. Crown black with a few dark brownish areas. Pronotum brownish anteriorly with black areas behind eyes, disc and posterior portion, black. Scutellum brownish with black basal angles. Forewings whitish, veins pale with brown margins.

Male genital plates more than 3 times as long as wide at middle, apex slightly narrowed, rounded. Style rather broad on basal two-thirds, then bent dorsally and narrowed, apex bluntly pointed. Aedeagal shaft with apical half gradually enlarged, broadly rounded apically, with 4 apical processes, 2 longer processes more than one-third length of shaft, 2 smaller processes one-half length of longer processes. Pyrofer narrowed, blunt apically.

Holotype male: Bolivia, Wakanki, Chepare Mts. 31-III-1978, C.R. Ward coll.

G. wakanka is placed in the subgenus *Marganalana* and is related to *G. nacula* DeLong and Freytag from which it can be separated by the four apical processes of the aedeagus and the broader more angled style.

Gypona colophaga n.sp. (Figs. 6-10)

Length of male 8.5 mm, female unknown. Crown more than twice as wide between eyes at base as long at middle. Ocelli closer to each other than to eyes. Crown yellowish brown. Pronotum yellowish brown, darker brown spots on disc and humeral angles. A row of small

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black spots just behind anterior margin of pronotum. Two black spots behind each eye next to lateral margin at half length of pronotum. Forewings pale brownish, claval area darker brown, dark brown spots at ends of claval veins on commissure and on cross veins of second sector. Veins pale or dark brown.

Male genital plates more than 3 times as long as wide at middle, apices bluntly pointed. Aedeagal shaft slender near base, gradually enlarged on apical half. Apex of aedeagus broadly rounded, (lateral view) with 4 processes arising ventrally on curved surface near apex, the 2 longer processes extend basad, the 2 shorter processes one-third length of shaft. Pygofer narrowed and rounded apically.

Holotype male: Bolivia, La Paz 7 mi. S.E. Unduavi 7-IV-1978, C.W. & L.B. O'Brien colls.

G. colophaga is placed in the subgenus *Marganalana* and is related to *G. wakanka* n.sp. from which it can be distinguished by the elongate, more slender style and by the longer, stouter apical processes of the aedeagus.

Gypona rusticana n.sp.

(Figs. 11-16)

Length of male 7.5, female 10.5 mm. Crown three-fourths as long at middle as wide at base between eyes. Crown orange yellow, ocelli red. Pronotum greenish yellow with remnants of four longitudinal red stripes. Scutellum dull yellowish. Forewings yellowish green, veins indistinct.

Last ventral segment of female with posterior margin shallowly, concavely excavated each side of a median lobe, produced to length of lateral angles and slightly notched at middle.

Male genital plates 3 times as long as wide at middle, apices bluntly pointed. Style sickle-shaped, apex pointed. Aedeagus short and thick, apical portion curved dorsally, apex bluntly pointed, composed of a ventral flat and a dorsal thicker portion. Pygofer bearing an apical process which arises on the dorsocaudal portion and is broadened and blunt apically.

Holotype male, Mexico, Camp. 19 mi. S.W. Escarcego, 4 Aug., 1974, C.W. and L.B. O'Brien & Marshall colls. Paratype: 1 female same data as holotype.

G. rusticana is placed in the subgenus *Marganalana* and is related to *G. palens* DeLong from which it can be separated by the single, thicker, dorsally curved, apical portion of the aedeagus and the sickle-shaped style.

Gypona clausula n.sp.

(Figs. 17-21)

Length of male 7.5 mm, female unknown. Crown broadly rounded, more than twice as wide between eyes at base as long at middle. Ocelli closer to each other than to eyes. Color, Crown dark brown. Pronotum dark brown, with 4 large black spots or areas behind each eye, the largest behind inner margin of eye. Scutellum paler brownish with 4 black spots along basal margin. Forewings pale brown, veins pale brown, partially margined with dark brown, first sector area with dark brown cross veins or cross bands.

Male genital plates 2 1/2 times as long as wide at middle, apices pointed. Style with median third slightly broadened and pectinate on dorsal margin. Apical third narrow, apex rounded. Aedeagal shaft enlarged apically, bulbous, bearing four subapical processes, the 2 nearest apex short, the more basal pair about one-third length of shaft and extend laterobasally. The apex of shaft bears 4 short spines. Pygofer narrowed apically and rounded.

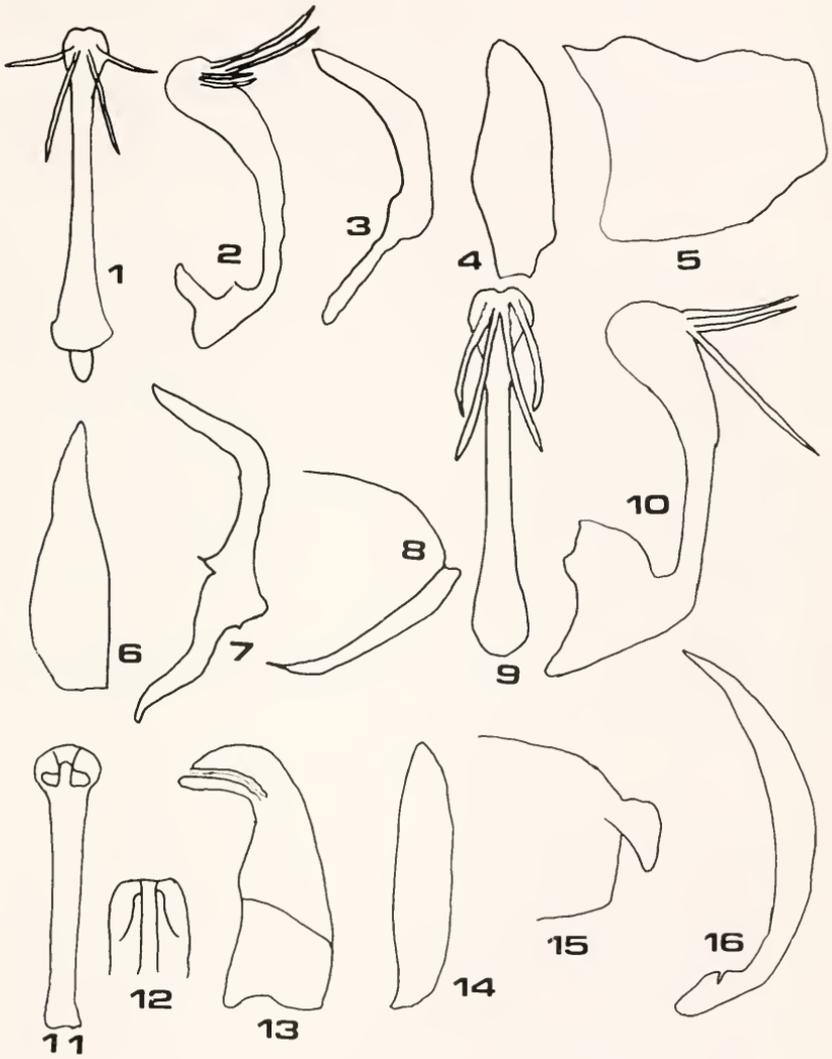


Plate I. Figs. 1-5 *Gypona wakanka* n.sp. 1. aedeagus ventrally, 2. aedeagus laterally, 3. style laterally, 4. plate ventrally, 5. pygofer laterally. Figs. 6-10 *G. colophaga* n.sp. 6. plate ventrally, 7. style laterally, 8. pygofer laterally, apical portion, 9. aedeagus ventrally, 10. aedeagus laterally. Figs. 11-16 *G. rusticana* n.sp. 11. aedeagus ventrally, 12. same, apical portion enlarged, 13. aedeagus laterally, 14. plate ventrally, 15. pygofer laterally, 16. style laterally.

Holotype male, Bolivia, La Paz, 7 mi. S.E. Unduavi, 7-IV-1978 C.W. and L.B. O'Brien colls.

G. clausula is placed in the subgenus *Marganalana* and is related to *G. rahra* DeLong, a close relative, from which it can be separated by the sharp pointed apex of the style and the four longer processes of the aedeagal shaft.

Gypona trepida n.sp.
(Figs. 22-26)

Length of male 8 mm, female unknown. Crown half as long at middle as width between eyes at base. Ocelli equidistant between each other and eyes. Crown pale brownish. Pronotum pale brown with a dark brownish circular band, a black spot at center near anterior margin each side, reaching to inner margins of eyes, two black spots near lateral margins each side at half length of pronotum. Scutellum pale brown with darker brown basal angles. Forewings pale brownish subhyaline, veins darker brown, claval area appearing dark brown at base.

Male genital plates 3 times as long as wide at middle, apex broadly rounded. Style roundedly broadened on ventral margin at middle, narrow to apical third which is curved dorsally with a spine-like pointed apex. Aedeagal shaft long, slender bearing 4 apical processes about one-fourth length of shaft, two of which, slightly shorter, extend laterobasad. Pygofer narrowed apically, bluntly angled, bearing a sclerotized plate on ventrocaudal margin.

Holotype male Bolivia, Santa Cruz, 10 km. N. Comarapa 30-III-1978, C.W. and L.B. O'Brien coll.

G. trepida is placed in the subgenus *Marganalana* and is related to *G. nigrena* DeLong from which it can be distinguished by the sharper pointed apex of the style and the broader apical portion of the aedeagal shaft.

Gypona unduavia n.sp.
(Figs. 27-32)

Length of male 9 mm, female unknown. Crown thin, foliaceous, broadly rounded, half as long at middle as wide between eyes at base, anterior margin curved upward above disc. Ocelli equidistant between each other and eyes. Crown black, ocelli red, upturned anterior margin brown, a small pale brown spot, each side at base behind ocelli. Pronotum black, median line brown, with brown curved line each side extending from spot at base of crown to lateral margin. Scutellum brownish yellow with a median black rectangular area from which a black band extends to middle, each side. Dorsum black. Forewings yellowish subhyaline.

Male genital plates 4 times as long as wide at middle, apex broad, blunt. Style rather broad, slightly narrowed before foot-shaped apex, with toe pointed dorsally. Aedeagal shaft straight, bearing a flattened, triangular, leaf-like process on ventral apical margin, bearing 4 spine-like apical processes not extending beyond ventral leaf-like portion. Pygofer narrowed, rounded apically, with a sclerotized process on caudoventral half.

Holotype, Bolivia, La Paz, 4 mi. N.E. Unduavi, 9-IV-1978, C.W. and L.B. O'Brien coll.

G. undavia is placed in the subgenus *Marganalana* and can be separated from *G. gelbana* DeLong, a related species, by the absence of a heel on the apical "foot" of the style, serrations on ventral margin of the

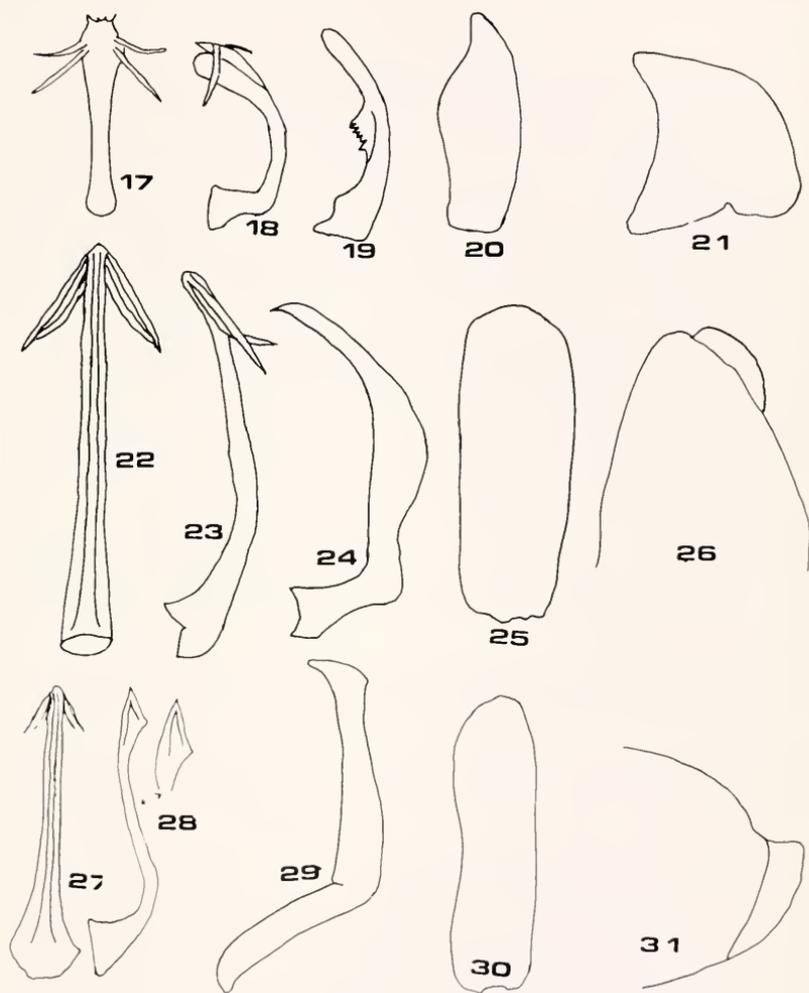


Plate II. Figs. 17-21. *Gypona clausula* n.sp., 17 aedeagus ventrally, 18. aedeagus laterally, 19. style laterally, 20. plate ventrally, 21. pygofer laterally. Figs. 22-26 *G. trepida* n.sp., 22. aedeagus ventrally, 23. aedeagus laterally, 24. style laterally, 25. plate ventrally, 26. pygofer laterally, apical portion. Figs. 27-31 *G. unduavia* n.sp. 27. aedeagus ventrally, 28. aedeagus laterally, 29. style laterally, 30. plate ventrally, 31. pygofer laterally, apical portion.

style, and different length and arrangement of apical processes on the aedeagal shaft.

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INTERNATIONAL COMMISSION OF ZOOLOGICAL NOMENCLATURE

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Opinion No.

- 1170 (p. 95) SATURNIIDAE Boisduval, 1837 (Lepidoptera): placed on official list.
- 1174 (p.105) The type species of *Attractocera* Meigen, 1803 (Diptera) is *Tipuls regelationis* Linnaeus, 1758.
- 1178 (p.114) *Megasternum* Mulsant, 1844, and *Cryptopleurum* Mulsant, 1844 (Insecta, Coleoptera): type species determined.
- 1179 (p.117) *Polydrusus* Germar, 1817 and *Phyllobius* Germar, 1824 (Insecta, Coleoptera): conserved in accordance with current usage.

The Commission regrets that it cannot supply separates of Opinions.

R.V. Melville,
Secretary

THE LARVA OF *BAETIS DARDANUS* McDUNNOUGH (EPHEMEROPTERA: BAETIDAE)¹

D.A. Soluk²

ABSTRACT: Larvae of *Baetis dardanus* McDunnough are described from specimens collected in Alberta, Canada. This species is most closely related to *B. epphipiatus* Traver. Characters used to separate these two species are given.

Baetis dardanus was originally described by McDunnough (1923) from male imagoes collected in Manitoba. The name was subsequently synonymized with *B. propinquus* (Walsh) by Burks (1953). Morihara and McCafferty (1979a) examined the lectotype (McDunnough, 1925) of *B. propinquus* and found the forceps to be of a type previously considered characteristic of males of *B. spinosus* McDunnough and distinctly different from those described for *B. dardanus*. Thus, they placed *B. spinosus* as a junior synonym of *B. propinquus* and resurrected *B. dardanus* as a valid species. It is therefore apparent that the specific name *B. propinquus* (Walsh) has been largely misapplied, and that many of the records of this species are probably applicable to *B. dardanus*.

Baetis dardanus appears to be widely distributed across central and western North American and has been reported from the following localities: Manitoba (McDunnough, 1923), Utah and Idaho (Edmunds, 1952), and Illinois (as *B. elachistus* and *B. propinquus*; Burks, 1953).

The larva of *B. dardanus* has been described by Edmunds (1952) but many of the character states now used for accurate species determination had not been developed at that time. Bergman and Hilsenhoff (1978) redescribed the larva of *B. dardanus* (as *B. propinquus*) but Morihara and McCafferty (1979a) declared that their description was of a species subsequently named *B. longipalpus* Morihara and McCafferty. When Morihara and McCafferty (1979a) reviewed the systematics of the *B. propinquus* group, they had not seen larvae of *B. dardanus* and could not accurately place this species in their phylogeny of the group. The larvae of the other species in the *B. propinquus* group are described and keyed in Morihara and McCafferty (1979b).

The initial association of larvae and male imagoes of *B. dardanus* was made from reared material and field collections obtained over 3 years from the Sand River. The following redescription of the larva of *B. dardanus* incorporates the variability existing in five populations occurring in different parts of Alberta. Most of the terms and abbreviations used in this

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description are defined by Morihara and McCafferty (1979b).

Baetis dardanus McDunnough, 1923

Mature larva:

Body length. - 6-8mm excluding caudal filaments.

Head. — Scape of antenna with scattered fine setae, scale bases, scales, and distinct distal lobe externally. Pedicel of antenna with scattered fine setae, scale bases, scales, and with tiny spinules apically. Labrum (Figure 1) with branched setae 1+6-9 submarginally on disc. Right mandible (Figure 2) with 3(1)+4 denticles, a row of fine setae along base of incisors, and with margin between incisor and molar areas smoothly sinuate, roughened only by minute tubercles. Left mandible (Figure 3) with 3(1)+3 denticles and slight excavation along base of incisor row posteriorly. Maxillary palpus extended beyond galea-lacinia and with inner apical excavation. Labial palpus (Figure 4) with internal median lobe of second segment greatly enlarged, almost as large as third segment and with 4-6 dorsal setae. Paraglossa (Figure 5) large, with 9-11 pectinate setae in innermost row. Glossa (Figure 5) with ventral setae arranged in irregular row in apical half.

Thorax. — Color pattern varied, mesonotum and pronotum (Figure 8) with narrow pale middorsal stripe. mesonotum with irregularly shaped pale areas anterior to bases of wing buds. Femur with long sharp setae dorsally and short ones ventrally; with or without dark mark ventro-medially on anterior side. Tibia and tarsus with long sharp setae ventrally and short setae dorsally. Tarsal claws with 12-16 denticles.

Abdomen. — Color pattern varied: two principal types of dorsal patterns, either terga 1-6 and 8-9 dark and tergum 7 with pale median area (Figure 8), or terga 1-9 dark with narrow pale middorsal stripe; most specimens with narrow pale areas along lateral margins and often along anterior and posterior margins of most terga; tergum 10 pale, darkened antero-medially or not; intersegmental membranes pale; at least the posterior sterna darkened medially, all darkened to some extent in most mature specimens. Tergal surfaces with scale bases, scales, and fine setae. Posterior margins of terga with short sharp teeth. Paraprocts with scale bases, scales, fine setae, and approximately 25 well developed sharp spines. Gill margins serrate with long fine setae. Caudal filaments of most specimens pale with broad submedian dark stripe, or wholly dark except for pale tips.

Material examined. — Specimens were examined from five locations in Alberta, Canada:

Sand River, 54°23'N 111°2'W; 12 larvae in alcohol, 7 on slides; 16 ♂ imagoes and 1 ♂ subimago all in alcohol.

Chinchaga River, 58°30'N 118°20'W; 7 larvae in alcohol, 1 on slide.

Vicinity of Fincastle Lake, 49°49'N 112°2'W; (R.G. Burland and D.J. Pledger collectors) 11 larvae in alcohol, 3 on slides.

Milk River, 49°6'N 11°42'W; 2 larvae in alcohol, 1 on slide.

Seven Persons Creek, 50°2'N 110°37'W; 5 larvae in alcohol, 2 on slides.

Specimens are deposited in the Canadian National Collection Ottawa, Ontario and the author's private collection.

Discussion

Baetis dardanus larvae can be separated from all known *Baetis* larvae, except those of *B. ephippiatus* Traver, by the following combination of character states: scape of antenna with distinct outer distal lobe,³ labial palpus with medial projection of second segment as large as third segment, maxillary palpus with subapical excavation, and labrum with branched

³Morihara and McCafferty (1979b) erroneously state (p. 146) that this structure occurs on the pedicel.

submarginal setae. Branched submarginal setae on the labrum is a derived character state common to both *B. dardanus* and *B. epphiatus* and indicates a close relationship between these two species. In the phylogeny of the *B. propinquus* group proposed by Morihara and McCafferty (1979a), *B. dardanus* and *B. epphiatus* should probably be considered sibling species (sensu Ross, 1974).

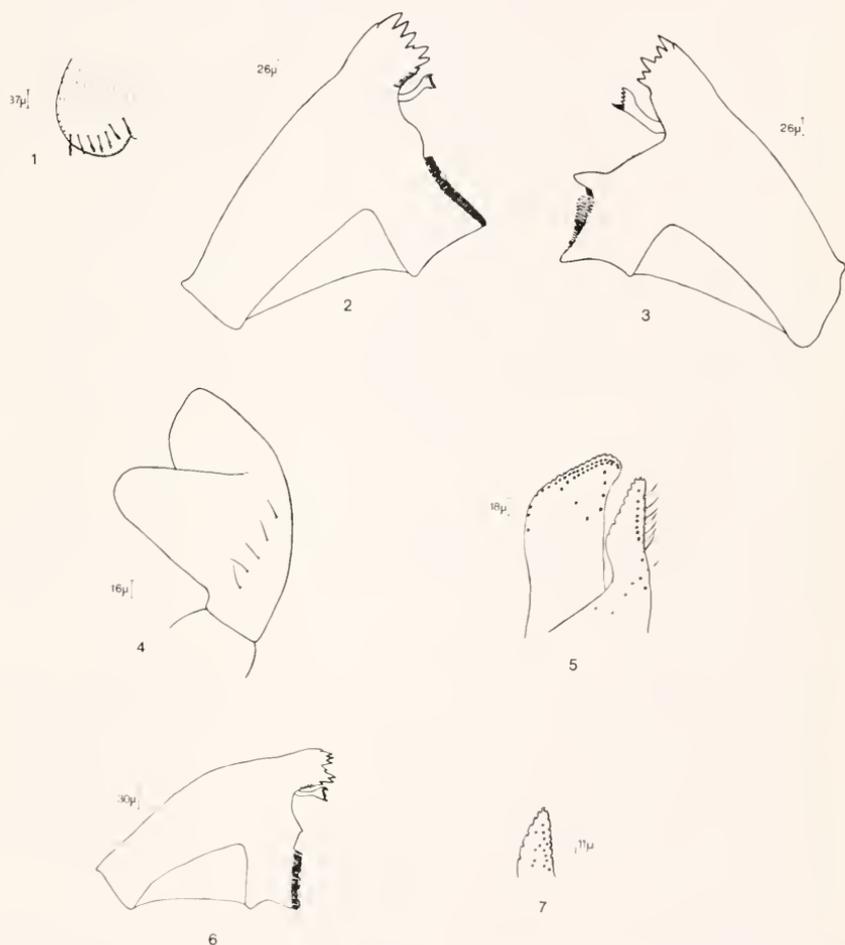


Fig. 1-5. mouthparts of *Baetis dardanus*: 1. Labrum, showing submarginal setae (others not illustrated). 2. Right mandible, posterior view. 3. Left mandible, posterior view. 4. Labial palpus. 5. Glossa and paraglossa.

Fig. 6-7. mouthparts of *B. epphiatus*: 6. Right mandible, posterior view. 7. Glossa.

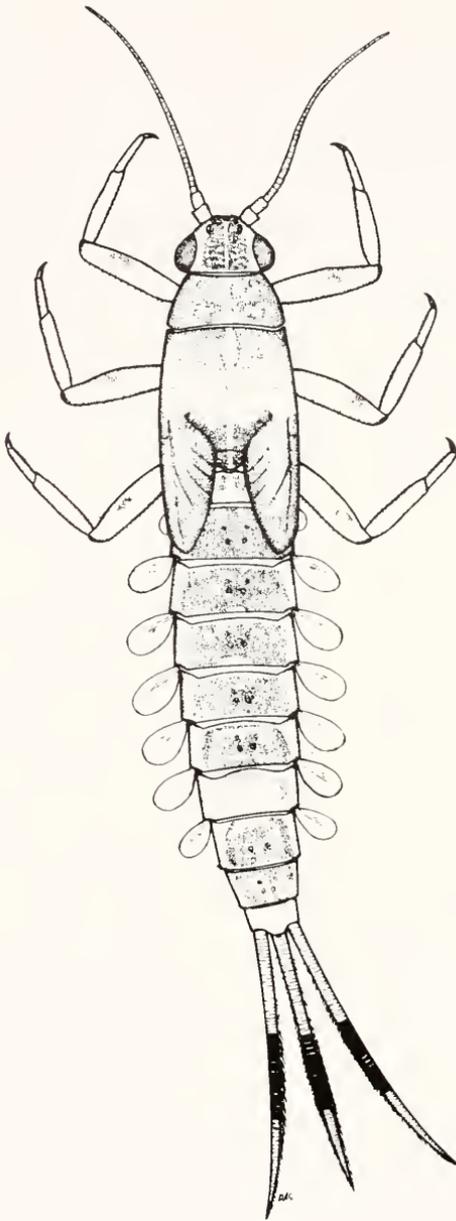


Fig. 8. Dorsal view of *B. dardanus*.

Male imagoes of *B. dardanus* and *B. epphiatus* can be distinguished by the structure of the posterior-median projection between the forcep bases (Moriyama and McCafferty, 1979a). Separation of larvae of these two species requires dissection and examination of the mouthparts. Larvae of *B. dardanus* key out to *B. epphiatus* in Moriyama and McCafferty (1979b). I examined a series of *B. epphiatus* from Mississippi and have prepared the following couplet to distinguish between larvae of these two species.

- Right mandible with margin between incisor and molar areas smoothly sinuate, at most roughened by small sharpened tubercles (Figure 2); ventral setae of glossa in one irregular row in anterior half (Figure 5)
 *B. dardanus* McDunnough
- Right mandible with margin between incisor and molar areas interrupted by a prominent toothlike tubercle (Figure 6); ventral setae of glossa scattered or arranged in two or more irregular rows (Figure 7)
 *B. epphiatus* Traver

This description in accompaniment with Moriyama and McCafferty (1979b) should allow easy separation of the mature larvae of the North American species in the *B. propinquus* group.

ACKNOWLEDGEMENTS

I wish to thank Dr. Lewis Berner for providing specimens of *B. epphiatus*, Mr. Robert Burland of Alberta Environment for the Fincastle material, and Drs. H.F. Clifford, G.F. Edmunds Jr., and G.E. Ball for suggestions in the preparation of this manuscript. This research was supported in part by a NSERC grant to Dr. H.F. Clifford and a Boreal Institute for Northern Studies grant to the author.

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***STENONEMA MEXICANA* (HEPTAGENIIDAE: EPHEMEROPTERA) IN SOUTHERN CENTRAL AMERICA¹**

R.W. Flowers, William L. Peters²

ABSTRACT: *Stenonema mexicana* (Ulmer) is reported from the Canal Zone in Panamá and its taxonomic status is clarified.

A single mature nymph of *Stenonema mexicana* (Ulmer) was collected in the Canal Zone of Panamá by one of us (WLP) and C.M. Keenan and this nymph was reported by Edmunds, Jensen and Berner (1976) in their stated distribution of *Stenonema* as "... as far south as Panama." The specimen was found in the Río Sardinillo on the Gamboa Road, 10-IX-1963 and is deposited in the collections of Florida A&M University. Allen and Cohen (1977) described a *Stenonema* nymph from Guatemala which they assigned to *Heptagenia mexicana* Ulmer (1920) and tentatively transferred *mexicana* to *Stenomema*. Bednarik and McCafferty (1979) assigned the same nymph to *S. integrum* McD and stated that there were not sufficient grounds for linking the nymph in question to *H. mexicana*.

We have examined type material of Ulmer's *Heptagenia mexicana* consisting of 2 ♂ and 1 ♀ syntypes. Although somewhat distorted in drying, the male penes are those of a *Stenonema*. Subimagos of the same species in the University of Utah collection collected in Costa Rica clearly show *Stenonema*-type penes (Fig. 1). Ulmer's syntypes somewhat resemble specimens of *Stenonema integrum*, particularly in regard to the mid-dorsal black streak on the abdomen, but differ in the following characters: (1) black diagonal lines are present on the thoracic pleura beneath the wing bases; and (2) spiracular marks on the abdomen are large round dots (not diagonal streaks, as in *S. integrum*) and are distinct on terga 8 and 9. We therefore conclude that Allen and Cohen's transfer of *H. mexicana* to *Stenomema* was correct and that *S. mexicana* and *S. integrum* are distinct species.

The Panamanian nymph agrees closely with Allen and Cohen's nymphal description. In addition, dark color markings of the subimago are visible through the abdominal cuticle of the Panamá nymph and these are consistent with the pattern on the syntypes of *S. mexicana*.

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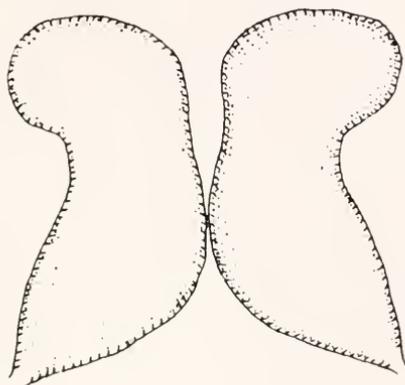


Fig. 1. *Stenonema mexicana*, outline of penes of male subimago.

The Panamanian nymph differs from nymphs of *S. integrum* in having the lateral spine on abdominal segment 8 subequal to that of segment 9 (in *S. integrum*, the spine on segment 8 is distinctly larger than that on 9). The color patterns of the two species are very similar, although the Panamanian nymph has more extensive pale markings than most nymphs of *S. integrum*.

The existence of the Heptageniidae in continental South America is indicated only by two questionable records: an unidentified wing from Brazil (Demoulin 1955) and Eaton's (1871) assignment of *Baetis guttata* (Pictet 1843) from Chile to *Ecdyonurus guttatus*. We have examined a color reproduction of Pictet's figure and are unable to determine the identity of this species, although Eaton's description of the body markings suggests that *Baetis guttata* may be a *Siphonella* (Siphonuridae). The occurrence of *Stenonema mexicana* in the Canal Zone of Panamá represents a southward range extension of over 1500 km and verifies the distributions given by Edmunds, Jensen and Berner (1976). It also represents the closest proximity known to continental South American of an identifiable member of the Heptageniidae.

Stenonema mexicana will key to *S. integrum* in Bednarik and McCafferty (1979). The two species may be separated using the following key.

Adults

Thoracic pleura with black diagonal streaks; spiracular marks on abdomen round	<i>S. mexicana</i>
Thoracic pleura without black diagonal streaks; spiracular marks diagonal	<i>S. integrum</i>

Mature Nymphs

- Lateral projections on segment 8 subequal to those on segment 9 *S. mexicana*
- Lateral projections on segment 8 distinctly longer than those on segment 9
 *S. integrum*

ACKNOWLEDGEMENT

We wish to thank Dr. Kurt K. Günther, Humbolt-Universität zu Berlin, for the loan of Ulmer's type material. We also thank Dr. George F. Edmunds, Jr., University of Utah, for loan of additional Central American specimens. This research was supported by a research program (FLAX 79009) from SEA/CR, USDA.

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A NEW DISTRIBUTIONAL RECORD FOR *TAENIOPTERYX* (PLECOPTERA: TAENIOPTERYGIDAE) FROM COLORADO¹

Steven Canton², James Chadwick², Linda Britton³

ABSTRACT: Nymphs of *Taeniopteryx* were collected from two stream locations in Jackson County, Colorado. The collection represents a new record for the State and an extension of the range for the genus.

Collection of benthic organisms from selected streams in Jackson County, Colorado (Fig. 1) during mid-September 1980, yielded many specimens of the stonefly *Taeniopteryx*. This is a new state and distributional record for the genus. Previous to this collection, published reports of *Taeniopteryx* in the western United States have been restricted to records of *Taeniopteryx nivalis* (Fitch) from California, Oregon and Idaho and a single *Taeniopteryx* nymph from New Mexico (Ricker and Ross 1968, Stewart et al. 1974, Baumann et al. 1977, Fullington and Stewart 1980). Recently, *T. nivalis* has also been found in Washington (Baumann pers. comm.)

Benthic organisms were collected from the Canadian River and Little Grizzly Creek (Fig. 1) with a Surber sampler. Only one specimen of *Taeniopteryx* was collected in Little Grizzly Creek at site JC-2. However, density of *Taeniopteryx* in the Canadian River at JC-5 was over 400 organisms per square meter. The Canadian River at site JC-5 has a gradient of 0.3% and meanders through a grassland-sagebrush valley at an elevation of 2438m. The river at this site has a shifting sand and gravel substrate. Nymphs of *Taeniopteryx* were not found at either of the upstream sites (JC-1 or JC-4), which have a coarser substrate of gravel and rubble.

Sampling for benthic organisms at these sites began during May 1980 and continued on a bimonthly basis through November 1980. However, only the 17 September 1980 sampling yielded collection of *Taeniopteryx*. The early fall occurrence of this population is interesting since it has previously been reported to occur later in the year during winter and early-spring (Knight et al. 1976). Further sampling at other streams in the area may yield more specimens.

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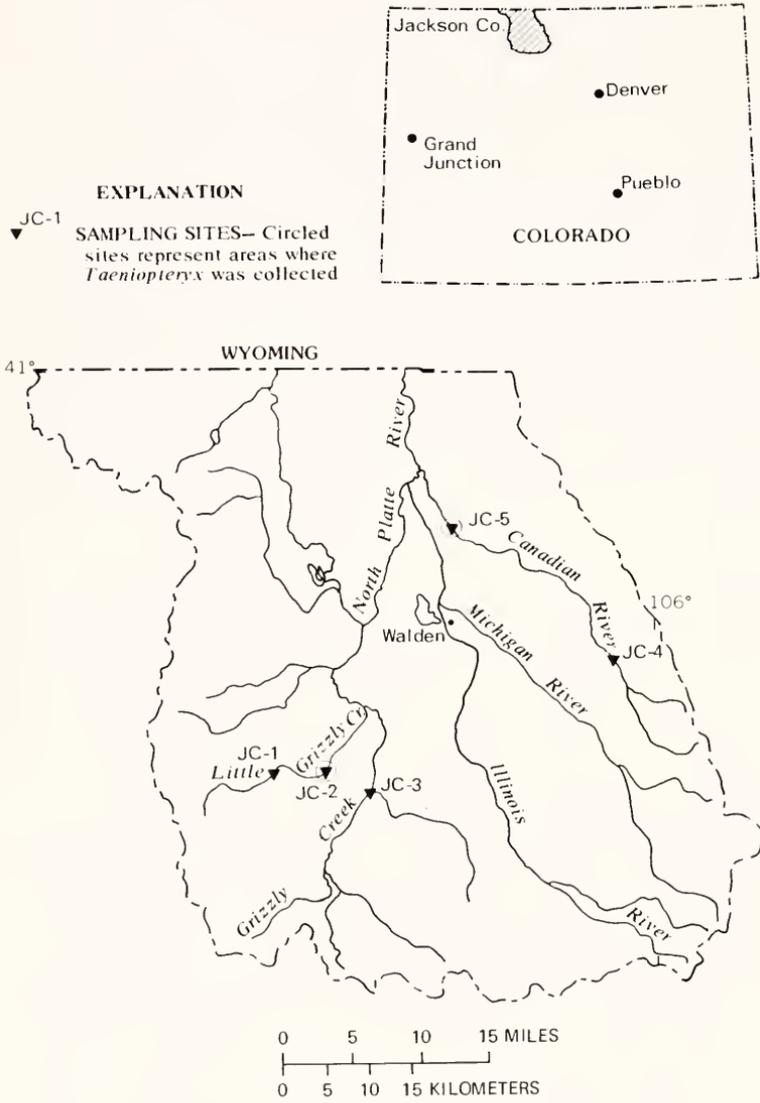


Fig. 1. Sampling locations for benthic invertebrates in Jackson County, Colorado.

ACKNOWLEDGEMENTS

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 INTERNATIONAL COMMISSION OF ZOOLOGICAL
 NOMENCLATURE

c/o BRITISH MUSEUM (NATURAL HISTORY), CROMWELL ROAD, LONDON,
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A.N.(S.)119

5 August 1981

The Commission hereby gives six months' notice of the possible use of its plenary powers in the following cases, published in *Bull. zool. Nom.*, Volume 38, part 3, 30 July 1981, and will welcome comments and advice on them from interested zoologists. Correspondence should be addressed to the Secretary at the above address, if possible within six months of the date of publication of this notice.

Case No.

- 2299 *Ahaullea* de la Llave, 1832 (Insecta, Heteroptera, Corixidae): proposed suppression under plenary powers.
- 2334 To grant precedence to the family-group name EPHYDRIDAE over HYDRELLIIDAE (Insecta, Diptera).
- 2147 *Nabis capsiformis* Germar, [1838] (Insecta, Heteroptera, Nabidae): proposed conservation.
- 1799 *Semblis marginata* Panzer, 1799 (Insecta, Plecoptera): additional steps needed to conserve this name.

Continued on Page 164

NEW RECORDS OF OHIO CADDISFLIES (TRICHOPTERA)^{1,2}

A.D. Huryn, B.A. Foote³

ABSTRACT: Twenty-five species of caddisflies are newly recorded for Ohio, bringing the total number of species reported for the state to 192.

Until recently, there have been few studies devoted exclusively to the faunal composition and distribution of Ohio caddisflies. Prior to 1977, Marshall's work (1939) on the occurrence of caddisflies in western Lake Erie was the only published study of this nature. However, numerous records for Ohio Trichoptera were contained in Ross (1944). Since 1977, seven studies concentrating on the caddisfly fauna of various localities in eastern Ohio have resulted in five publications (McElravy *et al.*, 1977; McElravy and Foote, 1978; Masteller and Flint, 1979; MacLean and MacLean, 1980; Petersen and Foote, 1980). In this paper, we are recording an additional 25 species, bringing the total state list to 192 species.

Adults were collected by hand picking, sweeping with an insect net, use of U.V. and fluorescent tube light traps, and emergence traps. Immature stages were obtained by hand picking or with an aquatic dip net.

The records presented below were obtained through the collecting efforts of the following individuals: T.L. Arsuffi, R. Beals, B.A. Foote, M.B. Griffith, T. Hausenstaub, R. Hunt, A.D. Huryn, W. Ladanyi, E.P. McElravy, J. O'Malley, C. Petersen, M.A. Tkac, R. Walker, and G. Wireman. For each species included in the list, the county, initials of the collector, collecting sites, date, and, when possible, the number of specimens obtained are given. Unless otherwise indicated (P=pupa, L=larva), all records are based on adult specimens. Taxa above the species are arranged as given in Wiggins (1977, p. 9-14). Species within each genus are listed alphabetically.

Polycentropodidae

Polycentropus carolinensis Banks: Portage, (RH, Porter Rd. spring in West Branch State Park, VI-2-79, IX-12-79). Previously reported only from the Black Mountains of North Carolina and southern Quebec (Roy and Harper, 1979), our records represent only the third locality record for this widespread but rare species.

Polycentropus elarus Ross: Monroe (ADH, tributary of Dog Skin Run, IX-3-80, 1♂, 1♀).

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²Research supported, in part, by a grant from the Ohio Biological Survey.

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Hydropsychidae

- Parapsyche apicalis* (Banks): Geauga (JO, V-13-78, L), Portage (RW, Mantua Springs, X-11-78, IL); Summit (BAF, Furnace Run at rt. 303, V-10-78, 2L)
Dipletrona metaqui Ross: Knox (MBG, spring, 2 mi. se of Millwood along state rt. 715, V-25-80, 1L).
Cheumatopsyche wabasha Denning: Ashland (MBG, Clear Fork of Mohican R, V-24-80, 1♂). Previously recorded from Oregon and Minnesota (Gordon, 1974), the Ohio record represents a significant range extension eastward.

Rhyacophilidae

- Rhyacophila minora* Banks: 5Columbiana (MAT, Sheepskin Hollow, VI-7-76), Geauga (MAT, Stebbins Gulch, V-25-75).
Rhyacophila parantra Ross: Ashland (MAT, VI-18-76).

Glossosomatidae

- Protophila maculata* Hagen: Ashtabula (TLA, Grand R. at Harpersfield, VIII-26-76).

Hydroptilidae

- Hydroptila amoena* Ross: Monroe (ADH, Wildcat Run, VIII-20-80, 2♂♂, 3♀♀, IX-15-80, 1♂; Witten Run at Rt. 800, VIII-20-80, 8♂♂, 2♀♀; Little Muskingum R., 1 mi. n. of Rt. 800 bridge, VIII-20-80, 2♂♂).
Ochrotrichia tarsalis (Hagen): Monroe (ADH, Clear Fork of Little Muskingum R. at State Rt. 26, VIII-6-80, 2♀♀; Little Muskingum R., 2 mi. s. Bloomfield, VIII-6-80, 3♂♂, 9♀♀; covered bridge, 1 mi. n. of Rinard Mills, IX-15-80, 1♀).
Stactobiella delira (Ross): Ashtabula (TH, Grand R. at Geneva, V-11, 24-73, 2♂♂, 1♀).
Neotrichia falca Ross: Monroe (ADH, Witten Run at Rt. 800, IX-15-80, 1♂). Previously known from Wisconsin and Illinois.
Neotrichia vibrans Ross: Monroe (ADH, Little Muskingum R., 2 mi. S. of Bloomfield, VIII-6-80, 1♂).

Brachycentridae

- Micrasema rusticum* Hagen: Portage (EPM, Cuyahoga R. at Coit Rd., VI-1-76, 1♂).

Limnephilidae

- Pseudostenophylax uniformis* (Betten): Ashtabula (TH, Grand R., V-30-73).
Frenesia missa (Milne): Ashtabula (RB, X-28-76, 1♂, 1♀), Portage (EPM, Kent, X-25-75; GW, spring, 0.75 mi. sw of Garrettsville, XI-10-78).
Neophylax fuscus Banks: Ashtabula (EPM, Grand R. at Harpersfield, X-13-75).
Neophylax wigginsi Sykora and Weaver: Monroe (ADH, Wildcat Run, IX-15-80, 1♂, 2♀♀, X-1-80, 1♂, 3♀♀). Originally described from material collected at Westmoreland City, PA (Sykora and Weaver, 1978), our records represent a slight extension westward of the known range.

Lepidostomatidae

- Lepidostoma griseum* (Banks): Geauga (TH, Grand R. near Camp Chickagami, VIII-27-73, 1♂). Lake (TH, Grand R., IX-11-73, 3♀♀), Portage (RH, Porter Rd. spring in West Branch State Park, X-5-79, 1♂).
- Lepidostoma sackeni* (Banks): Geauga (TH, Grand R. near Camp Chickagami, VIII-8-73, 1♂), Lake (TH, Grand R., VIII-8-73, 1♂).
- Lepidostoma sommernanna* Ross: Lake (TH, Grand R., VI-5-73, 1♂, VII-31-73, 2♀♀). Portage (BAF, Porter Rd. Spring and Triple Springs in West Branch State Park, VI-1-78).
- Lepidostoma vernalis* (Banks): Portage (BAF, Porter Rd. spring and Triple Springs in West Branch State Park, VI-10-78, 4♂♂).

Molannidae

- Molanna ulmerina* Navas (*Molanna musetta* Betten): Ashtabula (TH, Grand R., VI-25-73, IX-11-73, 6♂♂).

Leptoceridae

- Ceraclea neffi* Resh: Trumbull (TH, tributary of Grand R. near Farmington, V-22-73, IL).
- Triaenodes melacus* Ross: Monroe (ADH, Little Muskingum R. near Antioch, VIII-20-80, 1♀).

ACKNOWLEDGEMENTS

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A NEW SPECIES OF *LEPIDOPHORA* WESTWOOD
(DIPTERA: BOMBYLIIDAE) FROM COSTA RICA
REARED FROM *TRYPOXYLON* LATREILLE
(HYMENOPTERA: SPHECIDAE)¹

Jack C. Hall²

ABSTRACT: The adult of *Lepidophora trypoxylona* new species and its pupal exuvium are described and figured. *Trypoxylon* (*Trypargilum*) *tenocitlan* Richards (Sphecidae) is recorded as host of this bee fly.

Lepidophora Westwood is restricted to the New World with most species being described from Central and South America. The present description of the new species, *Lepidophora trypoxylona*, brings the total known species to eight.

Specimens of *L. trypoxylona* n.sp. were reared from nests of *Trypoxylon* (*Trypargilum*) *tenocitlan* Richards in Costa Rica by R.E. Coville. Specimens submitted by Coville to me for identification were identified as *Lepidophora vetusta* Walker. Coville and Coville (1980) gave a brief account of the life history of the bee fly, as *L. vetusta*. Further examination of additional material sent for identification showed this species to be undescribed.

Coville's host record makes *L. trypoxylona* the second species within the genus for which host information is known. DuMerle (1975) lists hosts for *Lepidophora lepidocera* (Wiedemann) as *Trypoxylon politum* (Say) (Sphecidae), *Podium rufipes* Fab. (Sphecidae) and *Stenodynerus saecularis rufulus* Bohart (Eumenidae), plus one questionable host, *Euodynerus foraminatus apopkinsis* (Robertson) (Eumenidae).

L. trypoxylona runs to *vetusta* in Paramonov's (1949) key to species of *Lepidophora*. *Trypoxylona* differs from *vetusta* in the darker scutellum and legs and by the less extensive white tomentose abdominal markings. In *vetusta* the wing infuscations are a little darker and more extensive, the anal cell being nearly entirely colored.

Lepidophora trypoxylona n.sp.

Male. — Body black, front, face, humerus, and side of mesonotum to transverse suture, pleura, coxae, scutellum slightly brownish. Eyes separated by width of ocellar tubercle; small area in front of ocellar tubercle bare, rest of front of black hair and mixed black and white scales; first antennal segment at least 3 times longer than second segment, with black scales

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(some of the scales are brownish and translucent and appear white or whitish in reflected light); second antennal segment covered with scales and about equal in length to third segment; third segment broadly rounded apically, with long black scales covering basal $2/3$ or more on outer surface, scales do not exceed $2/3$ length of third segment; arista minute, subapical, in a small circular depression. Face with long black scales on upper half, lower half with black hair. Proboscis short, not reaching second antennal segment. Underside of head and lower occiput with black hair; rest of occiput with short, scattered, strong black bristles and white scales, a few black scales next to eye margin and behind ocellar tubercle.

Pronotum white pilose, a few shorter black hairs present near base laterally, black bristles laterally; mesonotum with short black hair, tomentum white, dorsum of notum with three vague stripes of black tomentum, median stripe divided by white scales, lateral stripes reach from midpoint of notum to posterior margin; prealar and postalar bristles strong, black; scutellum with black hair, tomentum, and bristles, patch of white scales in middle of posterior margin; pleura mixed white and black pilose, white hairs dominate on upper half; coxae with mixed white and black hair; legs black with black tomentum and bristles, white tomentum on posterior surfaces of femora and tibiae; pulvilli nearly as long as claws; halter stem black with short appressed white hair, knob creamy yellow.

Basicosta of wing with black scales, extreme base with a patch of white hair; wing infuscated with blackish brown, apex and posterior margin of wing hyaline, color not filling apex of marginal cell and not extending much beyond apex of discal cell in first posterior cell; anal and axillary cells hyaline except for extreme base; wing membrane with scattered black scales covering most of the infuscated area; vein R_2+3 convoluted apically, with a short spur at bottom loop; vein R_4 convolutes "S" shaped ending in wing margin parallel to vein R_2+3 ; r-m crossvein slightly beyond middle of discal cell; anal cell closed at wing margin; costa tuberculate from near midlength to just beyond apex of vein R_2+3 .

Abdominal dorsum with black hair laterally, a few scattered white hairs at sides of tergites two and three; dorsum densely covered with black scales which are much longer on sides of tergites six and seven; white scales across posterior margin of first tergite; spot of white scales laterally on tergites two, three, four, and at base of five, the spots forming a vague line along side of tergum; spot of white scales in middle of tergite six; venter of abdomen with short, scattered black hair and black scales; genitalia enclosed in terminal segments and hidden by apical abdominal tuft of long black scales.

Female. — Eyes separated by 3 times width of ocellar tubercle; front with strong, black, bristle-like hairs; side and apical margin of scutellum with white hair; costa of wing not tuberculate; vein R_2+3 infuscated its entire length; vein R_4 with small area of infuscation near apex; areas of diffused color around crossveins at bases of all posterior cells; white hair and scales on head and body more abundant. Female otherwise as described for male.

Variations. — In some males the spot of white scales in the middle of tergite six is wanting as well as the lateral abdominal spots on tergites two to four. The amount and extent of white scales in both sexes is subject to considerable variation. The stripes of black scales on the mesonotum may not be present. The wing coloring in the female is often like that in the male. The black scales on the abdominal dorsum of some species are iridescent, reflecting a lavender color.

Pupal exuvium (Figs. 1-2). — Pale testaceous, cephalic thorns and abdominal setae black, apical half of wing pads darkened. Thoracic and abdominal spiracles raised, each appearing as a corneous circle marked with radiating lines. Head with six pairs of thorns or tubercles, one small pair on dorsum, one large pair on upper part of front, one medium sized pair in middle of front, three small pairs on lower part of front, these latter tubercles all have a common base; surface sculpture of the thorns is striate-rugose; base of proboscis with a pair of small tubercles; cheek with a small tubercle; a thin seta present between the tubercles on the proboscis and cheek; lower posterior corner of head with two small tubercles, a thin seta between them; two long, thin setae at bases of upper cephalic tubercles. Thorax twice as long

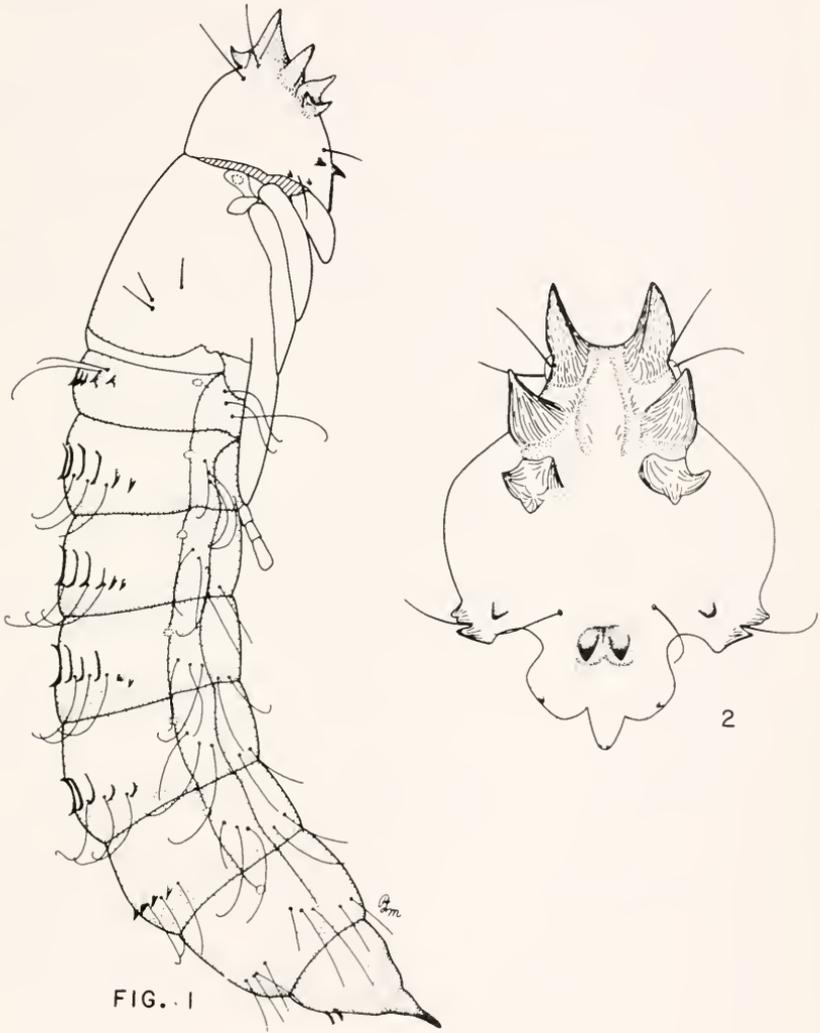


Fig. 1. Lateral view of pupal case of *Lepidophora trypoxylona* n.sp.

Fig. 2. Ventral view of head capsule of *Lepidophora trypoxylona* n.sp.

as wide, equal in width to head, with three fine, short hairs each side medially, wing pads extend to posterior margin of second abdominal sternite; leg sheaths extend to slightly beyond middle of third sternite. Abdomen with eight segments, first five tergites with a row of 8 to 11 stout setae, those on tergite one with only their apices turned up; tergite six with six small setae; tergite seven with a single median seta, and one pair of small setae on basal half; tergites one to seven each with six long, curved and apically hooked hairs, those on first tergite arise cephalad to the setae; those on rest of tergites arise between the setae; sternites, except last, each with five long, thin apically hooked hairs, three laterally and two just lateral of midline; apex of abdomen with one pair of straight, strong tubercles.

Holotype male from Costa Rica, Guanacasta Province, 15 km SW Baqaces, Comelco 25-II-75 (R. Coville); allotype from Costa Rica, Guanacasta Province, 4 km NW Cañas, La Pacifica 14-II-75 (R. Coville). Both reared from nest of *Trypoxylon* (*Trypargilum*) *tenocitlan* Richards.

Paratypes. — All reared from trap-nests of *Trypoxylon* (*Trypargilum*) *tenocitlan* by R.E. Coville, in Costa Rica. 1♀, topotypic, collected with holotype; 2♀, 1♂, same locality data as allotype, 30-III-80, 7-II-75; 4♀, 3♂, Heredia Province, La Salva, 4 km SE Puerto Viejo, 16-VII-80, 1-VIII-80, 16-VIII-80, 24-VIII-80.

Holotype and allotype in California Academy of Sciences. Paratypes in collections at University of California at Berkeley and Riverside.

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Continued from Page 157

INTERNATIONAL COMMISSION OF ZOOLOGICAL NOMENCLATURE

c/o BRITISH MUSEUM (NATURAL HISTORY), CROMWELL ROAD, LONDON,
SW7 5BD

- 2178 *Nomioides* Schenck, 1866, (Insecta, Hymenoptera, Halictidae):
proposed designation of type species.
- 2187 Corrections to data of three family-group names of butterflies on the
official list (Insecta, Lepidoptera).

R.V. MELVILLE,
Secretary

A NOTE ABOUT FLORISSANT FOSSIL INSECTS¹

F. Martin Brown²

ABSTRACT: The discoverer of the famous Oligocene fossil insect beds at Florissant, Colorado, has been moot. It now appears that Theodore Lutrell Mead first brought the fossil insects to scientific notice in 1871.

In 1909 T.D.A. Cockerell (p. 55) wrote at the end of his description of *Alepidophora pealei* (Diptera: Bombyliidae) "While I was preparing the above description, Dr. A.C. Peale, the discoverer of the Florissant shales, visited my laboratory...." Doubtlessly Cockerell was misled by Hayden's³ statements about the fossil beds. What few fossil specimens Peale collected constituted the third batch brought to the attention of scientists.

The earliest mention of fossil insects from the site is in the 5th Annual Report of the Geological Survey of the Territories, for 1872 p. 371, published in 1873. There it is noted that S.A. Allen collected some fossil plants and a few such insects at "South Park, near Costello's ranch". In the next Annual Report, the 6th, on p. 210 are the first descriptions of fossil plants from the shales, some of which Peale collected in 1873 along with a few insects.

The person who collected insect fossils in the Florissant area before any of Hayden's men were there was Theodore Lutrell Mead, a quasi-member of the Wheeler Surveys. It is understandable that Hayden made no mention of Mead. Hayden was feuding in Washington to remove the Army's Topographic Engineers from field surveying in the west. Mead was in between high school and college when he went to Colorado for his future father-in-law, William Henry Edwards, the man who contributed more to knowledge of the butterflies of North America than any other person.

Mead visited the Florissant fossil beds in September, 1871. The specimens he collected he sent to Edwards who in turn sent them to Samuel Hubbard Scudder in Cambridge, Mass. Scudder published on these in 1876, noting Mead as the collector but not giving any date of collection. Mead's only trip to Colorado was in 1871. Here is Mead's first-hand statement about collecting fossils, taken from a letter in the library of Rollins College, Winter Park, Florida.

¹Received March 26, 1981

²Wright-Ingraham Institute, Colorado Springs, Colorado

³Ferdinand V. Hayden was Chief of the United States Geological and Geographical Surveys of the Territories. This superceded the Wheeler Survey West of the 100th meridian and preceded the U.S. Geological Survey, of which Hayden was the second director.

The letter was started on September 13, 1871, at Mead's Station 39 on the road from Fairplay to Canyon City. It is addressed to his aunt in New York City, Mrs. S.B. Strang. The pertinent paragraph reads "I started this letter at Station 39. Before I had time to finish it I heard wonderful tales of petrified stumps and fossil insects, thirty miles away. So, I hired a horse and went there finding all as represented. I found nearly 20 insects and brought back about 25 lbs. of petrified wood. Some of the stumps are 20 ft. across. They are in all respects similar to ordinary stumps but converted to stone."

The next letter in Mead's copybook clinches the locality. It is to Mr. James Costello who operated the post-office and hostelry at Florissant in the late 1860s and early 1870s. In it Mead asks for the forwarding of some personal effects he had left behind. "Judge" Costello (spelled Castello by Scudder) owned a considerable ranch adjacent to a ranch owned by Adam Hill. Mead's reference to "20 ft. stumps" places the site on Hill's property. The large stump alluded to and Scudder's (1881: 283-284) trench are about a quarter mile north of the visitor's center of the Florissant Fossil Beds National Monument. It is not at all improbable that Mead dug his fossils from the same spot where Scudder later took thousands, a hundred yards or so southwest of the big stump.

The discoverer of the Florissant beds in Teller County, Colorado, is completely unknown. I suspect that it may have been Adam Hill on whose ranch Scudder developed his principle trench in 1877.

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1881. The Tertiary Lake Basin of Florissant, Colorado, between South and Hayden Parks. U.S. Geological and Geographical Survey of the Territories. Bulletin 6: 279-300. 1 pl.

THE PROCEEDINGS OF THE HENRY S. DYBAS SYMPOSIUM AT TRI-STATE UNIVERSITY¹

Gene Kritsky²

On November 22, 1980, Henry S. Dybas of the Field Museum of Natural History was awarded an honorary Doctorate of Science from Tri-State University. Henry S. Dybas joined the Field Museum in 1943 and was appointed Curator Emeritus upon his retirement in 1980. Dybas' major research interests are the ecology and evolution of periodical cicadas and the classification and biology of the beetle family Ptiliidae. To commemorate the awarding of the degree, a symposium was held, bringing together several entomologists to discuss research that related to Henry S. Dybas' own work. The moderator was Gene Kritsky of Tri-State University. Abstracts of the papers are presented herein.

An exciting decade with the aquatic Coleoptera.

Frank N. Young, Dept. of Biology, Indiana University, Bloomington, IN 47405.

New discoveries such as the smallest predaceous water beetle and the first blind, depigmented, aquifer - adapted Dytiscidae can be used to study the tempo of evolution. These water beetles illustrate convergence, and parallel evolution with other beetles. Analogies such as adaptive peaks can be used to symbolize evolution and understand the origin and extinction of species.

The evolution of complex acoustical behavior in cicadas.

Thomas E. Moore, Museum of Zoology & Division of Biological Sciences, The University of Michigan, Ann Arbor, MI 48109.

Cicadas and spittlebugs are close relatives that share many characteristics as juveniles and adults. Cicada songs probably evolved from common beginnings with spittlebug courtship sounds, hardly modified in modern Australian *Tettigarctine* cicadas. Cicadas are the only loud insects singing by timballing (which apparently evolved only once), by crepitating (wing-banging, which evolved more than once) and by stridulating (which evolved more than once). These loud species-specific songs are their primary isolating and initial aggregating mechanisms. Male cicadas are the timballing singers — only females of the two species of the Australian *Tettigarcta* have timbals — females of several species also crepitate and stridulate with their

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wings as do their males. Timballing produces the most complex songs; most timbals have either 3 or 4 sound-producing ribs, and many songs show both amplitude- and frequency-modulation. Most cicadas sing only while sitting on vegetation, and only as isolated males. Visual as well as acoustical cues are important in singing, and acoustic directional response has been demonstrated only in females of one species. Some species, however, have evolved group singing by strongly clumped males in "chorus trees" or "chorus bushes," some even synchronizing or alternating individual songs, but a few in Argentina sing only in flight from chorus vegetation with strongly clumped males. Females among many males in these chorusing groups probably measure individual male quality before accepting a mate, but the mechanisms and specific effects of this sexual selection have yet to be identified.

Evidence for a 13-year & 17-year hybridization.

Monte Lloyd, Department of Biology, University of Chicago, Chicago, IL 60637.

There are cases where two broods of 17 year cicadas 4 years apart coexist in the same woods. These can be interpreted as being in the process of forming a new 17-year brood that is 4 years accelerated over the previous one. There is some indication that crowding among 17-year nymphs can cause them to delete the 4 year inhibition that normally seems to be programmed as part of their life cycle. If this were to happen repeatedly and be genetically assimilated, it could lead to the evolution of 13-year cicadas from 17-year ones without ever having passed through a life cycle of intermediate length, which would inevitably destroy the periodicity.

There are also cases of two broods of 13-year cicadas coexisting in the same woods. These can not possibly be interpreted in the same way since 13-year cicadas have no 4-year inhibition in growth, and presumably could not grow up in 9 years. An alternative interpretation is that one of the 13-year broods (Brood XXIII) has resulted from hybridization between 13-year Brood XIX and one or another of the 17-year broods. Evidence for this interpretation comes from historical records of a hybridization in 1868 between Brood XIX and Brood X, which resulted in 1898 in the appearance of a new population of Brood XXIII in Dewitt County, Illinois, and the concurrent disappearance of Brood X from that area. A new population of Brood XXIII has also been discovered in Knox County, Illinois, where it appears to have resulted from a hybridization between Brood XIX and Brood III in 1946 and first appeared in 1976.

Theoretically if a 13- and a 17-year brood occur in the same woods, the 13-year brood should readily outcompete the 17-year one. Theoretical reasons are given as to why this should be true.

Competition among cicada species: ecological situations and biological evidence.

JoAnn White, Department of Zoology, University of North Carolina, Chapel Hill, N.C. 27514.

In mature forests the three periodical cicada species show distinct habitat preferences, which serve to keep them separated in space and minimize interspecific competition among them. However, all three species are attracted to the young vigorously growing trees of second growth habitats, where they find themselves stimulated to oviposit in a much wider variety of host species than occur together in mature forests. In second growth, then, interspecies competition does appear to be important, especially since the fungus disease (*Masospora cicadina*) tends to be absent or poorly developed in second growth habitats, and cicadas correspondingly high.

The evidence that competition is important in the population dynamics of a particular cicada species and in the structuring of periodical cicada communities comes from four sources: (1) oviposition preferences of the three cicada species, (2) variable growth rates among nymphs of the same age, (3) mortality of nymphs in crowded populations, and (4) the spatial patterns of nymphs below ground.

A common response of both nymphs and adults to severe competition is to space themselves in ways that reduce its effects. In addition to this the ovipositing adults of each species, when placed in competitive situations, specialize on and increase the use of different diameter categories of twigs for oviposition sites.

The limited mobility of nymphs decreases the probability that they can move away from a severely crowded situation. In those instances, nymphs of 17-year periodical cicadas have three options: (1) abort the usual 4-year inhibition in development, feed faster, and emerge 4 years ahead of schedule, (2) prolong development, feeding longer and emerging in the next year, (3) die in situ. By contrast, 13-year cicada nymphs may utilize the latter two options.

Evolutionary relationships among broods of 13-year and 17-year periodical cicadas.

Chris Simon, Dept. Zoology, University of Hawaii at Manoa, Honolulu, HI 96822.

This continuing study of the evolution of 13- and 17-year periodical cicadas has used numerical phylogenetic analysis of allozymic and wing-morphometric data to examine the evolutionary relationships of eight broods to date. Initial allozymic studies of three broods of 13-year cicadas

(XIX, XXII, and XXIII) and two broods of 17-year cicadas (XIII and XIV) produced a phylogenetic tree which supported the hypothesis of Lloyd and Dybas; brood formation in the 17-year cicadas preceded brood formation in the 13-year cicadas. Morphometric studies of 48 wing vein characters in these same five broods demonstrated that they could be distinguished from each other via discriminant function analysis. In both allozymic and morphometric analyses broods were well differentiated while populations within broods showed little or no differentiation suggesting that broods are definable evolutionary units.

From considerations of present day biogeography and Pleistocene forest movements, predictions were made as to the relationships of broods appearing in 1978 (Brood I), 1979 (Brood II) and 1980 (Brood III). Both allozymic and morphometric analyses of these broods produced phylogenies in which the 13-year cicadas were monophyletic and most recently derived but the placement of Broods I and II on the allozymic tree supported a "separate Pleistocene refuge" theory of origin while the placement of Broods I and II on the morphometric tree supported the hypothesis of Lloyd and Dybas.

STUART W. FROST: LIST OF PUBLICATIONS (1957-80), NEW NAMES PROPOSED, AND SPECIES NAMED IN HIS HONOR^{1,2}

A.G. Wheeler, Jr.³

ABSTRACT: Stuart W. Frost, a well-known student of the Agromyzidae (Diptera) and of insect biology, died in January 1980. Lists of Dr. Frost's publications during 1957-80, new names he proposed, and species named in his honor are provided.

With the death of Stuart W. Frost on January 21, 1980, Pennsylvania lost a well-known and respected entomologist — a student of agromyzid leafminers and apple pests, an author of several books and more than 240 papers on diverse subjects — and entomology lost one of its few remaining ties to John Henry Comstock's legendary department at Cornell. Shortly before his death, at the urging of colleagues, Dr. Frost published an informal, engaging account of his life's work (Frost 1979). His career, beginning with the pursuit of insects as a young naturalist in Tarrytown, New York, and undergraduate and graduate training at Cornell University, took him to the Arendtsville research station of the Pennsylvania State College (now University). There he began studies on fruit tree pests and eventually went to the College's main campus where he organized an insect collection and introduced the value of insect study to hundreds of students. His own text *General Entomology*, published in 1942 and retitled *Insect Life and Natural History* in a 1959 revision, aided his teaching. In later years he collected some 400,000 insect specimens during 13 winters of blacklight trapping at Florida's Archbold Biological Station (Highlands Co.). After retiring in 1957, he took obvious delight in identifying specimens and adding new material to the Penn State insect collection, aptly named the Frost Entomological Museum in 1969.

Dr. Frost's autobiographical sketch and the eloquent tribute prepared after his death by K.C. Kim (1980), present curator of the Museum, have provided insight into his personality and a good summary of his accomplishments; more of course could and, I hope, will be said about his work in entomology. In my own tribute to Dr. Frost, I am bringing up to date the list of his writings and listing both the new names he proposed during his studies in insect systematics and the species named in his honor.

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²Authorized on March 3, 1981 for publication as Paper No. 6201 in the Journal Series of the Pennsylvania Agricultural Experiment Station. A contribution from The Frost Entomological Museum, Department of Entomology, The Pennsylvania State University, University Park PA 16802 (AES Proj. 2070).

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The Writings of S.W. Frost, 1957-80

In 1958, S.W. Frost listed in this journal 191 of his papers published from 1916 to 1957 (Frost 1958). The following represents a nearly complete list of his scientific and popular articles published since late 1957 and includes a 1939 taxonomic paper omitted from his original list. To compile this list, I have used the record of writings that Dr. Frost maintained through 1972, a bound set of his reprints, and my own review of literature. I have omitted intentionally only his replies to questions sent in to *Adventure Magazine*, even though he had included most of these "Ask Adventure" responses in his 1958 list. Dr. Frost, an entomologist of diverse interests, was fascinated with postage stamps featuring birds, frogs, insects, and other animals, and I may well have overlooked a few of his contributions to philatelic magazines.

1939

- 123a. Two new species of *Agromyza* from South America (Dipt.: Agromyzidae). Entomol. News 50:97-100.

1957

192. Aphids attracted to light traps. Ann. Entomol. Soc. Am. 50:581-583 (S.W.F. and J.O. Pepper).

1958

193. Papers by S.W. Frost. Entomol. News 69:67-78.
 194. *Halysidoia tessellaris* S & A and pollenia. Entomol. News 69:137-138.
 195. The Ecological Insect Survey of Pennsylvania. Entomol. News 69:222-223.
 196. The Tabanidae of Pennsylvania. Trans. Am. Entomol. Soc. 84:169-215 (S.W.F. and L.L. Pechuman).
 197. Insects attracted to light traps placed at different heights. J. Econ. Entomol. 51:550-551.
 198. Traps and lights to catch night-flying insects. Proc. 10th Int. Congr. Entomol. 2:583-587.
 199. Insects captured in light traps with and without baffles. Can. Entomol. 90:566-567.
 200. Insects on postage stamps. Topical Time 9(4):156-160.
 201. Stamps featuring or suggesting fish. Weekly Philatelic Gossip 67(5):112-114.
 202. Art on postage stamps. Everyday Art 37:19-21.

1959

203. Insects captured in black-painted and unpainted light traps. Entomol. News 70:54-55.
 204. Insects caught in light traps with new baffle designs. J. Econ. Entomol. 52:167-168.
 205. Insects exalted. Everyday Art 37:4-21.
 206. The firefly, a truly photogenic species. Turtox News 37(8):212-213.
 207. Insect life and insect natural history. 2nd edition, revised. Dover Publications, New York, N.Y. 526 pp.
 208. Birds on United States stamps. Stamps 106(1):14.

1960

209. Review of "Synopsis of the species of agromyzid leaf miners described from North America (Diptera)" by K.E. Frick. Quart. Rev. Biol. 35:154.
 210. A solution for the O.G. problem. Linn's Weekly Stamp News 33(43):4.

1961

211. Key to common groups of spiders. Pages xix-xx in Emerton, J.H. The common spiders of the United States. Dover Publications, New York, N.Y.

1962

212. Obituary. Norris Dwight Blackburn, 1902-1962. J. Econ. Entomol. 55:1024.
213. *Liriomyza archboldi*, a new species (Dipt., Agromyzidae). Entomol. News 73:51-53.
214. Winter insect light-trapping at the Archbold Biological Station, Florida [Part 1]. Fla. Entomol. 45:175-190.

1963

215. Winter insect light trapping at the Archbold Biological Station, Fla. [Part 2]. Fla. Entomol. 46:23-43.

1964

216. Insects taken in light traps at the Archbold Biological Station, Highlands County, Florida. Fla. Entomol. 47:129-161.
217. Killing agents and containers for use with insect light traps. Entomol. News 75:163-166.

1965

218. Insects and pollinia. Ecology 46:556-558.

1966

219. Notes on common Scarabaeidae taken in light traps at Archbold Biological Station, Florida. Fla. Entomol. 49:189-194.
220. Additions to Florida insects taken in light traps. Fla. Entomol. 49:243-251.
221. Stamps featuring or suggesting insects. Topical Time (Nov.-Dec.), pp. 40-41 (S.W.F. and J. Chauvin).

1967

222. Mayflies taken at the Archbold Biological Station, Highlands County, Florida. Fla. Entomol. 50:281-284.

1968

223. Notes on Meloidae taken at the Archbold Biological Station, Highlands County, Florida. Fla. Entomol. 51:51-53.

1969

224. Improvement of the efficiency and selectivity of the insect light trap. Year Book Am. Philosophical Soc., 1968:299-300.
225. Supplement to Florida insects taken in light traps. Fla. Entomol. 52:91-101.

1970

226. Light trap collecting compared with general collecting at the Archbold Biological Station. Fla. Entomol. 53:173-177.
227. A trap to test the response of insects to various light intensities. J. Econ. Entomol. 63:1344-1346.

1971

228. *Pachydiplax longipennis* (Odonata:Anisoptera): records of night activity. Fla. Entomol. 54:205.

1972

229. Notes on *Blepharida dorothea* Mignot (Coleoptera:Chrysomelidae). Entomol. News 83:45-47.
230. Notes on *Urodus parvula* (Henry Edwards) (Yponomeutidae). J. Lepid. Soc. 26:173-177.

1973

231. Hosts and eggs of *Blepharida dorothea* (Coleoptera:Chrysomelidae). Fla. Entomol. 56:120-122.
 232. A summary of the Spingidae taken at the Archbold Biological Station, Highlands County, Florida. Entomol. News 84:157-160.
 233. Honeybees and bumblebees taken in light traps. Entomol. News 84:235-236.

1975

234. Third supplement to insects taken in light traps at the Archbold Biological Station, Highlands County, Florida. Fla. Entomol. 58:35-42.
 235. An index to the insects and spiders featured on Audubon's bird plates. Entomol. News 86:217-226.

1977

236. Insects associated with the extrafloral nectaries of elderberry. Fla. Entomol. 60:186.
 237. Damsel-flies and dragon-flies on stamps. Zoology 26(1):16-18.

1979

238. A preliminary study of North American insects associated with elderberry flowers. Fla. Entomol. 62:341-355.
 239. Autobiography of an entomologist. Melsheimer Entomol. Ser. 26:33-38.

1980

240. Inside the stamp. Scott's Mon. Stamp J. 61(3):10-17.

New Names Proposed by S.W. Frost

Diptera

Agromyzidae

- Agromyza allia* Frost 1943, J. N.Y. Entomol. Soc. 51:257 (now placed in the genus *Liriomyza* Mik)
Agromyza angelicae Frost 1934, Entomol. News 45:40 (now placed in *Melanagromyza* Hendel)
Agromyza approximata Frost 1936, Ann. Entomol. Soc. Am. 29:316 (now placed in *Melanagromyza*)
Agromyza baptisiae Frost 1931, Can. Entomol. 63:275 (now placed in *Liriomyza*)
Agromyza barrocoloradensis Frost 1936, Ann. Entomol. Soc. Am. 29:300 (now placed in *Liriomyza*)
Agromyza brazilensis Frost 1939, Entomol. News 50:97 (now placed in *Liriomyza*)
Agromyza busckei Frost 1936, Ann. Entomol. Soc. Am. 29:315 (now placed in *Ophiomyia* Braschnikov; inadvertently spelled "buskei" in original description)
Agromyza cassiae Frost 1936, Ann. Entomol. Soc. Am. 29:306 (now placed in *Calycomyza* Hendel)
Agromyza centrosemiae Frost 1936, Ann. Entomol. Soc. Am. 29:301 (now placed in *Japanagromyza* Sasakawa)
Agromyza cinereifrons Frost 1931, Can. Entomol. 63:276 (a synonym of *Phytobia angulata* (Loew))
Agromyza commelinae Frost 1931, Entomol. News 42:72 (now placed in *Liriomyza*)
Agromyza crotonis Frost 1936, Ann. Entomol. Soc. Am. 29:313 (now placed in *Melanagromyza*)
Agromyza currani Frost 1936, Ann. Entomol. Soc. Am. 29:305 (now placed in *Japanagromyza*)

- Agromyza curvibrissata* Frost 1936, Ann Entomol. Soc. Am. 29:309 (now placed in *Ophiomyia*)
- Agromyza dorsocentralis* Frost 1936, Ann. Entomol. Soc. Am. 29:307 (now placed in *Phytobia* Lioy)
- Agromyza ecuadorensis* Frost 1939, Entomol. News 50:99 (a synonym of *Liriomyza braziliensis* (Frost))
- Agromyza ipomaeae* Frost 1931, Entomol. News 42:74 (now placed in *Calycomyza*)
- Agromyza iridescens* Frost 1936, Ann. Entomol. Soc. Am. 29:303 (now placed in *Japanagromyza*)
- Agromyza kallima* Frost 1936, Ann. Entomol. Soc. Am. 29:299 (now placed in *Phytobia*)
- Agromyza oralis* Frost 1936, Ann. Entomol. Soc. Am. 29:309 (now placed in *Ophiomyia*)
- Agromyza orbitalis* Frost 1936, Ann. Entomol. Soc. Am. 29:314 (now placed in *Japanagromyza*)
- Agromyza phaseolunata* Frost 1943, J. N.Y. Entomol. Soc. 51:256 (now placed in *Liriomyza*; a synonym? of *L. sativae* Blanchard)
- Agromyza (Liriomyza) propepusilla* Frost 1954, Entomol. News 65:73 (new name for *Liriomyza subpusilla* (Frost), nec Malloch 1914, Ann. Mus. Hung. Budapest 12:314; a synonym of *L. sativae*)
- Agromyza punctohalterata* Frost 1936, Ann. Entomol. Soc. Am. 29:311 (now placed in *Ophiomyia*)
- Agromyza schmidti* Frost 1936, Ann. Entomol. Soc. Am. 29:302, nec Aldrich 1929, Proc. Entomol. Soc. Wash. 31:89 (renamed *Japanagromyza frosti* Frick)
- Agromyza subpusilla* Frost 1943, J. N.Y. Entomol. Soc. 51:255, nec Malloch 1914, Ann. Mus. Hung. Budapest 12:314 (renamed *Liriomyza propepusilla* Frost; a synonym of *L. sativae*)
- Agromyza tibialis* Frost 1936, Ann. Entomol. Soc. Am. 29:312, nec Fallen 1823, *Agromyzides Sueciae*. Diptera sueciae 2(37):1-10 (renamed *Melanagromyza aldrichi* Frick; now placed in *Japanagromyza*)
- Agromyza ulmi* Frost 1924, Cornell Univ. Agric. Exp. Stn. Mem. 78:54 (a synonym of *A. aristata* Malloch)
- Agromyza viridis* Frost 1931, Can. Entomol. 63:277 (now placed in *Melanagromyza*)
- Liriomyza archboldi* Frost 1962, Entomol. News 73:51
- Phytomyza affinalis* Frost 1924, Cornell Univ. Agric. Exp. Stn. Mem. 78:84
- Phytomyza angelicella* Frost 1927, Ann. Entomol. Soc. Am. 20:218
- Phytomyza aquilegiana* Frost 1930, Ann. Entomol. Soc. Am. 23:459
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- Phytomyza delphiniae* Frost 1928, Can. Entomol. 60:77 (a synonym of *P. aconiti* Hendel)
- Phytomyza flavinervis* Frost 1924, Cornell Univ. Agric. Exp. Stn. Mem. 78:85
- Phytomyza jucunda* Frost and Sasakawa 1954, Mushi 27:49
- Phytomyza lactuca* Frost 1924, Cornell Univ. Agric. Exp. Stn. Mem. 78:85
- Phytomyza marginalis* Frost 1927, Ann. Entomol. Soc. Am. 20:219
- Phytomyza melanella* Frost 1924, Cornell Univ. Agric. Exp. Stn. Mem. 78:86
- Phytomyza minuta* Frost 1924, Cornell Univ. Agric. Exp. Stn. Mem. 78:86 (now placed in *Haplomyza* Hendel)
- Phytomyza nigrinervis* Frost 1924, Cornell Univ. Agric. Exp. Stn. Mem. 78:87
- Phytomyza plumiseta* Frost 1924, Cornell Univ. Agric. Exp. Stn. Mem. 78:87
- Phytomyza subtenella* Frost 1924, Cornell Univ. Agric. Exp. Stn. Mem. 78:89
- Phytomyza trivittata* Frost 1924, Cornell Univ. Agric. Exp. Stn. Mem. 78:89

Species Named in Honor of S.W. Frost

Taxonomists have proposed the following patronyms to commemorate the entomological work of Stuart Frost. I may have overlooked some species named in his honor, but all other species named "*frosti*" that I was able to find were dedicated to the Massachusetts coleopterist C.A. Frost.

Hemiptera-Heteroptera

Miridae

Hyaliidocoris frosti Knight 1943, Entomol. News 54:120

Hemiptera-Homoptera

Aphididae

Grylloprociphilus frosti Smith & Pepper 1968, Proc. Entomol. Soc. Wash. 70:57

Coleoptera

Scarabaeidae

Serica frosti Dawson 1967, J. N.Y. Entomol. Soc. 75:166

Buprestidae

Pachyschelus frosti Fisher 1930, Proc. Entomol. Soc. Wash. 31:177

Diptera

Tipulidae

Limnophila (Phy'idorea) frosti Alexander 1961, Great Basin Nat. 21:84

Stratiomyidae

Chrysochlorina frosti James 1939, J. Kans. Entomol. Soc. 12:35

Merosargus frosti James 1941, Lloydia 4:307

Tabanidae

Hybomitra frosti Pechuman 1960, Can. Entomol. 92:794

Asilidae

Senobasis frosti Bromley 1951, Am. Mus. Novitates 1532:12

Tephritidae

Eutreta frosti Hering 1938, Deutsche Entomol. Z. 2:415

Agromyzidae

Cerodontha (Dizygomyza) frosti Spencer 1973, Arthropods of Fla. 7:65

Japanagromyza frosti Frick 1952, Univ. Calif. Publ. Entomol. 8:373 (new name for

Agromyza schmidti Frost 1936, nec Aldrich 1929, Proc. Entomol. Soc. Wash. 31:89)

ACKNOWLEDGEMENTS

I thank K.C. Kim (Department of Entomology, The Pennsylvania State University) for his support of this paper and Verda Haas for her encouragement of the project. K.C. Kim, K. Valley (Bureau of Plant Industry, Pennsylvania Department of Agriculture) and E.R. Hoebeke (Department of Entomology, Cornell University) kindly read the manuscript.

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 Kim, K.C. 1980. A tribute to Dr. Stuart W. Frost. Bull. Entomol. Soc. Am. 26:138.

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ENTOMOLOGICAL NEWS

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(Continued on inside of back cover)

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**A NEW SPECIES OF *CRYPTOXILOS*
(HYMENOPTERA: BRACONIDAE) ATTACKING
ADULT *LYMANTOR DECIPENS* LECONTE
(COLEOPTERA: SCOLYTIDAE)^{1,2}**

Mark Deyrup³

ABSTRACT: *Cryptoxilos lymantori* is described from specimens reared from the galleries of *Lymantor decipens* LeConte. Lack of conspicuous hairs on the eyes distinguish this species from the other Nearctic *Cryptoxilos*, *C. convergens* Muesebeck. The cocoon (illustrated) is spun in the scolytid gallery, and the adult parasitoid escapes through the scolytid entrance hole.

The genus *Cryptoxilos* includes only one described Nearctic species, *C. convergens* Muesebeck, reared by A.D. Hopkins from the scolytid *Phloetribus frontalis* (Olivier) in *Morus* sp. and *Celtis* sp. (Muesebeck, 1936). A second species, described below, was recently reared from another scolytid, *Lymantor decipens* LeConte in *Acer saccharum* Marsh.

The genus *Cryptoxilos* is characterized by small size (2 mm or less), the combination of the absence of a recurrent vein and the presence of an exerted ovipositor, and the eyes of the female strongly convergent below, sparsely to densely hairy (Muesebeck, 1936).

Cryptoxilos lymantori, new species

Holotype Female. Length (from frons to apex of gaster): 1.40 mm (paratypes 1.45-1.35). Color: dark brown, clypeus, mandible except for apex, yellow, apex of mandible dark brown; front legs yellow except for brown apical tarsomere; middle coxa, trochanters, apex of femur, basal tarsomere yellow, otherwise brown; antenna yellow basally, after first flagellomere gradually becoming dark brown apically; stigma of front wing dark brown. Head: about as wide as thorax; vertex smooth, shining, a few pale hairs laterally; occipital carina complete; frons above antennae smooth, shining, below antennae sparsely finely punctuate; eye in dorsal view protruding laterally beyond temples, strongly converging below, width of face about three-fourths length from clypeus to antennal bases, eye with fine, short, sparse hairs; antennae 13-segmented, first flagellomere not strongly swollen, more slender than scape and pedicel, slightly shorter than third flagellomere, flagellomeres 3-12 three to four times as long as wide. Thorax: mesonotum smooth, shining, except for a roughly triangular patch of coarse contiguous punctures, mesonotum declivous posteriorly with a series of longitudinal ridges; scutellum smooth, convex medially, declivitous with coarse contiguous punctures laterally and posteriorly; metanotum concave with a series of longitudinal ridges, hind margin elevated with an anteriorly directed triangular point; propodeum lightly rugose anteriorly, heavily rugose posteriorly; propleuron rugulose; pronotum smooth except for fine punctures around

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margins; mesopleuron with coarse contiguous punctures below wing base and in a median band across mesopleuron curving down to the anteroventral and posteroventral corners of the mesopleuron, mesopleuron with a smooth, shining, convex mediodorsal area and medioventral area; dorsal metapleural area smooth, ventral metapleural area rugose. Wing venation: Similar to *C. convergens* except that first intercubitus disappears posteriorly (totally lacking in some paratypes, complete in others). Gaster: first gastral segment with a median, paired submedian and lateral, longitudinal carinae, first gastral segment slender, gradually expanded from base to apical fifth, then more abruptly expanded, twice as wide at apex as at spiracles, spiracles distinctly anterior to middle, remaining gastral segments smooth, shining; ovipositor sheaths .3 mm, three-fourths as long as hind tibia.

Male. Similar to female except only a few hairs on eyes, invisible except under ideal lighting conditions, eyes only slightly protruding beyond temples, not strongly convergent below. Width of face below antennae 1.2 length from clypeus to antennal bases.

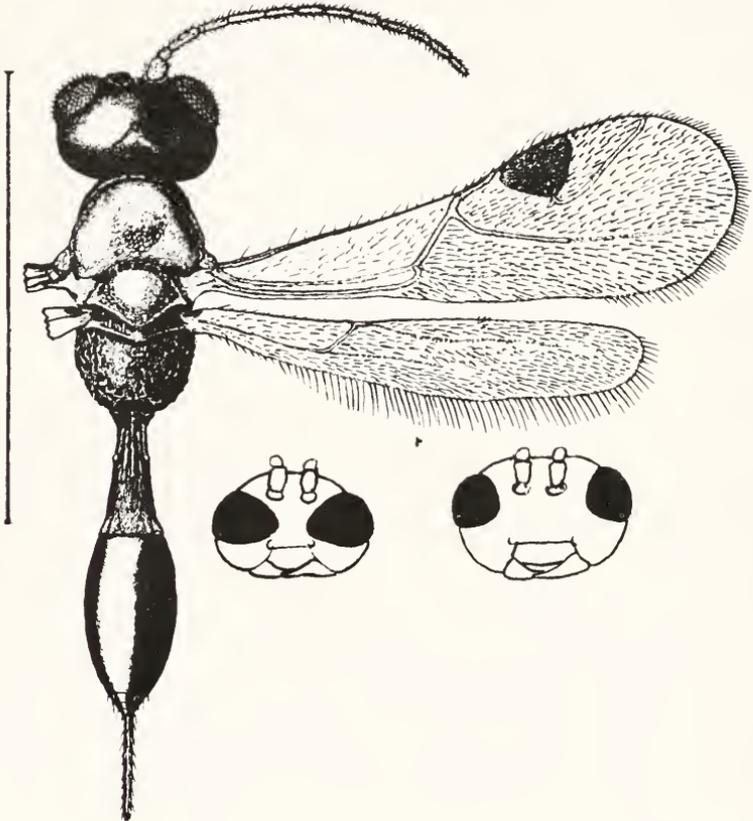


Fig. 1. Dorsal view of *Cryptoxilos lymanthori* n. sp; actual length head and body 1.4 mm; frontal view of head of female (left) and male (right).

Holotype female. West Lafayette, Tippecanoe County, Indiana, U.S.A., emerged 2 April 1980 from galleries of *Lymantor decipens* in *Acer saccharum* twigs collected 4 March 1980. The type is deposited in the U.S. National Museum, Washington, D.C.

Paratypes. 2 female, 6 male, same data as for holotype.

Discussion. This species is easily distinguished from *C. convergens* by short, sparse, inconspicuous hairs on the eyes; even male *C. convergens* have readily visible long hairs on the eyes. It would be premature to speculate on the relationship between the two species, but *C. lymantori* is in general less "atypical" and "extreme" for a euphorine than *C. convergens*; the eyes are less convergent and much less hairy, the antennal segments are longer and more slender, and the vestiture less coarse and less bristling.

Biology

Considering the host beetle, it is possible that *C. lymantori* is monophagous. *Lymantor decipens* is a common scolytid occurring in dead branches and small boles of deciduous trees, especially *Acer saccharum*. The galleries always occur in the surface of wood that contains fruiting bodies of an identified ascomycete. Branches are usually attacked when they are attached to a tree, or detached but held above the ground by understory trees and shrubs. This type of host plant material does not harbor other scolytids except for species of *Hypothenemus* and *Trishidias* less than 1 mm in length. *Lymantor decipens* has no congeners in the eastern or midwestern U.S., although there is a second species of *Lymantor* in Alaska.

The seasonal history of *C. lymantori* is not known beyond the fact that adults emerge in spring. The adults obtained in this study emerged on, or during a few days preceding, 2 April 1980, from material that had been brought back into the laboratory on 4 March 1980. The culture of beetles died out during the summer, and there was no second generation of

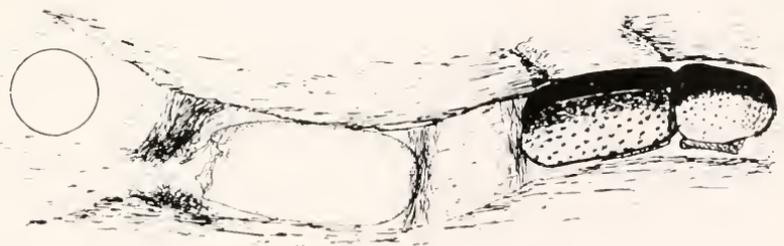


Fig. 2. Cocoon of *C. lymantori* in gallery of its host; bark, including entrance hole, removed to expose gallery. Circle marks former location of entrance hole.

parasitoids from the second generation of beetles. No occupied cocoons were found in galleries in fresh material collected in late summer, though empty cocoons and dead hosts were found in some old abandoned galleries.

Twelve cocoons were found in the maple twigs from which the type series emerged. In all cases but one, in which the adult wasp had become trapped and died in the beetle gallery, the adults had emerged through the entrance hole of its host. All host scolytids were facing away from the gallery entrance, leaving a clear path for the emergence of the wasp. Between the dead host and the wasp cocoon there was in all cases a vertical partition of silk strands, usually numerous enough to form an opaque white barrier. A second thick partition of silk was located between the gallery entrance and the cocoon. Where there was extra room between the dead host and the gallery entrance, this space contained one or two thin partitions of silk strands, and single strands fastened to the gallery to make a loose webbing. The orientation of the dead host, the partitions, the loose webbing, the transparent shining cocoon itself, are all strikingly similar to those of *Cosmophorus capeki* Loan and Matthews that I have observed in galleries of *Pityophthorus lautus* Eichhoff in *Acer saccharinum* L. As a rule, the *C. lymantori* cocoons were closer to the entrance than those of *C. capeki*, and in four instances *C. lymantori* had actually spun a cover across the entrance hole.

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- Meusebeck, C.F.W. 1936. The genera of parasitic wasps of the braconid subfamily Euphorinae, with a review of the Nearctic species. (Hymenoptera: Ichneumonoidea). USDA Misc. Publ. 241: 1-38.

DISTRIBUTION AND BIOLOGY OF FLIGHTLESS CARRION BEETLE *NECROPHILUS PETTITII* IN EASTERN NORTH AMERICA (COLEOPTERA; SILPHIDAE)¹

Stewart B. Peck²

ABSTRACT: Data are given on the life cycle, seasonality, habitats, and distribution of *Necrophilus pettitii* Horn, and a lectotype is designated.

The preparation of reviews of North American silphid carrion beetles (Miller and Peck, 1979; Peck 1982, Peck and Miller, 1982) has shown the need for the presentation of data on poorly known species. One of these is *Necrophilus pettitii* Horn, 1880, a flightless species and the only eastern North American representative of the tribe Agyrtini. The few scattered literature records show a wide but incompletely known distribution and poorly known biology. The following is offered to help correct this.

The species may be characterized as follows: size about one cm in length; body broadly oval and flattened; color shining brown or reddish brown; pronotum broad, marginally flattened and punctured; elytra non-truncate, covering abdomen, with nine deeply punctate striae; abdomen with five visible sternites; tarsal formula 5-5-5; antennae eleven segmented, club gradually clavate, last five segments covered with microsetae.

Detailed studies by A.F. Newton (in manuscript) show that the tribe, combined with Lyrosomini, should be elevated to family status, based on adult and larval characters. Data on larval characteristics will be given by Newton.

A type specimen has never been published, and the following is designated in the interest of stability of nomenclature.

Necrophilus pettitii Horn (1880: 243). LECTOTYPE (here designated), a female with white label "Can" and white label "646" and red ANSP label "lectotype 3006" and white label "N. Pettitii Horn" and my designation label. Also one female paralectotype with white label "Ky" and green label "paratype 3006"). Both in Horn collection, MCZ, Harvard Univ. The localities published with the description were Canada and Kentucky. The larger series of 3 (two additional paralectotypes in LeConte collection, MCZ) were from Grimsby, Ontario, Canada, which is here designated the type locality (see Horn, 1868: 125, and Pettit, 1869).

Life cycle characteristics have been determined by Dr. J.A. Payne, who has generously provided the following data: Five adults (2 pairs in

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²Department of Biology, Carleton University, Ottawa, Ontario, K1S 5B6, Canada.

copulo), were collected from deer mouse (*Peromyscus leucopus*) feces at Perry, Georgia, on 7 December 1969. The adults were kept in a cool basement in a large screen-covered container. They were offered decaying squirrel meat and mouse feces, but no evidence of feeding was observed. Approximately 20 small larvae were noticed on 14 December, giving a maximum of 7 days for the eggs to be laid, mature, and hatch. Larvae fed primarily on the mouse feces, but also on the squirrel meat. Some larvae were preserved. New adults appeared on 1 February, 1970, indicating a maximum egg to adult development time of 8 weeks, at temperatures from 13° to 19°C. The original adults lived about 6 weeks in culture.

The records show that the species is collected in forested habitats, most frequently in the higher elevations of the southern Appalachians in the summer months. At lower elevations the records more frequently show activity in the cooler spring and fall months. The species is most often taken on decomposing material, usually on or in dung and carrion baits or pit traps. It is probably nocturnal, hiding in deep litter or in the soil (judging from the lack of records from general hand collecting, and from the number of records in cave entrances where the soil fauna can often be sampled with comparative ease).

The general distribution is from New York, Ontario, and Michigan, southwards to Alabama, Georgia, and northern Florida.

The following distribution records are based on material in the author's collections or in museums, abbreviated with standard usage following Arnett and Samuelson (1969). The data of Davis (1980) are not repeated here.

Canada. Ontario. Grimsby (type locality) Sept. and Oct., on decaying fungi on logs. J. Pettit (Horn and LeConte collections, MCZ) (Horn, 1868, 1880; Pettit, 1869).

United States. Alabama. Jackson County. Russell Cave National Monument, Pig Entrance of Russell Cave, 17.VIII.1967, S. Peck and A. Fiske, 1 on carrion bait. Jefferson County. Birmingham, 8.IV.1953, 2; 11.IV.1955, 1 on rotten fish; 12.IV.1955, 1; 14.IV.1955, 1; all by H.R. Steeves (FMNH). Tallapoosa County. Cheaha Mountain (State Park), 7.VI.1040, W.B. Jones, Museum Expedition, 4 (UANH). Tuscaloosa County, 1935, A.F. Archer, 1 (UMMZ).

Georgia. Dade County. Cloudland Canyon State Park, 15-23.V.1972, S. Peck, 1 in forest carrion trap. Fulton County. Atlanta, 15.III.1938, P.W. Fattig, 1 (MCZ). Houston County. Perry, 7.XII.1969, J.A. Payne, 5 on mouse feces; 4.II.1970, J.A. Payne, 5 lab reared on mouse feces.

Illinois. Jackson County. Carbondale, 19.V.1971 (Baldwin, 1971: 19).

Indiana. Posey County. Grand Chain, 10.IV.1901, W.S. Blatchley, 2 on ill-smelling decaying fungi beneath log (PURC; Blatchley, 1910).

Kentucky. Edmonson County. Mammoth Cave National Park, Running Branch Cave, 5-26.V.1972, S. Peck, 4 on carrion baits; 7-26.V.1972, S. Peck, 2 in forest dung traps at maintenance area; Wilson Cave, 17.VI.1973, S. Peck, 1 on animal dung. Powell County, 5.IX.1958, 1 (FSCA).

Michigan. Oakland County, 1.V.1924, A.W. Andrews, 1 female missing head and prothorax (MSUC).

New York. Cattaraugus County. Allegheny State Park, July (Leonard, 1926); 15.VII.1938, 1 (USNM); 7.X.1936, M.J. Ramsey, 1 (USNM). Sullivan County. Cooks Falls, Sept., (Leonard, 1926). Westchester County. Armonk. Calder Conservation and Ecology Center of Fordham Univ., April, 1; May, 3; June, 3; October, 2; November, 1 (Pirone, 1974: 290).

North Carolina. Buncombe County. Asheville, April, May, June, 1928, 6 (MCZ). Haywood County. Cataloochee Divide, 9.VI.1940, 5000', C.A. Frost, 2 (MCZ). Mt. Pisgah, 12.IX.1934, Quirsfeld, 1 (MCZ). Mt. Sterling, Oct. 1938, W.B. Jones, 19 (CUIC). Sunburst, 25.X.1934, D. Dunavan, 1 (AMNH). Richland Balsam, 7-26.VIII.1965, 6000', S. Peck, 2. Henderson County. Hendersonville, 12.VI.1951, H. and A. Howden, 1, traps. Jackson County. Balsam, 7.VI.1962 (1), 2.XI.1958 (1), W. Rosenberg (CAS). Macon County. Aquone (Brimley, 1938). Highlands, no data, 2 (MCZ) McDowell County, Linville Falls, May, June (Brimley, 1938). Mitchell County. Spruce (Brimley, 1938). Swain County. Cherokee Orchard, 7.X.1960, 1, T.C. Barr. NE slope Mt. Collins, 17-22.V.1972, 5900'. A. Newton, 17 in carrion trap 452. Smokemont, 1939, W.B. Jones, 21 (CUIC). Wake County. Raleigh, March, November (Brimley, 1938): 21.X.1950, H. and A. Howden, 2 on chicken feathers. Yancey County. Mt. Mitchell (Black Mts.), 4.IX.1930, 5000-6711 ft., C. Banks, 1 (MCZ).

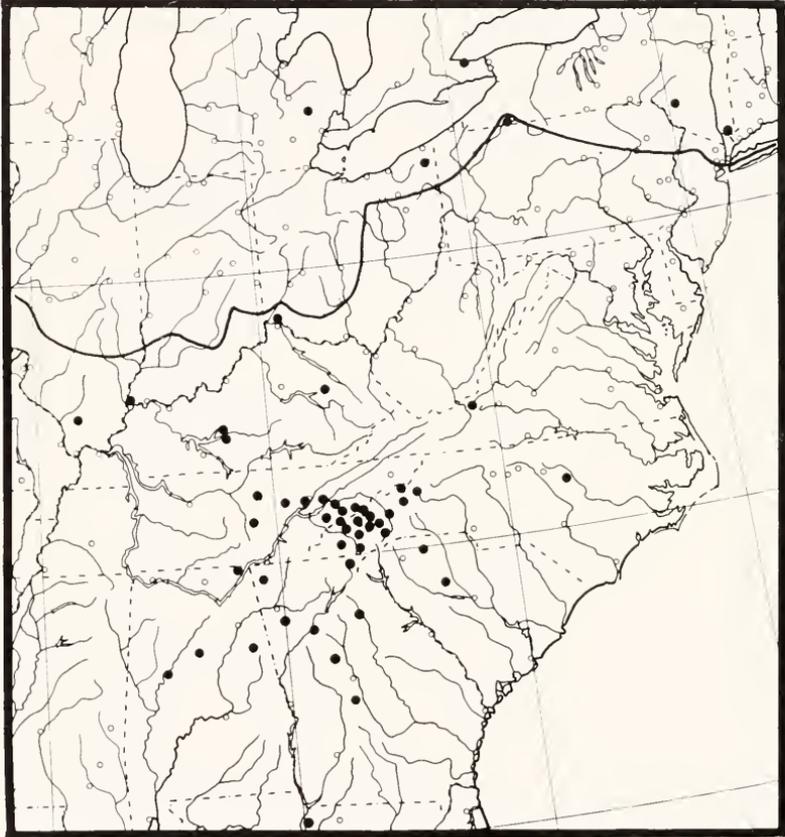
Ohio. Ashtabula County. Jefferson, no data, 3 (FMNH, ICCM). Hamilton County. Cincinnati, 20.X.1903, 1 (USNM); 25.X.1903, 1 (SEMC); 1.X.1926, 3 (USNM); 4.X.1920, 4 (CMNH); no data, 5 (CAS, USNM).

South Carolina. Newberry County. Newberry, Oct. (Kirk, 1970). Oconee County. Clemson College, 10.IV.1933, 1 (CAS); Clemson, Apr., May (Kirk, 1970); Feb., (1), Mar. (2), May, Sept. (1), Nov. (4), Dec. (3). J.A. Payne, on carrion (pig, 5; chicken, 1; frog, 2; squirrel, 3) in advanced decay state (Payne and King, 1970). Spartanburg County. Spartanburg, 10.III.1961, A.C. Bass, 1, (USNM).

Tennessee. Anderson County. Oak Ridge, 20.II and 14.III.1965, J.A. Payne, 7 on mouse feces and bodies. Oak Ridge, cave 4 mi. S. Sept. 1972, J.A. Payne, 2 on dead mouse 100' inside cave. Cumberland County. 3 mi. W. Ozone, 1700', 17.VI-14.VII.1972, A. Newton, 1 in hardwood forest dung and 1 in carrion trap. Knox County. Univ. Tennessee Farm, Feb. and March, 1972, H.B. Reed, 7 (USNM) with carcasses in late dry state (Reed, 1958). Putnam County. Quinland Lake, 17.I.1960, T.C. Barr, 1. Sevier County. Gatlinburg (Rainbow Motel), 17-23.V.1972, 1400', A. Newton, 2 in carrion trap 456; 5 mi. S. Gatlinburg, 17-22.V.1972, 2300', A. Newton, 6 in carrion and 1 in dung traps 455; 8 mi. S. Gatlinburg, 17-22.V.1972, 3100', A. Newton, 19 in squid carrion traps and 10 in human dung traps; 13 mi. S. Gatlinburg, 17-22.V.1972, 4500', A. Newton, 2 in carrion trap 453. Great Smoky Mountains National Park: Mollies Gap, 6-26.VIII.1965, S. and J. Peck, 2 in carrion trap; 18.VI.1955, 6000', H. Howden, 1 in malt trap; Cherokee Orchard, 2500', 20-27.V.1977, A. Newton and M. Thayer, 14 on squid bait. Greenbriar Cove, 20.IV.1954, 2000', 1, H. Howden; 1700', 19-23.V.1972, A. Newton, 1 in human dung trap; Ramsey Cascade Trail, 18-23.V.1972, 27-2900', A. Newton, 10 in human dung and 4 in carrion traps 457-8; 2.VII.1955, 5500', H. Howden, 2 in malt trap; Porters Creek Trail, 2600', 22.V.1977,

A. Newton, M. Thayer, 4 on carnivore scats. Clingmans Dome, 1947, Dietrich, 2 (CUIC); 6-26.VIII.1965, summit, S. Peck, 9 in carrion trap; 3-9.IV.1967, 6000', S. Peck, 1 in carrion trap. Swain County. Mt. Collins (GSMNP), 5900', 17-22.V.1972. A. Newton, 13 in squid bait and 5 in human dung bait traps. Warren County. McMinnville, Cumberland Caverns, 15-24.V.1972. S. Peck, 2 in forest dung trap.

Virginia. Giles County. Mountain Lake, 24-30.VI.1968, 3500', S. Peck, 3 in forest carrion trap.



Map of part of eastern North America showing known localities (solid, black dots) for *Necrophilus pettitii*. The localities listed by Davis (1980) are included. (Small, open circles indicate locations of major cities.) Dark line indicates maximum extent of the Wisconsin glacial ice sheet. The species has made modest northward range movements since deglaciation.

ACKNOWLEDGEMENTS

I am thankful for the cooperation of the curators of the various collections holding the material examined, and to individual collectors. J.A. Payne and A.F. Newton were especially helpful. A.F. Newton and R.S. Anderson reviewed the manuscript. My field work has been supported by operating grants from the Canadian Natural Sciences and Engineering Research Council.

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DISTRIBUTION OF *HARPALUS RUFIPES* DE GEER IN CANADA AND UNITED STATES (COLEOPTERA; CARABIDAE)¹

Gary A. Dunn²

ABSTRACT: The European ground beetle *Harpalus rufipes* DeGeer (Coleoptera: Carabidae) was introduced into maritime Canada prior to 1937. Adults were first collected in the United States at Orono, Maine in 1970. Four specimens were collected in New Hampshire in 1974, a southward range extension of 130 miles. Additional records for 395 specimens of *Harpalus rufipes* collected during 1977 and 1978 in southern New Hampshire show this species is well established in the state.

Harpalus rufipes DeGeer was introduced into the Canadian maritime provinces sometime during the 1930's. Brown (1950) presents evidence demonstrating how this carabid, and other ground-inhabiting Coleoptera, probably were transported by man and subsequently introduced into North America. It occurs in the paleartic region, as far east as eastern Siberia and Japan. (Lindroth, 1968)

Adults of this species average 12 mm in length, and are easily distinguished by the dense, semi-erect, golden hairs on the bases of both the pronotum and the elytra.

The earliest known North American specimens were taken in Canada at Charlottetown and Summerside, Prince Edward Island in 1937 (Morrison, 1941). Additional Canadian records of significance include: Kings County and Cape Breton Island, Nova Scotia, 1938 (Morrison, 1941; Lindroth, 1954); Tabusintac, New Brunswick, 1939 (Brown, 1940); Quebec, 1939 (Lindroth, 1968); southwest Newfoundland, 1949 - 1951 (Brown, 1950; Lindroth, 1955 and 1963); and Port-au-Saumon, Quebec, 1976 (Larochelle, 1976). The known distribution of *Harpalus rufipes* in North America is given in Fig. 1.

The first specimens to be taken in the United States were collected at Orono, Penobscot Co., Maine in 1970 (Larochelle, 1976). The species was first taken in southern New Hampshire in 1974. New Hampshire records of significance include: STRAFFORD CO.: Dover, 3-vii-1974, 17-vii-1978 (2), 21-vii-1978 (2) blacklight trap; Lee, 25-vii-1974 and 13-vii-1974 pitfall traps in cornfield; Durham, 1974 blacklight trap, 30-vi-1978 pitfall trap; Somersworth, 20-vii-1977 barrier pitfall trap; Statham, 13-vi-1978, 25-vi-1978, 28-vi-1978 (250), 29-vi-1978 (66), 10-vii-1978 (35), 13-vii-1978 (21) and 4-viii-1978 (4) blacklight trap; Madbury, 27-vi-1978 (8) blacklight trap; ROCKINGHAM CO.: Kensington, 2-vii-1978, 6-vii-

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1978, and 7-vii-1978 barrier pitfall trap. The New Hampshire distribution is given in Fig. 2.

Based on the large number of specimens collected in southern New Hampshire there is little doubt that *Harpalus rufipes* is well established in the area.

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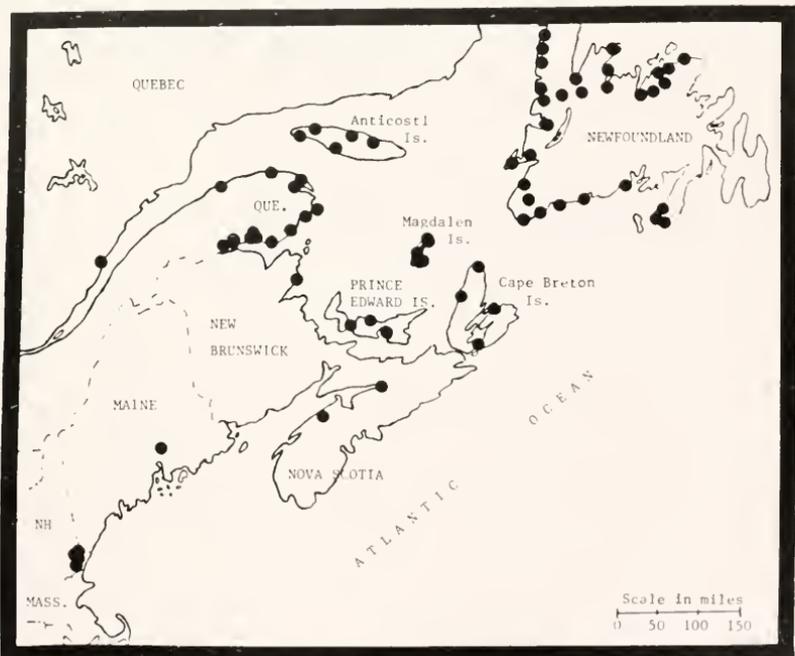


Fig. 1. The distribution of *Harpalus rufipes* DeGeer in North America.



Fig. 2. The distribution of *Harpatus rufipes* DeGeer in southern New Hampshire. The inset map shows the location of the enlarged section of the state.

SEASONAL DISTRIBUTION OF MAYFLIES (EPHEMEROPTERA) IN TWO PIEDMONT RIVERS IN VIRGINIA¹

Boris C. Kondratieff, J. Reese Voshell, Jr.²

ABSTRACT: The seasonal distribution of the mayflies in two piedmont rivers was studied from 1977 to 1978. Adult and nymphal data were integrated to elucidate seasonal trends. Fourteen species were encountered in sufficient numbers to determine their seasonal periodicity; 12 other species that occurred infrequently are listed. The fauna could be divided into three temporal components based on the time of their emergence: winter/early spring, spring, and summer/fall.

The distribution and seasonal pattern of mayflies of the eastern United States are not well known. Berner (1977) gave distributional records for many of the southeastern species of mayflies; however, he did not include the state of Virginia. To date the only study on distribution and seasonal occurrence of mayflies of Virginia has been Pugh (1956).

From 1977 to 1978 we conducted a detailed investigation of the downstream effects of impoundment on the life histories of two species of mayflies in Virginia (Kondratieff and Voshell 1980, 1981). This report presents notes on the distribution and seasonal patterns of other species of mayflies that we encountered during our studies.

Study Area

The North and South Anna Rivers (NAR and SAR, respectively) are tributaries of the York River Basin located in eastern Virginia (Fig. 1). Both rivers begin in the Piedmont Plateau Province and flow southeastwards over the Fall Line before joining to form the Pamunkey River in the Coastal Plain Province. The Fall Line is the boundary between the Piedmont Plateau and Coastal Plain Physiographic Provinces. Usually a succession of ledges result at this narrow zone because the granitic rocks pass below tide level. Most of the basin is forested (70%) or in cropland or pasture (22%), and only 2% is classified as urban (Virginia Division of Water Resources 1970). The NAR was impounded in 1972 to provide cooling water for a nuclear-powered electricity generating facility. Lake Anna is a mainstream impoundment with an area of 5261 ha; release is from the

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surface of the reservoir.

Two stations were established on each river at the Fall Line (Fig. 1). The study site on the NAR is approximately 32 km below Lake Anna. The elevation at the site is 20 m, with a gradient of 21.8 m/km, and the width is 73 m. At this point the river is a 5th order stream that drains approximately 1.14×10^5 ha. The substrate consists primarily of coarse pebble (32-64 mm), cobble (64-256 mm), and boulder (>256 mm). This site is characterized by several cascading falls and small islands producing auxillary side channels. The islands and shallow areas with slow current are covered with dense growths of *Justicia americana* (Linnaeus) (water-willow). Mine drainage previously affected the overall ecology of the river, but the impoundment of the NAR has alleviated the perturbation (Simmons and Voshell 1978).

The study site on the SAR was also established at the Fall Line. The elevation is 38 m, the gradient is 3.4 m/km, and the width is 100 m. At this point the SAR is also a 5th order stream, and its watershed is approximately 1.02×10^5 ha. The physical composition of the substrate is similar to the NAR, but the aquatic macrophyte *Podostemum ceratophyllum* (Michaux)

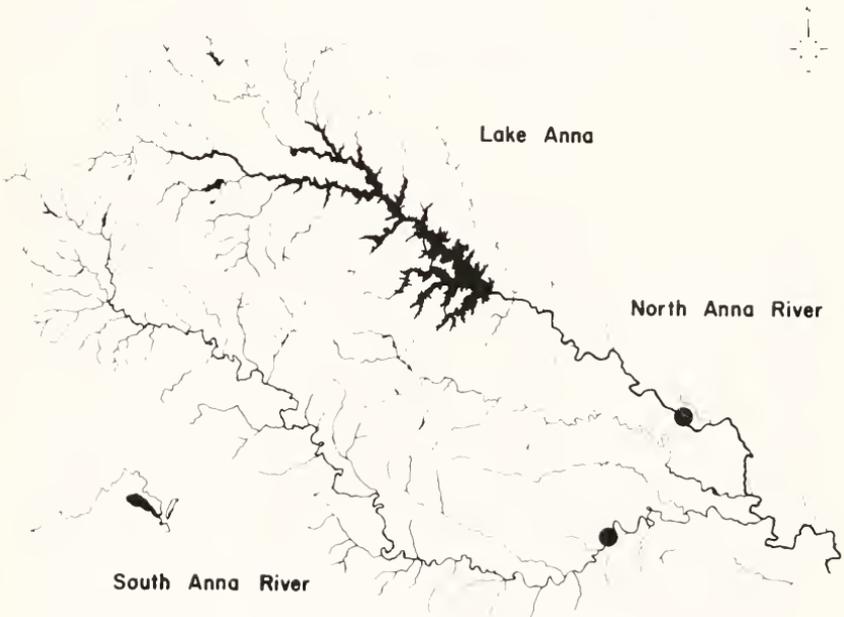


Fig. 1. Map of North and South Anna Rivers in Virginia, USA, indicating locations of sampling stations. (●).

(river weed) forms thick carpets on large rocks in fast water during summer months. Both rivers exhibit soft to medium hardness (12-35 ppm CaCO₃) and circum-neutral pH (5.90-8.05). Water temperatures range from 2-29° C. A complete description of the study area can be found in Flint et al. (1979) and Kondratieff and Voshell (1981).

Methods

Field studies were conducted from June 1977 to June 1978. Nymphs were collected in riffles with a Portable Invertebrate Box Sampler (PIBS) (Ellis Rutter Assoc., Douglassville, PA), D-frame dip net, and by hand. Samples were taken monthly in the winter (November to March) and every two weeks for the remainder of the year. Imagoes and subimagoes were collected from spring to autumn with portable black light traps and with lights (either black light or Coleman lantern) at white sheets of cloth. The collecting traps or lights were usually set up before dusk and operated for 1 to 2 hrs. Subimagoes were allowed to transform in ventilated plastic jars lined with wire screen. Mature nymphs of all species were collected, returned to the laboratory, and reared for positive association. Reliable specific identification is presently not possible for eastern *Pseudocloeon* and *Tricorythodes* species. For this reason, the nearest specific names are given.

Results and Discussion

South Anna River

Many of the species in the SAR were closely associated with the *Podostemum ceratophyllum*. The thick mats provide food and shelter for a mayfly community dominated by Ephemerellidae and Baetidae. The mayflies inhabiting *Podostemum* could be divided into three temporal components based on the time of their emergence: winter/early spring, spring, and summer/fall (Fig. 2). *Baetis amplus* was the sole example of the winter/early spring element, emerging as early as late February during warm periods. Apparently it had a univoltine life cycle in the SAR. Nymphs were absent in bottom samples from middle June to late November. Rapid growth occurred during the winter months.

Spring emerging species included *Drunella tuberculata*, *Ephemerella invaria*, *E. needhami*, and *Eurylophella versimilis*. All of these species were univoltine and exhibited short seasonal emergence periods. Subimagoes of *D. tuberculata* and *E. invaria* emerged in late morning (ca. 8:30 A.M. to 11:00 A.M.). Mating flights of both species occurred near dusk (ca. 7:00 P.M. - 9:30 P.M.). *Isonychia pictipes* was bivoltine at this site with one brood hatching from late March to middle May and the second from July to early October. Subimagoes emerged in late afternoon to early evening (ca. 6:00 P.M. - 7:30 P.M.). Nuptial flights were observed near

dusk (ca. 8:00 P.M. - 9:30 P.M.).

The summer/fall emerging component included the most abundant species and those with the longest seasonal emergence periods: *Baetis intercalaris*, *B. ephippiatus*, *Serratella deficiens*, *S. serratoides*, *Pseudocloeon* nr. *dubium*, and *Tricorytodes* nr. *allectus*. The two species of *Baetis* emerged from late morning to late afternoon (ca. 11:00 A.M. - 4:00 P.M.) throughout the summer months. The life cycles of both species were difficult to interpret from nymphal or emergence data. Nymphs were present in all stages throughout the warm months (Fig. 3). The life cycle of *Heterocloeon curiosum* was bivoltine (Figs. 2 and 4) and has been described in detail by Kondratieff and Voshell (1981). Other than *H. curiosum* and *B. intercalaris*, *E. serratoides* was the most abundant mayfly in the mats of river weed. Large hatches of this species were observed, with a peak in early July. Nymphs were present in bottom samples from October to middle August (Fig. 5). Nymphs of *S. deficiens* were present from February to November. Peak nymphal density was observed in early October (Fig. 6). *T. nr. allectus* did not exhibit definite emergence modes. Small sporadic emergences occurred in early afternoon throughout the

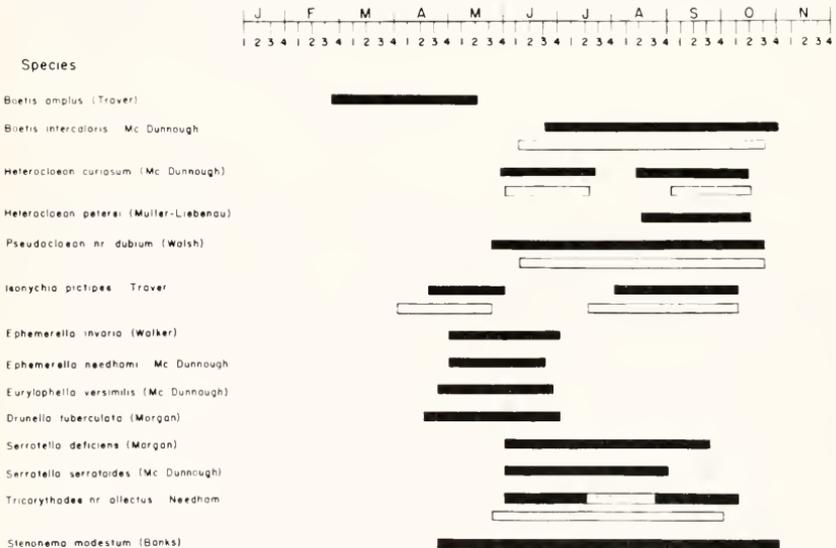


Fig. 2. Seasonal occurrence of imagoes from June 1977 to June 1978. Open bars = North Anna River; solid bars = South Anna River. Baetidae: *B. amplus*, *B. intercalaris*, *H. curiosum*, *H. petersi*, *P. nr. dubium*; Oligoneuriidae: *I. pictipes*; Ephemerellidae: *E. invaria*, *E. needhami*, *E. versimilis*, *D. tuberculata*, *S. deficiens*, *S. serratoides*; Tricorythidae: *T. nr. allectus*; Heptageniidae: *S. modestum*.

summer similar to what Macan (1958) called "driblets". *Heterocloeon petersi* emerged for a short period in late afternoon in the later summer and early fall. Nymphs of *H. petersi* were present in bottom samples from early summer (middle June) to late fall (October).

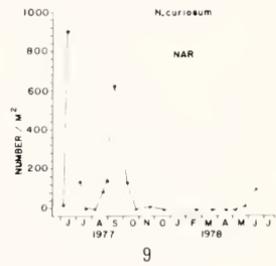
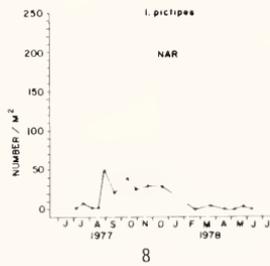
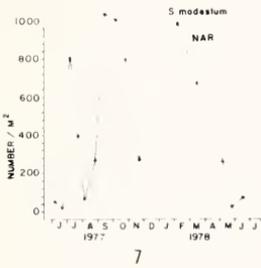
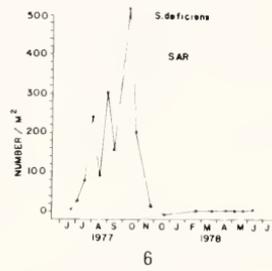
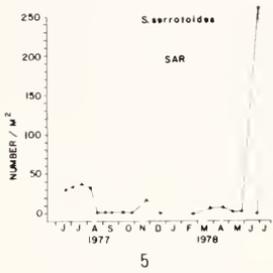
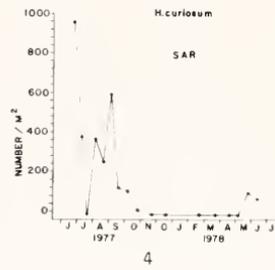
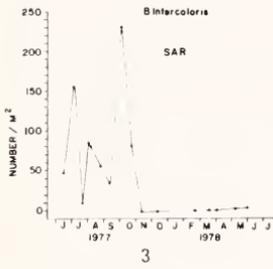
Other mayflies encountered at this site but collected too infrequently to ascertain emergence periodicity were *Stenacron interpunctatum* (Say), *Stenonema modestum* (Banks), *S. integrum* (McDunnough), *S. terminatum* (Walsh), *Heptagenia flavescens* (Walsh), *Leucrocuta aphrodite* (McDunnough), *Drunella lata* (Morgan), *Neophemera youngi* Berner, *Caenis amica* Hagen, and *Hexagenia munda* Eaton. *Leptophlebia bradleyi* (Needham) also inhabited nearby marshes from which it emerged in early March.

North Anna River

The mayfly community in the NAR was dominated by members of the families Heptageniidae and Baetidae (Fig. 2). The Ephemerellidae were conspicuously absent, apparently because *Podostemum ceratophyllum* was not present to provide a suitable habitat. *Podostemum* probably once occurred in the NAR but was eliminated many years ago by acid and metal mine drainage. Lake Anna has significantly improved the quality of downstream water by acting as a sink for sediment and metals (Simmons and Voshell 1978), but *Podostemum* has not yet recolonized the NAR.

All mayflies occurring at this site were spring and summer/fall emerging species. The life history and ecology of *S. modestum* and *H. curiosum* have been reported by Kondratieff and Voshell (1980, 1981). The life cycle of *S. modestum* was probably bivoltine with "driblets" emerging throughout June and July. Peak nymphal densities in July, September, and October corresponded with emergence modes (Fig. 7). *H. curiosum* was bivoltine with the second brood emerging approximately 1 mo. later in the SAR (Fig. 8). The life cycles of *B. intercalaris*, *P. nr. dubium*, and *T. nr. allectus* were difficult to interpret. Possibly, *B. intercalaris* and *P. nr. dubium* were trivoltine and *T. nr. allectus* bivoltine at this site. Both *B. intercalaris* and *P. nr. dubium* emerged in late morning to early afternoon (ca. 11:00 A.M. - 4:00 P.M.) during the entire summer. Nuptial flights of both species occurred in late afternoon to early evening (ca. 2:00 P.M. - 7:00 P.M.). No emergence of *T. nr. allectus* was observed; however, a nuptial flight was observed in early morning (ca. 7:00 A.M. - 8:00 A.M.) in early August. *I. pictipes* had two emergence peaks at this site; one in late May/early June and the other in middle August. Nymphal densities are shown in Fig. 9.

Other mayflies occurring in the NAR but very rarely collected were *Neophemera youngi* Berner, *Hexagenia munda* Eaton, *Ephemerella*



Figs. 3 - 9. Seasonal densities of nymphs from June 1977 to June 1978 in the North Anna River (NAR) and South Anna River (SAR).

dorothea Needham, *Drunella tuberculata* Morgan, and *Heptagenia marginalis* Banks.

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AN ANNOTATED CHECKLIST OF THE SCORPIONFLIES (MECOPTERA) OF KENTUCKY^{1,2}

George W. Byers³, Charles V. Covell, Jr.⁴

ABSTRACT: Collection data are reported for 17 species representing 3 families of scorpionflies (Mecoptera) from Kentucky. The published record of one further species is discussed.

A number of years ago the authors agreed to collect data on Mecoptera from Kentucky in order to publish a base-line list of the state scorpionfly fauna. Specimens and records from various sources were collected by the first coauthor, and specimens taken in various localities in Kentucky (particularly the Louisville vicinity) by the second coauthor and his students were sent to the first coauthor who determined them. Specimens were also borrowed from the University of Kentucky collection, and the resulting data are included here.

Collection localities and dates of capture are reported here for 17 species in 3 families. Year designations are given when known, except in cases in which many dates are listed for the locality.

Family Meropeidae

Merope tuber Newman. Bernheim Forest, Bullitt Co., in Malaise trap, 22-29 June, 30 June-2 July, and 3-8 July, 1976; Otter Creek Park, Meade Co., at UV light, 10 Aug. 1979; Land Between the Lakes, Trigg Co., 4 June 1965 (see Byers 1973a, 1973b).

Family Panorpidae

Panorpa acuta Carpenter. Paintsville, Johnson Co., 21 June 1966 (see Byers, 1973a).

Panorpa banksi Hine. Bernheim Forest, Bullitt Co., in Malaise trap, 20-23 May 1976; Golden Pond, Trigg Co., June 1964; Land Between the Lakes, Lyon Co., 23 June 1971 (see Byers, 1973a); London, Laurel Co., 17 June 1946; Morehead, Rowan Co. (as Fleming Co. in Byers, 1973a). 3 June 1971.

Panorpa helena Byers. Bell Co., 19 June; Big Black Mountain, Harlan Co., 6 June 1951, 19 June, 9 July 1977, and 12 July 1972; Goldbug, Whitley Co., 10 June 1980; Golden Pond, Trigg Co., in Malaise trap, 25 May-10 June 1964; Jellico, Magoffin Co., 15 Aug.; London, Laurel Co., 17 June 1946; Morgan Co., in UV trap, 23 May 1975; Robertson Co., 23 Aug. 1974; Wolf Creek Lake, Wayne Co., 5 June 1952.

Panorpa hungerfordi Byers. Carter Caves State Park, Carter Co., 30 July 1977.

Panorpa insolens Carpenter. Bernheim Forest, Bullitt Co., in Malaise trap, 20-26 May and 21-23 Aug. 1976; Boone Co., 24 June 1978, 29 June 1980, 19 July 1979, 29 July 1977;

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Brownsboro, Oldham Co., 1 July 1975; Caperton Swamp, Louisville, Jefferson Co., 17 May 1969; Covered Bridge Boy Scout Reservation, Oldham Co., 30 April, 8 May, 17-22 June, 11 and 27 Aug., 15 Sept.; Goshen, Oldham Co., 21 Sept. 1971; Harrod's Creek, 10 miles NE of Louisville, Oldham Co., 21 June 1968; Horner Wildlife Sanctuary, Oldham Co., 1 July, 4-5 Sept.; Jessamine Creek, Jessamine Co., 26 May 1971; Jessamine Co., in Malaise trap, 7-14 Sept. 1974; Louisville vic., Jefferson Co., 18 and 28 April, 1-31 May, 11-27 June, 5 July, 30 Aug., and 16 Sept.; Oldham Co., 8-17 May, 30 July, and 6-12 Aug. This species has been discussed by Byers (1973a: 372).

Panorpa isolata Carpenter. Goldbug, Whitley Co., 28 Aug. 1976; Hazel Patch, Laurel Co., 5 June 1981.

Panorpa longicornis Carpenter. Big Black Mountain, Harlan Co., 9 July 1977.

Panorpa nebulosa Westwood. Bernheim Forest, Bullitt Co., in Malaise trap, 23-26 May 1976 (also netted 21 May 1966); Carter Caves State Park, Carter Co., 30 July 1977; Cumberland Falls State Park, Whitley Co., 6 June 1960 and 24 June 1952; Golden Pond, Trigg Co., in Malaise trap, 25 May-5 June 1964; Harlan Co., 19 June; Laurel Co., 29 June 1980; Levi Jackson State Park, 4 miles SE of London, Laurel Co., 8 June 1969; Louisville, Jefferson Co., 22 April 1966; Natural Bridge State Park, Powell Co., 26 May 1974.

Panorpa speciosa Carpenter. Boone Co., 19 July 1979; Covered Bridge Boy Scout Reservation, Oldham Co., 17 June 1976, 30 July 1974, 11 and 13 Aug. 1974, and 15 Sept. 1976; Louisville, Jefferson Co., 25 May 1968, 12 Aug. 1974, 7 Oct. 1976, St. Matthews, Jefferson Co., 8 Aug. 1974 and 4 Sept. 1976.

Panorpa submaculosa Carpenter. Bell Co., 2 July; Big Black Mountain, Harlan Co., 14 July 1979; Kingdom Come State Park, Harlan Co., 13 July 1979; Levi Jackson State Park, 4 miles SE of London, Laurel Co., 8 June 1969; Pine Mountain State Park, Bell Co., 18 June 1968.

Panorpa new sp. (undescribed) near *virginica* Banks. Barren River State Park, Barren Co., 2 Oct. 1979; Kenlake State Park, Calloway Co., 17 Sept. 1979; Slade, Powell Co., 3 Oct. 1976.

Family Bittacidae

Bittacus occidentis Walker. Laurel Co., 27 May; Lexington, Fayette Co., 5 Sept. 1976; Louisville, Jefferson Co., 9 Sept. 1953 (see Byers, 1973a); Perry Co., 7 June.

Bittacus pilicornis Westwood. Brownsboro, Oldham Co., 1 July 1975; Covered Bridge Boy Scout Reservation, Oldham Co., 31 June 1968.

Bittacus stigmaterus Say. Anchorage, Jefferson Co., 27 July 1952; Jessamine Co., 1 mile W of Spears, 27 Aug. 1971; Oldham Co., 30 July 1974 and 8 Sept.; Sleepy Hollow, Oldham Co., 9 Aug. 1951.

Bittacus strigosus Hagen. Big Bone Lick State Park, Boone Co., 17 June 1970; Caperton Swamp, Louisville, Jefferson Co., 8 July 1965; Covered Bridge Boy Scout Reservation, Oldham Co., 21 June 1968 and 26 July 1966; Frankfort, Franklin Co., 23 June; Harrod's Creek, 10 miles NE of Louisville, Oldham Co., 21 June 1968; Anchorage, Jefferson Co., 27 June and 1 July 1959; Jefferson Co., 30 June 1960; Louisville, Jefferson Co., 19 June 1975.

Hylobittacus apicalis (Hagen). Covered Bridge Boy Scout Reservation, Oldham Co., 21 June 1968; Doe Run area near Muldraugh, Meade Co., 3 July 1971; Frankfort, Franklin Co., 23 June; Horner Wildlife Sanctuary, Oldham Co., 24 June 1965 and 1 July 1975; Louisville, Jefferson Co., 30 May 1955 and 1965, 1 June 1955, and 23 June 1971; Jefferson Co., 4 Aug. 1974.

In addition to the species listed above, *Panorpa americana* Swederus was reported by Hagen from Kentucky (Carpenter, 1931). However, we consider that record to be questionable, the range of that species being well to the south and east of Kentucky on the basis of specimens seen. Other

species certainly occur in Kentucky, but definite records are not known to us. These include species reported from adjacent states, such as *Panorpa anomala* Carpenter, *P. debilis* Westwood, *P. latipennis* Hine, *P. maculosa* Hagen, and *Bittacus punctiger* Westwood. The authors will continue the search for these and other species, and welcome the opportunity to examine material that readers may have taken in Kentucky.

ACKNOWLEDGEMENTS

We are grateful to the following for the loan of specimens for study: Mr. Wes Bicha, Logansport, Ind.; Mr. W. Blaine Early III, Dept. of Biology, Cumberland College, Williamsburg, Ky.; and Dr. Paul H. Freytag, Dept. of Entomology, University of Kentucky, Lexington, Ky. We also thank Ms. Rozenna B. Carr for clerical assistance, and the Isaac Bernheim Foundation, Louisville, Ky., for funds and the opportunity to survey Bernheim Forest.

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INSECT ENDOCRINOLOGY & NUTRITION. G. Bhaskaran, S. Friedman, J.G. Rodrigues, eds. 1981. An E.S.A symposium on insect endocrinology. Plenum Press. 362 pp. \$39.50.

Nine papers in part one are on neuroendocrine regulation of endocrine glands; ecdysis, pupariation, & diapause; developmental response to juvenile hormone; and biochemical changes in cuticular proteins. Part two contains seven papers on digestive enzymes, lipid & carbohydrate requirements and dietetic complexities of plant-insect interactions.

FROM ARSENIC TO DDT: A HISTORY OF ENTOMOLOGY IN WESTERN CANADA. Paul W. Riegert. 1980. Univ. of Toronto Press. 353 pp. \$30.00.

The story of entomology and the struggles of man vs. insects on the prairies of the four western provinces of Canada from the earliest explorers to the Second World War.

A NEW MODEL OF FLIGHT-INTERCEPTION TRAP FOR SOME HYMENOPTEROUS INSECTS¹

Lubomir Masner, Henri Goulet²

ABSTRACT: A new model of insecticide-treated flight-interception insect trap has been designed for sampling of minute and slow-flying hymenopterous insects (microhymenoptera and Symphyta). Technical data for the new trap as well as comparisons with other types of insect flight traps are given.

Airborne insects can be intercepted by a simple barrier. The most efficient barrier consists of a net-like material, which blends with the background and allows free flow of air. Numerous models of insect flight traps have been designed (Leech, 1955, Gressitt and Gressitt, 1962, Butler, 1965, Townes, 1972, Steyskal, 1981) following publication of the classical prototype by Rene Malaise (1937). Among hymenopterists the most popular recent modification of the Malaise trap has been designed by Townes (1972). The latter trap is superior for its simplicity, light weight, and greater efficiency. However, its usefulness is limited primarily to large and swift-flying Hymenoptera such as ichneumonoid flies and miscellaneous Aculeata which readily climb up the walls and eventually enter the head of the trap. However, the vast majority of parasitic microhymenoptera as well as the slow-flying sawflies appear to be relatively poorly represented in these catches. This may be partly explained by the rather coarse mesh openings of the fabric used in Townes' model, and by the low phototropic reaction of many insects. Consequently a new trap has been designed to expedite collection of sawflies and microhymenoptera.

Operating principles and efficiency of the new trap

The structure of the new trap is indicated in Fig. 1a. The target specimens of Hymenoptera (microhymenoptera and sawflies) alight on or are blown into the interceptor. The strongly phototropic specimens start climbing up, the less phototropic ones rest or move randomly. Specimens of both groups are soon overcome by a fast-acting insecticide, and fall into the trough.

Our trap is comparable to that designed for flying beetles by Peck and Davies (1980). Both traps are simple flight interceptors with plastic roofs and bottom troughs. However, the two traps take advantage of the different flight techniques of Coleoptera and Hymenoptera respectively. Whereas the Peck-Davies trap operates on the simple principle of "bounce and fall" displayed by most Coleoptera, our trap relies primarily on the principle of rapid poisoning of Hymenoptera.

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Laboratory tests were designed to determine the effect of a pyrethroid insecticide on various Hymenoptera. Newly emerged adults of *Idris* sp. (Proctotrupoidea, Scelionidae) as well as those of *Pontania* sp. (Tenthredinidae) were allowed to climb on Ambush[®] (2% solution)-treated polyester fabric. The tiny (1.5 mm) *Idris* wasps did not progress more than 10 cm on the fabric before showing symptoms of poisoning (e.g. loss of positive phototropism) after 30 seconds and fell, on average within 60 seconds of alighting. The larger (7 mm) *Pontania* sawflies managed to climb up the whole of the fabric (132 cm), but fell on average in 4 minutes.

Field tests were carried out from May to the end of September 1980 near Carleton Place, Ontario, adjacent to a mixed forest. Two Ambus[®]-treated traps (3 m and 5 m length, see below) were operated along with an untreated control trap (3 m length). The catches of both microhymenoptera and sawflies were about 6 times greater in the treated traps than those in the control trap.

Technical data

The new trap consists of three parts (the trough, the interceptor, and the roof), and two chemicals (the insecticide and the trough preservative).

The trough. The trough is made of metal or pliable plastic (assembled as illustrated in Figs. 2 - 4). Plastic troughs may require wooden supports (mouldings, sticks) to keep edges upright, especially with a long trough. The trough should be about 50 cm wide and any length judged practical. As the soil surface is often irregular and sloping, shorter lengths (50 to 75 cm) are easier to install. The total length of the trough(s) should slightly exceed that of the interceptor.

The interceptor. A rectangle (height 132 cm, length 300 cm) of dense (about 0.5 mm between strands), black polyester fabric (such as Dacron or Terylene) is suspended between two ropes sewn into both the upper and lower edges. As black polyester fabric is difficult to find on the market, a white or light colored fabric may be sprayed black (Magix Shoe Spray[®] No. 35 Black, by Magid Corp., N.Y., available at shoemakers' supplies). The vertical edges of the interceptor are reinforced with black polyester tape.

The roof. The function of the roof is twofold: (1) as a rain cap, and (2) as a barrier for keeping positively phototropic insects on the interceptor. A clear polyethylene sheet (6 mil.) rests on the rope sewn into the upper edge of the interceptor. The width of the roof is about 60 cm and its length slightly longer than that of the interceptor. Strings tied in each eyelet (reinforced with vinyl tape) keep the roof suspended (Fig. 1c). The side flaps of the roof are taped medially by vinyl tape after the roof is mounted on the rope (Fig. 1b). There should be no gap between the tape and the rope (use odd pieces of tape).

The insecticide. Ambush[®] (synthetic pyrethroid with permethrin base) is satisfactory for killing insects that alight on the interceptor. The milky water

solution dries rapidly and remains active for 7-10 days. For our protection we used plastic gloves and eye protectors while applying the insecticide. Use flat brush to apply the insecticide.

The trough preservative. A supersaturated salt solution (NaCl) is used in the trough, with a squirt of surfactant (e.g. Extran 300[®], Triton X-100[®], Fotoflow[®]) as a surface tension breaker. Salt is an inexpensive preservative, readily available to most collectors. The contents of the trough are collected with a small dip net, then carefully rinsed in fresh water to prevent a buildup of protein coagulant after transfer into 70% ethyl alcohol. The traps should be emptied at least once a week, or more often in hot and rainy weather.

Choice of the site and setting of the trap

Choose a flat open site, preferably with predominant winds perpendic-

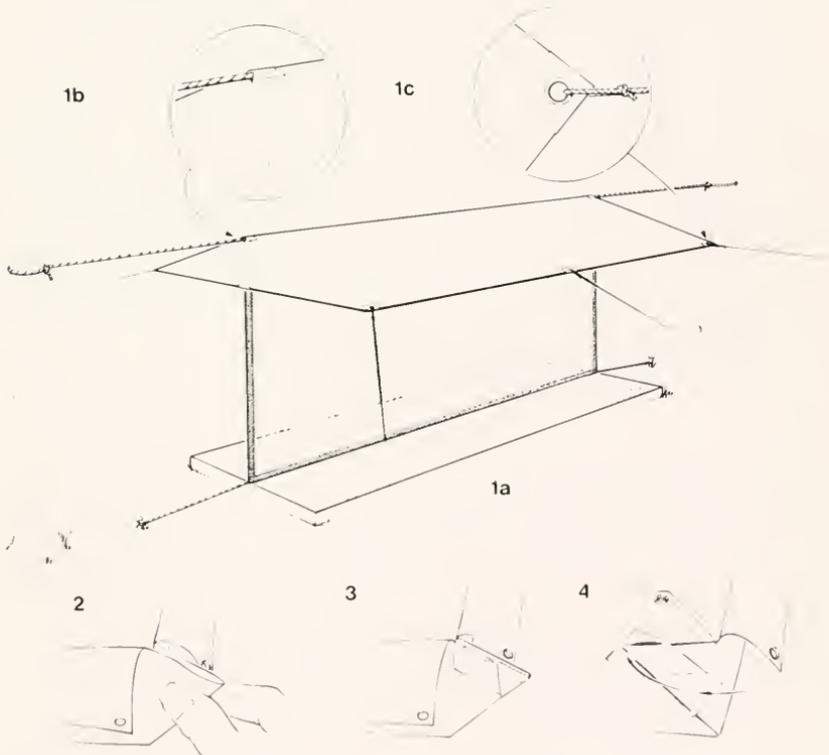


Fig. 1. The trap (1a) as it appears in the field with the roof, the interceptor (stippled), and the trough. Details of vinyl reinforcement of side flaps of the roof (1b) and eyelets along roof lateral edges (1c).

Figs. 2 to 4. Steps in folding and taping corners of plastic troughs.

ular to the interceptor. Windswept edges of forests and natural pathways with a funnel effect (along a trail, stream, etc.), are the best choices. The trap should be exposed to direct sunshine.

The trough should be positioned first (by digging a trench), then the central interceptor installed by suspending the upper rope between two trees or poles, then the roof mounted, the roof flaps taped, the roof strings tied and the trough filled with the salt solution.

Common hazards and failures

The quality and quantity of material collected depends on careful observance of the above instructions, and points listed below.

1. Never rush the selection of a collecting site. Consider all potential hazards to the trap (e.g. vandalism, grazing cattle, game trails).
2. Maintain a high salt content in the solution (allow a thin layer of salt to develop on the bottom of the trough); use inexpensive rock salt.
3. Rinsing of the collected material must be thorough but gentle; use a shower attachment to avoid pounding of specimens. Rinsing may be done in the field by using natural sources of water.
4. If specimens are left in the trough for a prolonged period of time, use maximum care while rinsing the contents. Generally, material from this type of trap should not be treated in ultrasonic cleaners.
5. Whenever possible keep contents refrigerated in alcohol.
6. Since 70% ethanol is not a good long-term preservative, specimens should be critical point dried as soon as convenient (Gordh and Hall 1979).
7. Do not discard residues; colleagues, including the authors, may want to study your unused catches.

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Messrs. B.E. Bowen and S.J. Miller (Biosystematics Research Institute, Agriculture Canada) helped us with the field tests. Mr. F. Bruce Jones (Chipman Inc., Toronto) kindly donated samples of the insecticide for testing. Ms. Susan Rigby (Biosystematics Research Institute, Agriculture Canada) prepared the illustrations. Dr. C.D. Dondale and A.E. Davies (Biosystematics Research Institute, Agriculture Canada) kindly checked the manuscript.

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A COMPACT SAMPLING DEVICE FOR ECOLOGICAL STUDIES OF CRYPTOZOAN COMMUNITIES¹

Gerald Summers, H. Badortes²

ABSTRACT: A compact sampling device constructed from discarded beverage containers is described for use in ecological studies at remote field sites. Environmental conditions within sampling units do not differ from leaf-litter microhabitats. Individuals of various cryptozoan groups are generally distributed at random in both time and space in sampling units. The procedure is as effective as quadrat sampling in determining relative abundances for centipede communities.

Ecological studies of soil and litter arthropods ("cryptozoa", cf. Cole, 1946) are generally based on absolute density measures obtained from quadrat sampling techniques (reviewed by Wallwork, 1970), or from data obtained by relative methods such as pitfall trap collections (Uetz and Unzicker, 1975). These methods involve numerous, bulky sample units that present logistical difficulties for studies in remote areas. More convenient sampling methods would be useful for analyses of community structure.

A primary objective of community studies of cryptozoa is to determine the relative abundance of species within the leaf-litter microhabitat. Any alternative collection method must sample this microhabitat with the same efficiency as conventional procedures. In addition, the sampling units must (1) all have an equal chance of collection, (2) have stability throughout the sampling period, and (3) sample a constant proportion of the target populations (Morris, 1955). The following material describes a compact unit for sampling cryptozoan communities. We report the collections for various taxa and compare the efficiency of the proposed method with quadrat sampling of centipede communities.

Sampling units were made from 355 ml (12 oz) tin beverage containers with the ends removed. All containers were thoroughly scrubbed to remove residue and allowed to air-dry before placement in the field. Preliminary studies of the sampling unit were conducted in a dry uplands forest at Robert Allerton Park, Piatt Co., Illinois. Units were placed in six blocks of a randomized-blocks design. Each block consisted of a 6x6-m plot subdivided into 36 compartments. Sampling units were packed loosely with leaf litter and placed on the ground in each compartment of every block. Units in three blocks were collected after 4 weeks, but only ten centipedes were collected.

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The remaining three units were left for 10 weeks.

After 10 weeks in the field, six sampling units in each block were randomly selected for collection at each of six times during a 24-hr period (0200, 0600, 1000, 1400, 1800, and 2200 hrs). At the time of collection, each unit was placed in a plastic bag, labelled, and taken to the laboratory for Berlese funnel extraction of all arthropods. Ten 0.1m² litter samples were also collected in each block for Berlese funnel extraction.

Sampling units were covered with leaf litter in order to prevent disturbance and to reflect the environmental conditions of the leaf-litter microhabitat as closely as possible. Temperature readings during a 24-hr period were taken on three separate occasions. Temperatures in the sampling units never differed from adjacent leaf-litter temperatures by more than 1.5 C and the two temperatures were highly correlated ($r=.991$, $p<.001$). This suggests that the artificial nature of the environment within sampling units is not greatly different from environmental conditions in undisturbed litter.

The number of individuals of various cryptozoa collected by these sampling units is presented in Table 1. These data are used to analyze spatial and temporal components of the collection process. It is possible that individuals of a taxon might have been attracted to some sampling units or that some of the units might have been placed in areas where individuals aggregated for other reasons. Either of these conditions would be indicated if the variance: mean ratio for the number of individuals per unit was significantly greater than one. The significance of variance: mean ratios can be tested against chi-square with one degree of freedom (third column of Table 1). Significant clumping of individuals in units occurred in collembola and ants, but not in roaches, millipedes, centipedes, or spiders.

Field studies of cryptozoan populations generally show contagious

TABLE 1. Number of individuals of several cryptozoan groups collected by a compact litter-sampling device ($n = 108$).

Group	Number of individuals collected	Mean no. of individuals per unit	P for random distribution among units	P for uniform distribution in time
Collembola	2,530	23.65	<.0005*	.10 > p > .05
Roaches	52	0.49	.90 > p > .80	.20 > p > .10
Millipedes	55	0.51	.20 > p > .10	.60 > p > .50
Ants	6,331	59.17	<.0005**	.80 > p > .70
Centipedes	77	0.72	.25 > p > .20	.60 > p > .50
Spiders	266	2.49	.20 > p > .10	.50 > p > .40

* χ^2_1 for the distribution of individuals among sample units for this group is 136.93

** χ^2_1 for the distribution of individuals among sample units for this group is 542.72

distributions in association with environmental features. However, the degree of aggregation appears to be strongly correlated with population density (Usher, 1976). Collembola and ants were collected in much greater numbers than any other group and have variances that are considerably greater than their means. Ant aggregation is a social phenomenon. Aggregations of collembola appear to be influenced by water and food sources (Verhoef and Nagelkerke, 1977). Furthermore, collembola secrete aggregation pheromones (Mertens and Bourgoignie, 1977; Mertens *et al.*, 1979). Aggregations of the other taxa probably occur in association with features not detected by the sampling device. In any event, these taxa do not appear to be attracted to the sampling unit and are sampled at a constant level.

An analysis of matched sets of sampling units at each of the six sampling times indicates no significant difference in the number of individuals collected at various times of day (Friedman's one-way analysis of variance by ranks, significance noted in Column 4 of Table 1). Thus, sampling units do not vary in efficiency with time of collection.

The efficiency of this sampling unit in studies of centipede community structure is compared to quadrat sampling in Table 2. These data indicate that centipedes collected by compact sampling units occur in the same relative frequencies as those obtained by Berlese funnel extraction from quadrat samples. This impression is confirmed by a contingency table analysis of species abundances (*Lithobius forficatus*, *Strigamia branneri*, *Schendyla nemorensis*, and *Geophilus vitattus* abundances are combined to conform to Cochran's rule [Zar, 1974:50]; $\chi^2 = 2.685$; $.50 > p > .40$).

The results of this preliminary study indicate that the compact sampling unit described here is as effective as conventional procedures in assessing species richness and relative abundances in leaf-litter microhabitats. If units are covered with leaf litter and left in place for at least 10 weeks, the

TABLE 2. Centipedes collected at various times of day by a modified litter-sampling device in a dry, uplands forest. Specimens collected by Berlese funnel extraction of 0.1m² litter samples (n=30) are noted in the right column.

Species	Time of Day							Total	Quadrat
	0200	0600	1000	1400	1800	2200			
<i>Nadabius ameles</i> Chamberlin 1944	7	6	6	8	7	7	41	10	
<i>N. iowensis</i> (Meinert 1886)	3	4	6	4	-	-	17	8	
<i>Neolithobius voracior</i> (Chamberlin 1912)	3	1	1	2	1	1	9	4	
<i>Strigamia branneri</i> (Bollman 1888)	1	2	3	-	-	-	6	4	
<i>Lithobius forficatus</i> Linnaeus 1758	-	2	-	-	-	-	2	0	
<i>Schendyla nemorensis</i> (C.L. Koch 1836)	1	-	-	1	-	-	2	0	
<i>Geophilus vitattus</i> (Say 1821)	-	-	-	-	-	-	0	3	
TOTALS	15	15	16	15	8	8	77	29	

sampling device meets the criteria of stability and equiprobable colonization by target populations. This unit would be useful for ecological studies of cursorial litter-inhabitants in sites with features that make conventional methods unsuitable.

ACKNOWLEDGEMENTS

Jeanine Kasproicz and Gloria Myers assisted in field collections during the long nights at Allerton Park. This work supported in part by a Grant-in-Aid from Sigma Xi.

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INSECT PHYSIOLOGY. W. Mordue, G.J. Goldsworthy, J. Brady, W.M. Blaney. 1980. Halsted Press, John Wiley & Sons. 108 pp. \$16.95

A concise and well illustrated study covering essential elements of insect physiology, including basic knowledge of membrane biophysics, biochemistry, cell biology and behavior. Chapter headings cover energy metabolism, transporting tissues, growth & development, nervous & sensory systems, muscles & movement, behavior, and interactions with the environment.

INSECT CYTOGENETICS. R.L. Blackman, G.M. Hewitt, M. Ashburner, eds. 1980. A symposium of the Royal Entomological Society of London: #10. Blackwell Sc. Pub., Halsted Press, John Wiley & Sons. 278 pp. \$69.95.

Fifteen papers discuss advances in cytogenetics at the molecular level and studies on the evolution and maintenance of genetic systems.

A NEW GENUS AND SPECIES OF GYPONINE LEAFHOPPER RELATED TO *GYPONA* (HOMOPTERA: CICADELLIDAE)¹

Dwight M. DeLong²

ABSTRACT: A new genus, *Woldana*, and a new species, *W. campana* of leafhopper (Gyponinae, Homoptera: Cicadellidae) from Panama are described.

The genus *Gypona* (subgenus *Paragypona*) and 3 closely related genera were treated by DeLong and Freytag (1964). A new genus* and species from Panama, with a produced, more triangular head is described in this paper.

Genus *Woldana*, New Genus

Crown triangular, roundly pointed apically, length at middle equaling width between eyes at base. Crown with a longitudinal median groove, a slight longitudinal carina on each side, extending from near apex to 2/3 length of crown. Ocelli proximal on each side of median groove at 2/3 length of crown.

Type-species *Woldana campana* n.sp.

Woldana is most closely related to *Gypona* (*Paragypona*) DeLong & Freytag (1964) but is smaller and much narrower, body with the widest portion at humeral angles of pronotum. Forewings covering abdomen, sloping to a pointed caudal apex. In general form, superficially resembling *Coelogypona*.

This genus can be separated from all other described genera of Gyponinae by the roundly pointed crown containing a median longitudinal groove 2/3 its length, with proximal ocelli at the same length of the crown, and by the slender, wedge-shaped, pointed abdomen and forewings.

I take pleasure in naming the genus for Dr. Henk Wolda, the collector, population biologist with the Smithsonian Tropical Institute in Panama.

Woldana campana n.sp.

(Figs. 1-5)

Length of male 13 mm, female unknown. Crown triangular, rounded apically, length at middle equaling width at base between eyes. Crown with conspicuous groove, a slight carina on each side, extending from near apex to 2/3 length of crown. Ocelli on each side of groove at 2/3 length of crown. Crown narrower than pronotum. Forewing venation normal. Color, crown dull yellow with a black margin each side and at apex. Pronotum and scutellum brighter pale yellow. Pronotum with black lateral margins. Forewings dark brown, appearing black, costal margin broadly yellow to near apex.

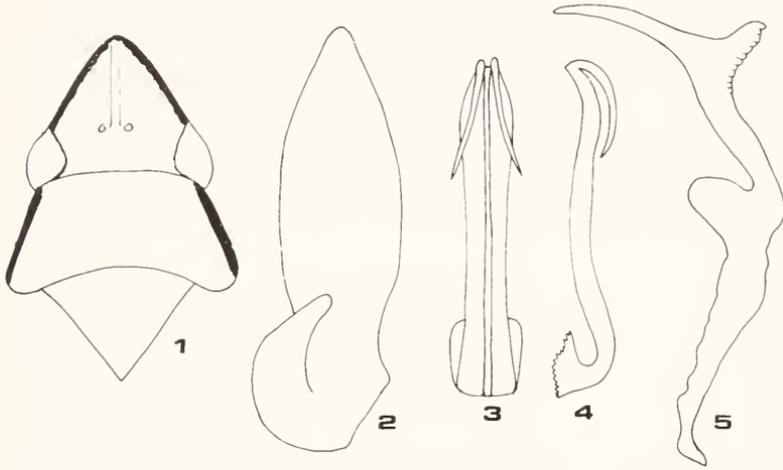
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²Department of Entomology, the Ohio State University

Male genital plates more than 3 times as long as wide at middle, apices narrowed, rounded at tips. Style with apical portion foot-like, bearing a long slender tapered "toe" and a narrow rounded "heel". Aedeagus broadened in ventral aspect, roundly broadened subapically, then narrowed to form a blunt apex bearing a pair of apical processes which extend basad 1/3 length of shaft. Pygofer rounded apically.

Holotype male, Panama, Cerro Campana, 350 m, 12-VI-1975, H.Wolda coll. in the DeLong collection, the Ohio State University.

The head is more produced and angled than any known species of Gyponinae but the genital structures resemble those of the *Gypona trista* group.



Figs. 1-5. *Woldana campana* n.sp. 1. head, pronotum and scutellum, 2. plate ventrally, 3. aedeagus ventrally, 4. aedeagus laterally, 5. style laterally.

LITERATURE CITED

- DeLong, D.M. & P.H. Freytag. 1964. Four genera of world Gyponinae: A synopsis of the genera *Gypona*, *Gyponana*, *Rugosana* and *Reticana*. Ohio Biological Survey Bulletin (N.S.) II(3), iii, 227p, 43 pl. 373 figs.

COLLEMBOLA DESCRIBED BY DR. H.G. SCOTT IN THE COLLECTIONS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA¹

Selwyn S. Roback²

From 1958-1965 Dr. H.G. Scott published a series of papers on Collembola from the U.S. (esp. New Mexico) and Japan in *Entomological News* [EN]. Specimens and types were to be deposited in the collections of the Academy of Natural Sciences of Philadelphia. This collection has now been received from Dr. Scott and contains, in addition to the synoptic material, the holotypes (H) and/or paratypes (P) of the following new species described in the aforementioned papers. The neotype of *Hypogastrura punctata* Coleman 1941 was also deposited here. A list of the papers is appended.

Species List

- | | |
|--|--|
| <i>albamaculata</i> , <i>Hypogastrura</i> 1960
EN 71 (3):55 H, P | <i>louisiana</i> , <i>Isotoma</i> 1962
EN 73 (3):68 H |
| <i>alpinus</i> , <i>Xenyllodes</i> 1960
EN 71 (6):184, 185 2P | <i>multimaculata</i> , <i>Bourletiella</i> 1965
EN 76 (2):53-55 H |
| <i>annulicornuta</i> , <i>Drepanura</i> 1963
EN 74 (1):11, H | <i>neomexicana</i> , <i>Biacanthella</i> 1961
EN 72 (4):94-96 H, 27P |
| <i>binoculata</i> , <i>Sphyrotheca</i> 1964
EN 75 (10):263, 264 H, 3P | <i>neomexicana</i> , <i>Drepanura</i> 1963
EN 74 (1):12 H, 2P |
| <i>ceruleacauda</i> , <i>Bourletiella</i> 1965
EN 76 (2):50-52 H,P | <i>neomexicana</i> , <i>Tullbergia</i> 1961
EN 72 (3):64, 65 H, 8P |
| <i>hoffi</i> , <i>Bourletiella</i> 1965
EN 76 (2):52 H | <i>neomexicana</i> , <i>Xenylla</i> 1960
EN 71 (3):60, 61 H |
| <i>hoffi</i> , <i>Folsomia</i> 1961
EN 72 (10):264 H, 3P
1P labelled <i>Proisotoma</i>
corrected in pencil to <i>Folsomia</i> | <i>neomexicanus</i> , <i>Pararrhopalites</i> 1964
EN 75 (10):264, 265 H, 3P |
| <i>hoffi</i> , <i>Proisotoma</i> 1962
EN 73 (1):20,21 H | <i>orogonensis</i> , <i>Spinifacies</i> 1963
EN 74 (4):108, 109 H, P |
| <i>hoffi</i> , <i>Xenyllodes</i> 1960
EN 71 (6):185 2P | <i>pallescens</i> , <i>Xenyllodes</i> 1960
EN 71 (6):186 2P |
| <i>japonica</i> , <i>Hypogastura</i> 1961
EN 72 (5):122,123 H,P | <i>pseudornata</i> , <i>Neanura</i> 1961
EN 72 (5):124, 125 H |
| <i>krafti</i> , <i>Spinachorutes</i> 1962
EN 73 (9):238, 239 H,P | <i>pseudoviolaceus</i> , <i>Sminthurides</i> 1964
EN 75 (2):50 H |
| | <i>punctata</i> , <i>Hypogastrura</i> . [Coleman
1941] 1960
EN 71 (3):58 Neotype |

¹Received July 25, 1981.

²Academy of Natural Sciences of Philadelphia

purpureus, *Neosminthurus* 1964
 EN 75 (10):260 H, P
robusta, *Haffia* 1961
 EN 72 (3):63 H,P
rubra, *Orchesella* 1963
 EN 74 (9):250 H,3P

socorrensis, *Drepanura* 1963
 EN 74 (1):12-14 H
subsegmenta, *Proisotoma* 1959
 EN 70 (1):13, 14 H
violacea, *Anurida* 1960
 EN 71 (6):186, 187 H

LITERATURE

- .. 1958. New locality record for *Proisotoma frisoni* (Collembola, Isotominae). 69 (8):202.
- .. 1959. Collembola from Colorado. 70 (1):13-16.
- .. 1959. Collembola from Pennsylvania. 70 (3):81-83.
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- .. 1962. Collembola from Louisiana. 73 (3):67-68.
- .. 1962. The Collembola of New Mexico. VIII. Tomocerinae (Entomobryidae). 73 (6):141-145.
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- .. 1963. The Collembola of New Mexico. IX. Entomobryinae: *Drepanura*, *Entomobryoides*, *Isotobryoides*, *Sinella*. 74 (1):9-18.
- .. 1963. Collembola from Oregon II. 74 (4): 107-111.
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- .. 1964. The Collembola of New Mexico. XIII. Sminthurinae: Sminthurini. 75 (10):259-266.
- .. 1965. The Collembola of New Mexico. XIV. Smithurinae: Bourleticellini. 76 (2):49-55.
- .. 1965. The Collembola of New Mexico. XV. Dicyrtominae. 76 (5):129-131.

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INSECT PHYLOGENY. Willi Hennig. 1981. Wiley-Interscience Pub. John Wiley & Sons. 514 pp. \$78.75.

This English edition contains Hennig's exposition of his theory, reference to fossil faunas, a review of major sites for Palaeozoic and Mesozoic insects and a phylogenetic classification of the Insecta.

INSECTS AND ALLERGY AND WHAT TO DO ABOUT THEM. C.A. Frazier, F.K. Brown. 1980. Univ. Oklahoma Press. 171 pp. \$8.95 pbk.

Illustrations enable identification of all significant venomous and disease bearing insects in America. Text describes proper up to date methods to prevent and treat insect caused illnesses.

CARABID BEETLES: THEIR EVOLUTION, NATURAL HISTORY, AND CLASSIFICATION. T.L. Erwin, G.E. Ball, D.R. Whitehead, eds. 1979. Proceedings 1st Intern'l. Symposium of Carabidology. Dr. W. Junk bv. 635 pp. \$115.

The 31 papers in this volume provide a comprehensive study of the historical perspectives, systematics, zoogeography, paleontology and natural history of this great family of coleopterous insects.

BUTTERFLIES OF THE ROCKY MT. STATES. Clifford D. Ferris, F. Martin Brown. 1981. Univ. Oklahoma Press. 442 pp. 4 color plates. \$15.95 pbk.

This comprehensive field guide covers all Rocky Mt. species and most subspecies, each species illustrated by more than one black & white photograph. Species descriptions include life histories, flight periods, habitats, distinguishing characteristics and distribution maps. Successor to *Colorado Butterflies*, now out of print.

ENERGY METABOLISM IN INSECTS. Roger G.H. Downer, ed. 1981 Plenum Press. 244 pp. \$32.50.

Eight papers presented at a symposium on Energy Metabolism and its Regulation in Insects at the XVI Intern'l. Congress of Entomology. This volume explores environmental and physiological factors affecting basic patterns of energy flow and examines specific aspects of carbohydrate, lipid, and proline metabolism.

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ENTOMOLOGICAL NEWS

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(Continued on inside of back cover)

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***DELTOSTETHUS SCITULUS*, A NEW HYDROPHILID BEETLE FROM MEXICO (COLEOPTERA: HYDROPHILIDAE)¹**

Paul J. Spangler², Aurea H. Huacuja³

ABSTRACT: A new species of sphaeridiine hydrophilid beetle, *Deltostethus scitulus* is described, illustrated, and compared to the other two species in the genus, *D. palpalis*, Sharp and *D. sulcatus* Sharp. The type-material was collected in pitfall traps in the state of Hidalgo, Mexico, during a study of staphylinid beetles attracted to various baits. The new species was attracted to pitfall traps baited with chicken viscera, fish, cow and human feces, and bananas.

During a study by A.H. Huacuja of staphylinid beetles attracted to baited pitfall traps, several species of sphaeridiine hydrophilid beetles also were attracted to the baits. Among these sphaeridiines were several species of *Cercyon* and a species of *Deltostethus*, a genus described by Sharp (1882). This species proved to be distinct from the other known species in that genus, *D. palpalis* Sharp and *D. sulcatus* Sharp. The new taxon is described below.

Deltostethus scitulus, new species

Figures 1 - 6

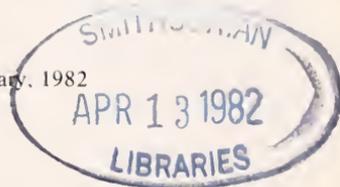
Holotype male. — Body form and size: Ovoid (Fig. 1). Length 2.5 mm; greatest width 1.6 mm, slightly before midlength of elytra.

Coloration: Head piceous except small indistinct spot above base of each antenna and anterior margin of clypeus dark reddish brown. Pronotum piceous except sides with broad yellowish-brown margins, marginal color band as wide as width of eye on anterior two-thirds, then narrowing abruptly to posterolateral angle. Elytra black except yellowish-brown markings as follows: intervals 1-4 vittiform, intervals 5 and 6 with a basal (humeral) and medial elongate macula, intervals 7 and 8 each with a medial elongate macula, interval 10 yellowish brown on basal half; intervals 3-6 with short, elongate, yellow maculae subapically; yellow markings terminate a short distance before piceous apex. Ventral surface as follows. Antennae, maxillae, and palpi light reddish brown. Labium and genae very dark reddish brown. Prosternum very dark reddish brown to piceous. Hypomera yellowish brown. Mesosternum with elevated middle portion light reddish yellow and sides piceous. Metasternum piceous laterally; elevated middle pentagonal area piceous medially, with narrow reddish-brown border. Epipleura yellowish brown. Legs reddish brown except basal four-fifths of profemora piceous. Abdomen reddish brown.

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Head: Moderately coarsely, moderately densely punctate; punctures on frons separated by one-half to 1 times their diameter; surface between punctures smooth. Clypeus rounded and strongly margined anteriorly (Fig. 2). Mentum with coarse punctures; punctures separated by about 4 to 6 times their diameter (Fig. 2).

Thorax: Pronotum strongly convex; sides and anterolateral angles broadly rounded, posterolateral angles obtusely angulate; narrowly margined laterally; punctate as on head except punctures separated by 1 to 3 times their diameter. Elytron strongly convex; widest slightly before midlength; finely but distinctly margined along entire length; surface with a sutural stria and 9 rows of coarse punctures, lateral rows (5-7) effaced by humeral area; intervals between rows finely and sparsely punctate, punctures separated by 2 to 5 times their diameters; surface between punctures smooth on basal half and becoming strongly microreticulate on apical half; epipleuron extending from base to midlength, moderately declivous. Metathoracic flight wings present. Scutellum narrow and triangular. Elevated middle portion of prosternum pubescent, sides not pubescent (Fig. 3). Prosternum and sides of mesosternum and metasternum microreticulate. Elevated middle portion of mesosternum elongate, pentagonal (Figs. 3 & 4) margined, shiny, finely and sparsely punctate and smooth between punctures. Metasternum (Fig. 4) with elevated middle portion shiny, moderately coarsely and sparsely punctate, punctures on discal area separated by 1 to 4 times their diameters; punctures on microreticulate sides about equal to those on elevated part but sparser. Profemur pubescent on basal two-thirds of ventral (posterior) surface. Mesofemora and metafemora not pubescent but coarsely and sparsely punctate, punctures separated by 1 to 5 times their diameters.

Abdomen: Sterna microreticulate; with sparse, short, fine, golden setae. First sternum with distinct median longitudinal carina as long as sternum. Male genitalia as illustrated (Fig. 6).

Female. — Similar to male externally but lacks the adherence disc present on the maxilla of the male (Fig. 5).

Variations. — Specimens vary slightly in color pattern, e.g., in most specimens, the yellowish-brown humeral macula is about half as large as it is in others. In 16 specimens the humeral macula is distinctly separated from the basolateral yellowish-brown elytral margin by a narrow, black, lineate band; in 7 specimens the black color of the elytra is reduced and the macula is confluent or very nearly confluent with the basolateral yellowish-brown elytral margin. Also, in a few of the specimens with reduced black on the elytra, the yellowish-brown subapical maculae on intervals 3-6 are absent or indistinct. Females are larger (3.0 mm to 3.1 mm) than the males (2.5 mm to 2.7 mm).

Type-data. — Holotype male: MEXICO: Hidalgo, Zacualtipan, Cam. a Ferreria, 11-12 July 1980, A.H. Huacuja; USNM type-number 100112, deposited in the U.S. National Museum of Natural History, Smithsonian Institution. Allotype, same data as holotype, deposited in the Universidad Nacional Autonoma de Mexico. Paratypes: Same locality and collector as holotype, collected on the following dates: 27 May 1979, 1 male, 1 female; 12-14 Oct. 1979, 2 males, 4 females; 14 Oct. 1979, 2 males, 3 females; 8-10 Mar. 1980, 1 female; 20-22 June 1980, 1 male, 1 female; 11 & 12 July 1980, 1 male, 1 female; 11-13 July 1980, 1 female; 12 July 1980, 1 male, 1 female. Paratypes will be deposited in the entomology collections of the Smithsonian Institution (9), the Universidad Autonoma Metropolitana, Xochimilco (4), the Universidad Autonoma de Mexico (4), and in the Museo de Historia Natural de la Ciudad de Mexico, Chapultepec (4).

Etymology. — From scitulus (L.) =pretty, in reference to the attractive color pattern of this species.

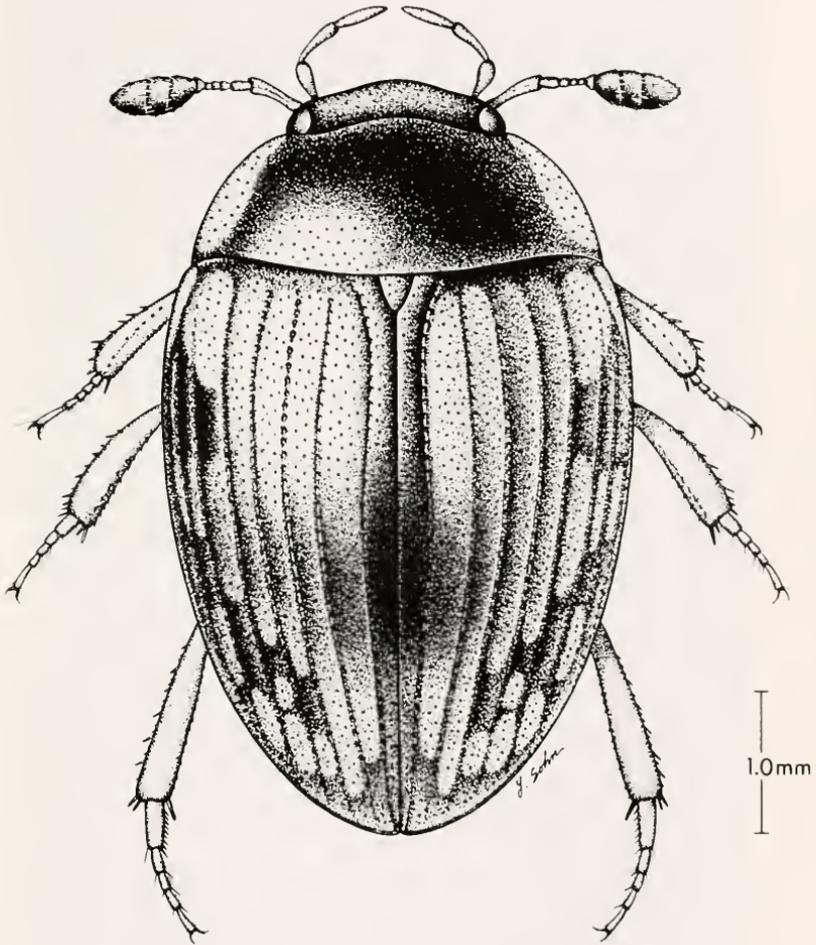
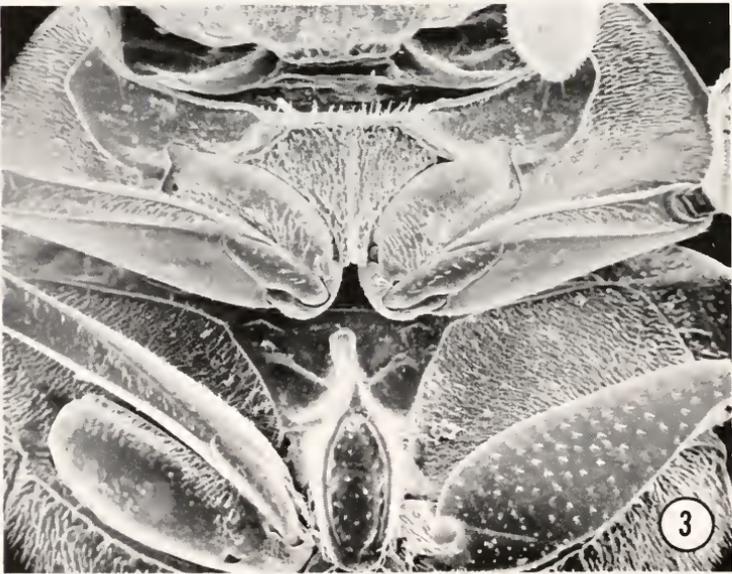
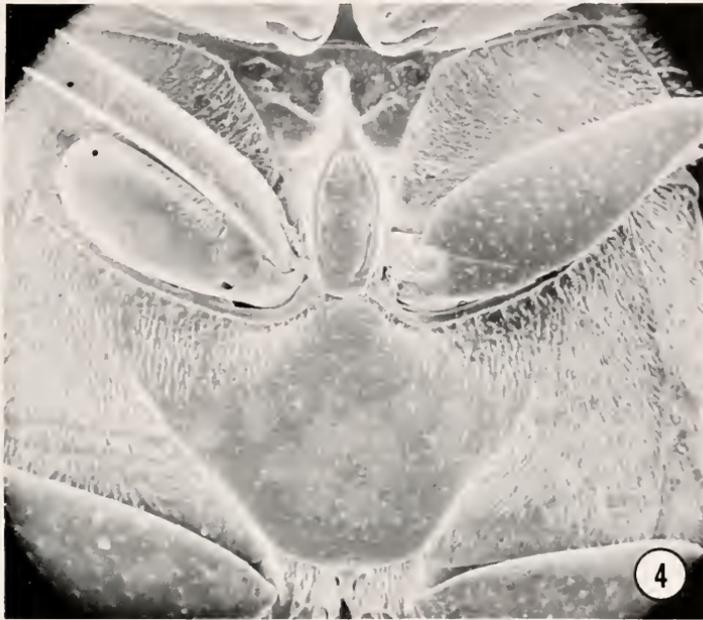


Fig. 1. *Deltostethus scitulus*, n. sp., habitus view.



Figs. 2 & 3. *Deltostethus scitulus*, n. sp.: 2, Clypeus & mentum, 225 times; 3, Prosternum and mesosternum, 85 times.



Figs. 4 & 5. *Deltostethus scitulus*, n. sp.: 4, Mesosternum & metasternum, 85 times; 5, Adherence disc on male maxilla, 550 times.

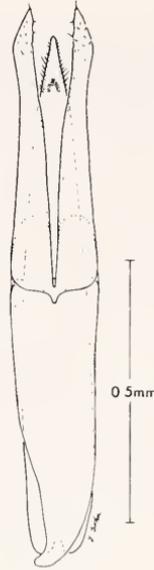


Fig. 6. *Deltostethus scitulus*, n. sp., male genitalia.

Habitat. — All of the specimens were collected in baited pitfall traps in a montane rain forest in the Sierra Madre Oriental at an altitude of 1860 m. The vegetation in the area is composed principally of *Pinus patula* Schlecht. & Cham., *Quercus* spp., *Liquidambar styraciflua* L., and *Alnus jorullensis* HBK with a groundcover of pteridophytes and bryophytes. The baits that attracted the specimens were decomposing chicken viscera, fish, cow and human feces, and banana. The beetles were attracted to the baits during both day and night. Five specimens were collected directly from cow manure deposited 48 hours earlier; these were found under the encrusted surface in the moist manure.

Comparative notes. — This new species of *Deltostethus* may be distinguished easily from *D. palpalis* Sharp and *D. sulcatus* Sharp, the only other species described for the genus, by the following character states: (1) Mesosternum elongate, pentagonal, half as wide as long; (2) metasternal disc sparsely and moderately coarsely punctate; (3) color black with yellow-brown markings and intervals 1-4 vittiform.

The following key will separate the three known species of *Deltostethus*.

1. Elevated part of mesosternum elongate, pentagonal, twice as long as wide; metasternal disc with moderately coarse, sparse punctures; elytral intervals 1-4 vittiform; Mexico
..... *scitulus*, n. sp.

Elevated part of mesosternal disc as long as wide, pentagonal or practically round; metasternal disc with coarse, dense punctures; elytra uniformly reddish-yellow, uniformly black, or black with transverse fascia of minute yellow marks behind the middle. 2

2. Elevated part of mesosternal disc pentagonal, laterally angulate; dorsum uniformly reddish-yellow to black with transverse fascia of minute yellow marks behind the middle; Guatemala & Panama. *sulcatus* Sharp

Elevated part of mesosternal disc practically round; laterally not distinctly angulate; dorsum uniformly black; Panama. *palpalis* Sharp

ACKNOWLEDGMENTS

We are indebted to Mr. Young Sohn, Smithsonian Institution biological illustrator, for preparing the pen and ink line drawings of this new species, to Ms. Mary-Jacque Mann, Smithsonian Institution scanning electron microscopist, for the micrographs, and Mrs. Phyllis Spangler for typing the manuscript.

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BARRIERS INCREASE EFFICIENCY OF PITFALL TRAPS^{2,3}

Thomas J. Durkis⁴, R. Marcel Reeves⁵

ABSTRACT: The efficiency of a newly designed barrier-pitfall trap was investigated. The trap is inexpensive and easily constructed and consists of two plastic collecting containers buried at ground level and connected by a clear plastic barrier. Addition of a barrier increased numbers of surface dwelling arthropods caught compared to traps without barriers. Nearly two times as many ground beetles and other insects were caught with each two foot increment in barrier length. The trap is suitable for collecting live specimens or may be used with killing - preserving agents.

Ground beetles (Family Carabidae) are primarily nocturnal, carnivorous insects that live on or near the ground. Their secretive habits make daytime searching and collecting activities tedious and inefficient. Of the various trapping devices available, pitfall traps are most commonly used and are superior to all other methods (Thiele 1977).

The effectiveness of pitfall traps as qualitative sampling tools have been shown by Orbtel (1971) who found that increased numbers of pitfall traps resulted in an increased number of species caught. Pitfall traps have also been useful for gathering life history and distributional information (Mitchell 1963, Rivard 1964, Leech 1966, Barlow 1970, Goulet 1974 and Larochelle 1975). Thiele (1977) summarized pitfall trap investigations in central Europe and concluded that only active carabids are likely to be caught; Thomas and Sleeper (1977) came to the same conclusion for the family Tenebrionidae.

Both Mitchell (1963) and Greenslade (1964) found pitfall traps of little value as quantitative sampling devices for either estimating populations or making community comparisons. Greenslade (1964) even concluded that pitfall trapping could not be used for quantitatively assessing the carabid beetle fauna of any habitat. Southwood (1966) expanded on Greenslade's criticisms of pitfall trapping of carabid beetles by including all other animals as well. However, Banerjee (1970), working with millipedes, found that the number trapped could be used to estimate population densities. Uetz and Unzicker (1976) working with wandering spiders compared pitfall traps to

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quadrat sampling and found pitfall traps more useful in species diversity studies. They proposed several conditions for limiting the use of pitfall trapping in ecological research.

Various investigators have designed or modified pitfall traps for their own specific needs. Fichter (1941) designed an elaborate pitfall trap to help eliminate rain water. Williams (1958), Houston (1971), and Holthaus and Riechert (1973) all experimented with various timing and mechanical sorting devices. Wojcik et al. (1972) and Morrill (1975) concentrated their efforts on developing quick and inexpensive plastic pitfall traps. Cutler, et al. (1975) and Uetz and Unzicker (1976) found aprons increased the catch of spiders in pitfalls and Housewart, et al. (1979) adapted the apron to a large capacity pitfall trap. Thiele (1977) discussed several preservatives and attractants that can be used with pitfall traps, while Thomas and Sleeper (1977) note several precautions which may help to avoid non-random effects. Trap modifications which attempt to direct or guide organisms to the pitfall trap were studied by Smith (1976) who used several "drift fence" designs around single gallon sized cans. He increased beetle catches up to 3.2 times for certain designs. The "barrier-pitfall" trap (Reeves 1980) used in this study is similar to Smith's but has pitfalls at each end of a "barrier" rather than a single pitfall at the center of a "drift fence".

Traps used in this study were developed after several years of experimentation and improvement (Reeves 1980). The barrier-pitfall traps consisted of 2 pitfalls connected by varying lengths of 6 inch (15 cm) high plexiglass®. Tested lengths were 1 foot (30.5cm), 3 feet (91.5cm) and 5 feet (152.5cm). Each pitfall consisted of 3 plastic cups (Reeves 1980). The larger outer cup had small holes in the bottom for rainwater drainage.

This experiment was conducted in a mixed hardwood stand located in Stafford County, Lee, New Hampshire. Northern red oak, *Quercus rubra* L., red maple, *Acer rubrum* L., sugar maple, *Acer saccharum* Marsh. and shagbark hickory, *Carya ovata* (Mill.) K. Koch comprised most hardwood species present. Small amounts of eastern white pine, *Pinus strobus* L. and eastern hemlock, *Tsuga canadensis* (L.) Carr. were scattered through the hardwood mixture. The area was bordered on three sides by fields, one planted to corn.

Ten rows with 6 barrier-pitfall traps each were established in the spring of 1974; five rows on April 30 and the remainder in early June. Rows were approximately 50 feet (15 m) apart with traps in each row spaced about 25 feet (7.5 m) apart. Local ground conditions (roots, rocks, etc.) did not permit precise distances between all trap units or the alignment of all barriers in the same direction. Each row contained 6 different trap designs; 2 traps with the cups 1 foot apart; 2 traps with the cups 3 feet apart; and 2 traps with the cups 5 feet apart. One trap of each spacing was supplied with a barrier, while the other was without a barrier. Locations within a row were chosen randomly.

Traps were emptied twice a week on Tuesday and Thursday from 2

May through 13 August 1974. Contents of the traps were recorded in the field and their live animals released within 10 feet (3.3 m) of the trap in which they were caught. To minimize bias due to trap location, traps with and without barriers were rotated within the same spacing length in each row following the July 9 collections. A total of 30 collections were made, 20 in period one (2 May through 9 July) and 10 in period two (11 July through 13 August) (Fig. 1). Increased trap disturbance by raccoons in early August caused discontinuation of the study after 13 August. Where one or more traps were disturbed in a row the data from that row were discarded.

Traps with and without barriers caught about the same number (201 viz. 193) of ground beetles during the first period at the 1 foot spacing. However, during period two, traps with barriers caught 1.8 times as many beetles as traps without barriers (Fig. 1). Traps with a 3 foot spacing caught 2.0 and 2.5 times as many beetles during periods one and two respectively

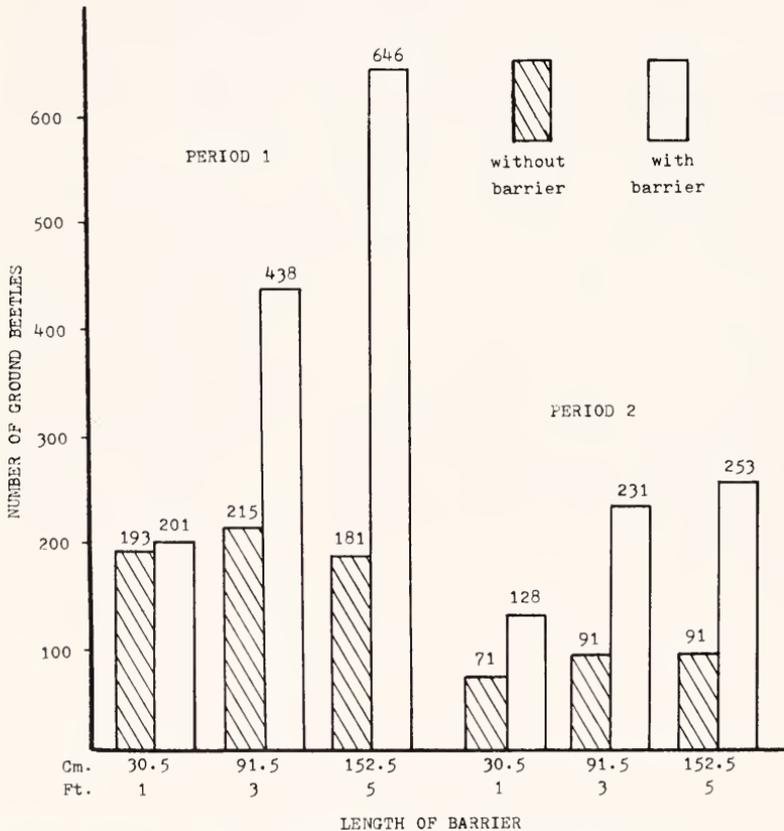


Figure 1. Number of adult carabid beetles caught in traps with and without barriers for period 1 (2 May through 9 July) and period 2 (11 July through 13 August).

as traps without barriers. At the 5 foot spacings, these ratios increased to 3.6 for period one and 2.8 for period two.

Comparison of catches within each period shows that traps without barriers caught nearly the same number of beetles regardless of the distance between the pitfalls. As barrier length increased, traps with barriers caught more beetles. Thus, 3 foot barrier traps caught 2.2 times as many carabids as 1 foot long barrier traps. Five foot barrier traps caught 1.5 times as many beetles as 3 foot barrier traps and 3.2 times as many as traps with 1 foot barriers. These same comparisons for period 2 are 1.8, 1.1 and 2.0 respectively.

The strength of association determined by Chi-Square (X^2) was 91.97 for period one ($P \leq 0.001$) and 8.85 for period two ($P \leq 0.100$). The reduced significance for period two is probably the result of only half as many observations due to predator disturbance. Rotation of the barriers is not considered a factor. Although reduced observations may have affected statistical significance, percentages of total beetles caught in traps with barriers remained nearly the same: 69% for period one and 71% for period two.

Our results compare favorably with those of Smith (1976), although features differed, such as duration of the trapping period, number of pitfalls/trap, length and numbers of barriers and trap orientation. Smith's cross trap caught 11.3 times as many insects as an unfenced trap and approximately 4 times as much as a single V-shaped trap. We conclude that the addition of a fence or barrier significantly increases the catch of ground-dwelling insects.

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IDENTITY OF *ABLABESMYIA* SP., ROBACK, BEREZA AND VIDRINE (1980) (DIPTERA: CHIRONOMIDAE)¹

Selwyn S. Roback²

ABSTRACT: *Ablabesmyia* sp., Roback, Bereza and Vidrine (1980), has been reared and has proven to be *Ablabesmyia janta* (Roback). Additional measurements and descriptive notes on the pupa, the adult ♂ and ♀ are given.

Through the efforts of Mr. M. LaSalle, D. Clark and M. Vidrine, the species described as *Ablabesmyia* sp. in Roback, Bereza and Vidrine (1980) was successfully reared from the mollusc *Quadrula pustulosa* gr. sp., collected in Village Creek, TX. One ♂ and one ♀ complete larval-pupal-adult (LPA) association were made and one ♂ was recovered from the rearing tank but the immature stages could not be found. The ♂♂ when determined proved to be *Ablabesmyia* (*A.*) *janta* Roback.

Two additional ♂♂ were taken by sweeping the vegetation along Village Creek (Vidrine and LaSalle); one ♂ was reared by the author from a pupa collected in Hollow Creek, SC and two ♂♂ were collected from Keowee Reservoir, SC by Mr. Patrick Hudson (SE Reservoir Inv., Dept. of Int.).

I am additionally indebted to Dr. W.W. Wirth [USNM] for the loan of the holotype ♂ of *A. janta* and Dr. R. Wenzel [CHN] for the loan of the Georgia ♂. These were compared with the Texas and South Carolina specimens. This work was supported, in part by research funds of the Division of Limnology and Ecology of the Academy of Natural Sciences of Philadelphia.

These additional specimens make possible the amplification of the adult ♂ description in Roback (1971), the pupal description in Roback, Bereza and Vidrine (1980) and to give some notes on the ♀. For the \bar{x} of the ♂ genital measurements $n=9$ and for the \bar{x} of the pupal measurements $n=6$, unless otherwise indicated.

The adult terminology follows Roback (1971) and that for the pupa, Fittkau (1962) and Roback (1981). Unless otherwise indicated all specimens are in the collections of the Academy of Natural Sciences of Philadelphia.

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Ablabesmyia (Ablabesmyia) janta Roback)*Pentaneura (A.) janta* Roback 1959:120*Ablabesmyia* sp. Roback, Bereza and Vidrine 1980:580-583

ADULTS-Male. Antennal ratio 1.90-2.20; LR I 0.80-0.82; LR II 0.86-0.89; LR III 0.90-0.96; MB, Ti I 0.50-0.053 sub-basal to apical bands; L/W 2.50-3.33; 0.30-0.36 length of basal clear band; MB, Ti II 0.50 sub-basal to apical; L/W 3.23-3.97; 0.40-0.50 length of basal clear band; MB, Ti III 0.50 sub-basal to apical; L/W 4.19-5.16; 0.46-0.64 length of basal clear band.

Basistyle as in Fig. 9, 163-204 μ long (\bar{x} 186.2); dististyle 174-222 μ (\bar{x} 197.8); B/D 0.91 9.99 (\bar{x} 0.943); aedeagal complex variations as in Figs. 1-4; elements of complex, fully flattened, Figs. 5, 6; blade (Fig. 5) 44-66 μ (\bar{x} 52.1); dorsal lobe (Fig. 5) 25-37 μ (\bar{x} 34.0); lateral lobe (Fig. 6) 67-101 μ (\bar{x} 79.7); blade/lateral lobe 0.59-0.70 (\bar{x} 0.656).

Female. Antenna with 11 flagellomeres; last four in ratio 44:44:44:130; wing 1.74 mm; dark pattern broad and spots confluent; LR I 0.84; LR III 0.90; MB, Ti I 0.49 sub-basal to apical; L/W 3.33; 0.50 length of basal clear band; MB, Ti II 0.48 sub-basal to apical; L/W 3.87; 0.67 length of basal clear band; MB, Ti III 0.49 sub-basal to apical; L/W 3.87; 0.63 length of basal clear band; spermathecae (3) almost globular (Fig. 13) 85 μ diameter; apex clear.

PUPA-the following additional measurements include those given in Roback, Bereza and Vidrine (1980). Respiratory organ (Fig. 7) length 420-500 μ (\bar{x} 441.7); medium to dark brown in color; reticulate pattern (Fig. 8) visible but not strong; variation in apical tubercle and apex of aeropyle tube as in Figs. 10-12; LS₁ A VII 0.40-0.50 from base (\bar{x} 0.455); LS₁ VIII 0.27-0.38 from base (\bar{x} 0.320); anal fins 451-528 μ long (\bar{x} 473.5); LS filaments of anal fins (mid-point of pair) 0.49-0.57 from base (\bar{x} 0.545); σ genital sacs 0.74-0.81 anal fin length (\bar{x} 0.775, n=4); ρ 0.41-0.45 (2).



Figures 1-6. Aedeagal complex. Fig. 1-holotype, MD; Fig. 2-Albany, GA; Fig. 3-Keowee Reservoir, SC; Fig. 4-Village Creek, TX; Fig. 5-dorsal lobe and blade (fully flattened), Village Creek, TX; Fig. 6-lateral lobe (fully flattened), Village Creek, TX.

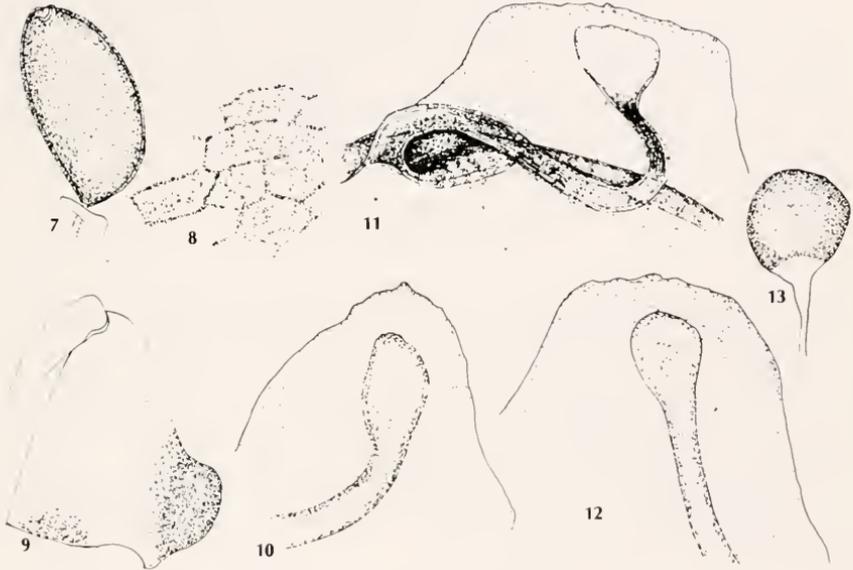
Specimens examined-

Maryland- Plummers Island, ♂ A, 23-V-14 (Shannon) [USMM], Holotype

South Carolina- Hollow Creek nr. Jackson, 3-VI-68, ♂ PA

- Keowee Reservoir, Seneca, Oconee Co. 7-V-75 (Hudson) ♂ PA; June 18-22 (Hudson) ♂ A

Georgia- Chehaw St. Park 2 mi E. Albany ♂A, 29-30-VIII-49 [CHN]

Texas- Village Creek at Rt. 96, S. of Silsbee, Hardin Co. 2 ♂A 13-IV-79 (Vidrine and LaSalle) sweeping vegetation; 1 ♂ 1 ♀ LPA, reared from *Quadrula pustulosa* gr. var. em. 15-VIII-80 Clark, LaSalle, Vidrine); 1 ♂ emerged from tank containing *Q. pustulosa* gr. var. 22-VIII-80, larva and pupa not recovered.

Figures 7-13. Fig. 7-pupal respiratory organ; Fig. 8-reticulate pattern of respiratory organ; Fig. 9-basistyle; Figs. 10-12-detail of apical tubercle of pupal respiratory organ. Fig. 10-Village Creek, TX; Fig. 11-Keowee Reservoir, SC; Fig. 12-Hollow Creek, SC; Fig. 13-female spermatheca.

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NEW SPECIES OF *GYPONANA* (HOMOPTERA: CICADELLIDAE) FROM PANAMA AND MEXICO¹

Dwight M. DeLong², Henk Wolda³

ABSTRACT: Four species of *Gyponana*: *G. fortuna* n. sp., *G. boquetea* n. sp., and *G. chiriquea* n. sp., all from Panama and *G. impeta* n. sp. from Mexico, are described and illustrated. All species are placed in the subgenus *Gyponana*.

The genus *Gyponana* was described by Ball (1920) as a subgenus of *Gypona*. The genus *Gyponana* was treated by DeLong (1942) and reviewed by DeLong and Freytag (1964). A corrective note on *Gyponana decorata* Fowler was published by Freytag and DeLong (1968). Four new species are described at this time. All types are in the DeLong collection, the Ohio State University. All species are placed in the subgenus *Gyponana*.

Gyponana fortuna n. sp.

(Figs. 1-5)

Length of male 12 mm, female 15 mm. Crown broadly rounded, almost half as long at middle as wide at base between eyes. Ocelli much closer to median line than to eyes. Color, very pale green, almost white, ocelli red.

Female 7th sternum with posterior margin broadly rounded, each side, to form a median notch about half length of segment.

Male genital plates almost 5 times as long as wide at middle, apices narrowed, rounded. Style broadened apically, apex triangular, with angled portion extending dorsally. Aedeagal shaft thin laterally, apex in lateral view broadened. Pygofer angled apically.

Holotype male, Panama, Chiriqui Fortuna, 1050 m, II-30-1976, H. Wolda coll.

G. fortuna is closely related to *G. germari* Stal and can be separated by the absence of apical aedeagal spines.

Gyponana boquetea n. sp.

(Figs. 6-10)

Length of male 12 mm, female 13 mm. Crown broadly, blunted angled, 2/3 as long at middle as wide at base between eyes. Margin slightly angled half way between each eye and apex. Ocelli nearer to median line than to eyes. Color green, basal angles of scutellum and veins of forewing darker green.

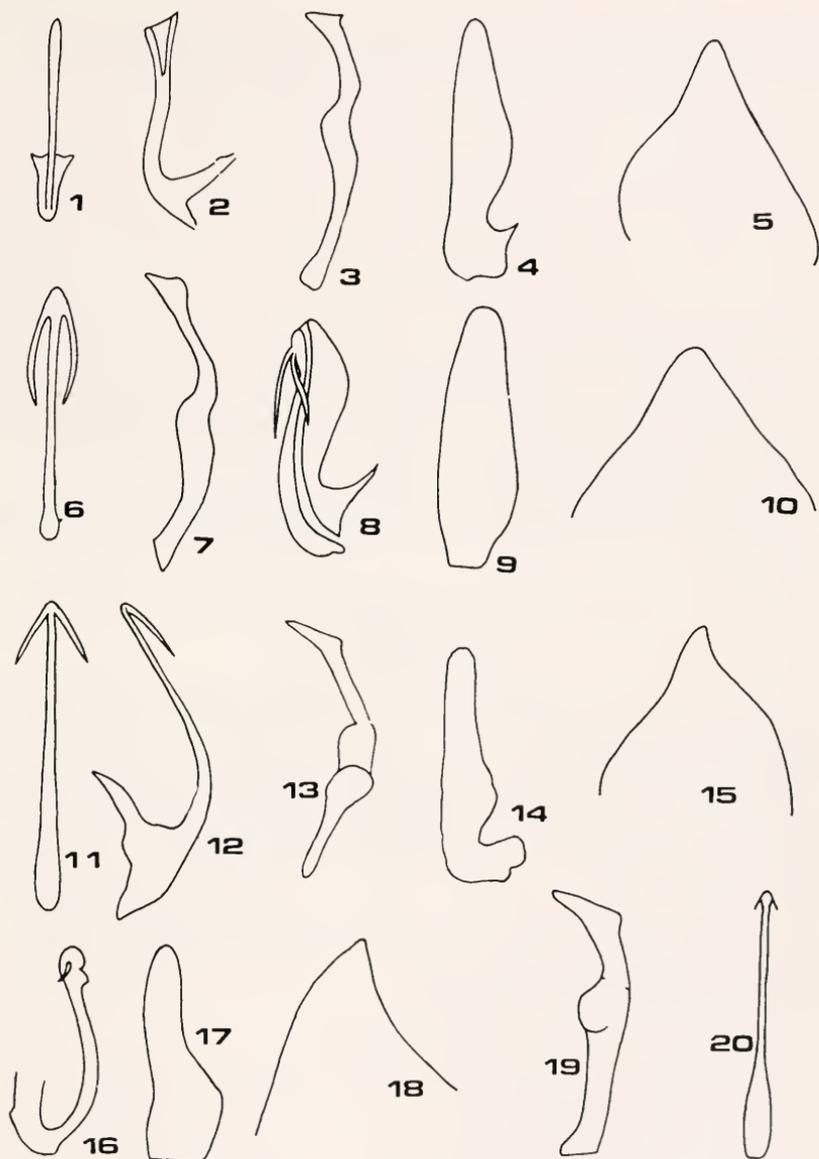
Female 7th sternum with posterior margin convexly rounded, each side of middle, to form a broad V-shaped notch almost 1/2 distance to base.

Male genital plates almost 3 times as long as wide at middle, apices rounded. Style with

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Figures 1-5 *Gyponana fortuna* n. sp. 1. aedeagus ventrally, 2. aedeagus laterally, 3. style laterally, 4. plate ventrally, 5. pygofer laterally, apical portion. Figs. 6-10 *G. boquetea* n. sp. 6. aedeagus ventrally, 7. style laterally, 8. aedeagus laterally, 9. plate ventrally, 10. pygofer laterally, apical portion. Figs. 11-15 *G. chiriquea* n. sp. 1. aedeagus ventrally, 12. aedeagus laterally, 13. style laterally, 14. plate ventrally, 15. pygofer laterally, apical portion. Figs. 16-20 *G. impeta* n. sp. 16. aedeagus laterally, 17. plate ventrally, 18. pygofer laterally, apical portion, 19. style laterally, 20. aedeagus ventrally.

apex truncate, broadened, triangular in shape, with apex extending dorsally. Aedeagal shaft thin laterally, broad dorsoventrally, bearing 2 apical processes which extend basad more than 1/3 distance to base. Pygofer bluntly angled apically.

Holotype male, Panama, Chiriqui Boquete IX-21-1967. Paratype female same data except IX-20-1967.

G. boquetea is related to *G. germari* Stal but the aedeagai shaft is broadened laterally and the aedeagal apical processes are shorter.

Gyponana chiriquea n. sp.

(Figs. 11-15)

Length of male 9 mm, female unknown. Crown produced and rounded, 3/5 as long at middle as wide at base between eyes. Ocelli nearer to median line than to eyes. Color greenish yellow. Forewings whitish subhyaline, veins greenish yellow.

Male genital plates 3 times as long as wide at middle, apex narrow, rounded. Style broadened apically, forming an angle, with the apex extending dorsally and bluntly pointed. Aedeagal shaft elongate, slender, bearing 2 apical processes which extend laterobasally about 1/4 length of shaft. Pygofer bluntly pointed apically.

Holotype male, Panama, Chiriqui Boquete 1250 m, XII-5-1975, H. Wolda coll.

G. chiriquea is related to *G. fructa* DeLong & Freytag and can be separated from it by the more narrowed and elongate apical portion of the style.

Gyponana impeta n. sp.

(Figs. 16-20)

Length of male 9.5 mm, female unknown. Crown angularly produced, apex rounded, 4/5 as long at middle as basal width between eyes. Color yellowish green. Forewings pale green subhyaline, veins greenish yellow.

Male genital plates 3 & 1/2 times as long as wide at middle, apices narrowed, rounded. Style with apex of blade foot-like with angled ventral "heel", and rounded "toe" extending dorsally. Aedeagal shaft slender with apex slightly enlarged, and with a pair of minute subapical spines extending basally. Pygofer narrow and pointed at apex.

Holotype male, Mexico City, Mexico, C.C. Plummer coll. Paratype male same data as holotype.

G. impeta is related to *G. sincera* DeLong and Freytag and can be separated from it by the longer more slender aedeagal shaft and the shorter, very tiny, aedeagal apical processes.

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BIOLOGY AND LIFE HISTORY OF THE RICE FIELD PREDATOR *ANDRALLUS SPINIDENS* F. (HEMIPTERA: PENTATOMIDAE)¹

Gary V. Manley²

ABSTRACT: The pentatomid bug, *Andrallus spinidens* (F.), is a non-specific predator on Lepidoptera larvae in rice fields of West Malaysia. Large populations of *A. spinidens* were observed associated with outbreaks of *Melanitis leda* (Satyridae). Field and laboratory studies on the biology and behavior of *A. spinidens* were conducted to clarify its role in suppressing lepidopteran populations. Development from egg to adult averaged 26 days.

During investigations of arthropod predators in rice fields of West Malaysia, the asopine pentatomid *Andrallus spinidens* (F.) was observed to be a non-specific predator on lepidopteran larvae. Further studies indicated that *Andrallus* was a potentially useful biological control agent in rice fields. Laboratory studies were conducted for the purpose of gaining information on life history, behavior, and ecology of the species. Specimens were collected from rice fields in Province Wellesley and Kedah, West Malaysia.

A review of the literature, distribution, and recorded hosts of *Andrallus spinidens* can be found in a paper by Kajendra (1971).

Methods and Materials

Studies were conducted on both field-collected and laboratory-reared specimens. For instar development studies, female pentatomids were placed in individual petri dishes for egg collection. After eggs were laid the females were separated from the eggs.

Adults and nymphs were fed grain moth larvae and larvae of various lepidopteran species collected from the rice fields. Living larvae were given to each pentatomid daily.

First instar nymphs were given damp cotton and left in the container with the eggs until they molted. After molting they were moved to individual dishes and reared to adults. Stock cultures were maintained in cages 3 x 3 feet in the laboratory in order to have specimens at various developmental stages for behavioral and ecological studies.

Lepidoptera larval weights were determined by weighing the live larvae

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immediately before introducing them to the pentatomid predator. Larvae were weighed again immediately after feeding stopped. The difference between the first weight before feeding and the second weight after feeding was assumed to be what the pentatomid removed during its feeding.

Biology

In rearing cages, eggs were laid randomly both on dead and living leaves, as well as on the sides of the cages. There appeared to be no preference for oviposition sites, but the shape of the mass varied, depending upon the substrate. Egg masses attached to the sides of the cages or laid in petri dishes were normally irregular or elongate. Eggs laid on the leaves of rice plants were laid in two rows ranging from 2 to 5 cms. long. Regardless of the shape of the mass, eggs were glued at the base to the substrate and to each other along the sides. On living plants the upper surface of the leaf more frequently contained eggs than other parts of the plant.

The number of eggs per mass ranged from 7 to 96 with an average of 50 for 20 masses. Rajendra (1971) in India found an average of 54.47 eggs per mass.

Females were observed to mate repeatedly, but this does not appear to be necessary since females kept in isolation after a single mating laid more than one batch of eggs which hatched normally. Duration of the egg stage was 7 days (Table 1). When laid, the eggs are creamy white. After being exposed to the air they become dark silver gray. It was noted that eggs laid directly on wet filter paper remained white and did not turn dark if the filter paper was kept wet. As the eggs were nearly ready to hatch they became increasingly reddish.

Nymphal development averaged 19.0 days. The last instar required the longest development period (5.4 days); the first instar was the shortest, lasting 2.6 days. The middle instars were about equal in length (Table 1).

The first instar nymphs were gregarious, tending to congregate on the eggs. Oetting (1971) indicates the young nymphs of *Podisus placidus* Uhler feed on the unhatched eggs. In the case of observed egg masses of *Andrallus spinidens* nearly all the eggs hatched. Other than perhaps feeding on the eggs, no feeding was observed during the first instar, but water was taken readily from damp cotton.

Second to fifth instar nymphs were fed on a variety of lepidopteran larvae collected from the rice fields. After molting, second to fifth instar nymphs fed almost continually until a few hours before the next molt, when they would not feed again until the new cuticle had hardened. As soon as the new cuticle had hardened, nymphs became aggressive predators, attacking almost any size larvae.

In a population of mixed ages, younger nymphs often would scavenge

on large larvae killed by older nymphs. Sometimes all stages of nymphs were found feeding together. Frequently the younger nymphs were observed feeding on larvae abandoned by older nymphs or adults. Both hunting and feeding may take place as a group.

The gregarious behavior of the younger instars appeared to play an important part in feeding. On several occasions I observed that 1 or 2 younger instar pentatomid nymphs were unable to subdue a larvae, but with the help of the entire group they were able to attack and kill even the very large larvae. The capture of larger larvae by young nymphs was accomplished by repeated attacks of many bugs. This gregarious behavior is most strongly expressed in the first 2 instars and to a lesser degree in instar 3. Instars 4 and 5 are mostly solitary, with the solitary behavior most strongly expressed in 5th. instar nymphs which were observed to be slightly cannibalistic if starved and confined to containers. The cannibalistic behavior was not observed in the larger cages.

Andrallus spinidens was a persistent predator. When a pentatomid nymph came in contact with a larva too big to subdue immediately, it would repeatedly follow and attack. Frequency of repeated attacks depended on the demeanor of the predator and aggressiveness of the larvae in repelling the attack. On some occasions nymphs followed a large larva for nearly a day.

Oetting (1971) suggests that pentatomids use a poison to kill their prey. My observations indicate that such a substance may be utilized. The time required for a pentatomid to kill a larva varied greatly; normally 1-4 minutes were required once a successful attack had been made. Larvae which were successful in escaping early attacks from predators were, however, greatly weakened and usually were unable to resist later attacks. Larvae which were able to escape the first few attacks would show a general weakening over time, loss of coordination, and shaking.

The observed method of attack is similar to that described by Oetting (1971) for *Podisus placidus*. The prey was approached with the labium extended and the antennae vibrating rapidly. The only contact made with the prey was with the labium and stylets. Upon insertion of the stylets the prey would start to thrash about and frequently try to bite the pentatomid. Frequently the pentatomid would use the pronotum to avoid being bitten. Orienting the pronotum toward the head of the larva proved to be a successful method of defense. This method was often successfully used to protect the forelegs.

Observations of behavior indicate that the pentatomid uses some kind of mechanism of communication. The finding of a caterpillar attracted nearby pentatomid nymphs. In rearing cages many nymphs and adults repeatedly fed on a single prey and within a few minutes of an attack all pentatomids in the cage were seen feeding or rapidly moving about looking

for food.

When a normally solitary fifth instar pentatomid began to feed, it rapidly attracted other nymphs. When one fifth instar nymph was placed on each of five rice plants, arranged in such a way that only one or two leaves were touching and providing a bridge for the nymphs to cross from one plant to the next, it was found that during hunting only occasional contact was made between bugs. Only one or two of the insects would be hunting at any given time while the others were inactive. The introduction of a lepidopteran larva made little difference except when it came close enough to disturb a nymph, then that predator would pursue it. Once a larva was attacked, however, all other pentatomids were affected. The other four nymphs would become active and start to hunt for the point of attack. Hunting did not appear random but directed at trying to reach the area of predation. As the hunting nymphs moved from plant to plant and got closer, their intensity of search appeared to increase. The distance the nymph was away from the killed larva appeared to have an effect on both the required time for it to respond to the kill and its persistence in reaching the prey.

When the maximum number of prey which could be consumed by fifth instar nymphs during a twelve hour day was figured based on feeding time per gram wet weight in the laboratory, it was found that many more small larvae could be consumed during the day than larger ones. Eighteen larvae weighing 0.01 grams could be consumed but only eight larvae weighing 0.05 grams. As larvae became larger than 0.09 - 1.0 grams the increase in larval weight made little difference in the number eaten per day.

Number of larvae eaten per day for each predator was unaffected by the feeding capacity of the pentatomid. Eighteen larvae with a wet weight of 0.01 grams per individual would total 0.18 grams, far below the feeding capacity of the fifth instar nymphs, some of which killed larvae weighing a total 0.40 grams wet weight and consumed 0.18 grams of body fluids in eight hours. Sixty to eighty percent of the wet weight was usually consumed.

Fifth instar nymphs were able to feed continually for several hours. The average weight for 18 fifth instar nymphs was 0.06 grams. They were observed to eat as much as 0.18 grams during eight hours of continual feeding, equal to 3.1 times their average body weight. They killed as much as 7 times their own body weight during the same time. Many were still feeding at the end of eight hours.

Role as Predator

Andrallus spinidens was abundant in rice fields only when associated with out breaks of lepidopteran larvae such as *Melanitis leda*. During periods when non-stem borer lepidopteran larvae were scarce, few specimens

of *A. spinidens* were observed.

There are 3 factors which should favor *Andrallus spinidens* as a predator of rice pests: 1) relatively short life cycle, 2) aggressive feeding behavior, and 3) ability to feed continually for several hours. There are also 3 behavioral characteristics which contribute to survival of the younger instars: 1) gregarious hunting and feeding, 2) mixed-aged groups feeding together, allowing the young instars to feed on the prey of larger nymphs, and 3) the apparent attraction of nymphs to a fresh kill by other nymphs. The attraction phenomenon would be a particular advantage in low-density situations, clumped populations of prey, and localized prey increases.

The number of larvae eaten per day for an individual predator is determined by larval size and hunting time required by the predator. As the size of the larvae increases, hunting time is less important since the actual time spent feeding is so large, but with smaller larvae the number of larvae eaten will depend on the amount of time taken to find the various prey.

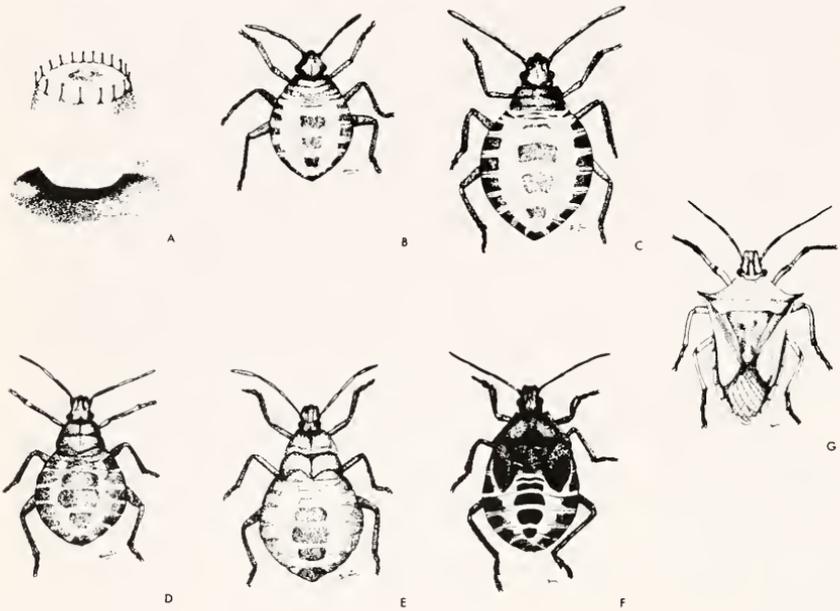
With second and, to some degree, third instar nymphs the number of larvae eaten will also depend on capture ability. When larvae are maximum size that can be overpowered, significant time may be spent in killing the larva. Laboratory observations indicated that under some circumstances capture time could amount to hours.

It is possible that the attraction phenomenon may also have some limiting effects in terms of number of larvae eaten. Under conditions where the nymphs are widely dispersed, the movement of the nymphs to one spot would reduce total hunting time and area searched. It was observed, however, that if a pentatomid nymph is moving to a prey and comes across an undetected larva in the process, it will attack the living larva and not go to the killed larva.

Observations of field populations along with laboratory studies indicate that *Andrallus spinidens* may be of limited importance under low host density. Its major usefulness is likely in connection with outbreak or moderate to high density conditions, where its short life cycle time and continuous feeding ability should operate to make it a useful control agent.

Table 1. Development (days) of eggs and nymphs of *Andrallus spinidens*.

Stage	Number	Range	Mean	Cumulative Mean age
Eggs	20	7	7	7.0
Nymphal				
First	20	2-3	2.6	9.6
Second	20	4	4	13.6
Third	20	3-4	3.4	17.0
Fourth	19	3-5	3.6	20.6
Fifth	17	4-8	5.4	26.0



Figs. A-G. *Andrallus spindens*. A, Lateral view of egg; B, first instar; C, second instar; D, third instar; E, fourth instar; F, fifth instar; G, adult.

ACKNOWLEDGMENTS

The author wishes to express thanks to Shamsulmajidi bin Abdul majid for the drawings. Thanks are also expressed to Elinar Manley and Julia Kintzley for help in rearing specimens and data collection.

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AIR SACS IN ANTS (HYMENOPTERA: FORMICIDAE)¹

George C. Wheeler, Jeanette Wheeler²

ABSTRACT: The air sacs in the gaster of *Veromessor lariversi* are described and illustrated. They appear as white spots in the living ant.

During our recent study of the ants of Nevada we brought some living workers of *Veromessor lariversi* M.R. Smith into the laboratory for observation. There we were greatly surprised to see 2 large white spots on the gaster. See Figure 1. We had not noticed spots on workers of this species in the field and there were no spots on any of our preserved workers. The mystery was not solved until we preserved some of the spotted workers in a vial of alcohol. When the stopper was inserted the spots shrank. When the stopper was removed, i.e., pressure released, the spots returned to their original diameter. A trachea could be seen attached to the



Figure 1. Left: dorsal view of a living worker showing the two air-sacs through the transparent gastric integument, X10; spots retouched slightly to show true color. Right: Anterodorsolateral view of air-sacs in place, X100.

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posterodorsal surface of each sac. So we concluded that they must be air sacs.

Having spent most of our academic lives studying the *outsides* of ants, we had almost forgotten that ants also have *insides*. So we began checking the literature for clues to possible tracheal sacs. In books on myrmecology, air sacs are not mentioned. Textbooks on entomology describe and figure air sacs of flying insects. Finally we consulted the publications of that old master of ant anatomy, Charles Janet. It did not take long to find a reference on the gaster of *Myrmica rubra*.

“Just as the esophagus, which, upon reaching the gaster, swells into a spacious crop, so do the two tracheal trunks, at the same level, swell into two spacious respiratory sacs, with very flexible walls, plainly visible because of the transparency in those ants which have a light-colored integument. Under the influence of dilatation and constriction of the chitinous integument of the gaster . . . these sacs swell and then empty, just as our lungs fill under the influence of the movement of our thoracic cage.” (Janet 1902: 30, translated from the French.)

Janet shows these sacs in Pl. II, but they are much smaller and more irregularly shaped than the huge smoothly oval sacs of *V. lariversi*. See Figure 1 (right).

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CONCENTRATIONS OF MUTILLID WASPS (HYMENOPTERA: MUTILLIDAE)¹

William L. Jellison²

About 1936 a considerable number of mutillid wasps were found in a strip in Rocky Mountain bee plant, *Cleome serrulata*, growing along an abandoned irrigation ditch south of Dillon, Beaverland County, Montana. Males were feeding on the flowers and females were active on the ground. About 50 specimens, representing several species, were collected and sent to Dr. Clarence E. Mickel at the University of Minnesota. This apparently represented the largest single collection from Montana up to that time.

In the spring of 1971 the County Agent, Mr. Rob Johnson, at Hamilton, Montana, asked me to examine some insects which had been brought in for identification. The jar contained 10 to 15 live mutillids from a local garden. Inspection of the garden revealed dozens of female wasps on young sunflower plants and on the ground. Many of the wasps were feeding on the sunflower leaves near the petiole. Apparently they were obtaining plant sap or secretions as no damage to the leaves was visible. Many specimens were collected but the infestation continued for days. Only females were present. Inspection of the garden, its grassy border and adjoining lawn did not disclose the source of the insects.

A few weeks later an unusual amount of bee activity was noticed on a vacant lot across the alley from the garden. This lot had been sprayed with herbicide sometime previously and was practically free of vegetation. The surface was clean and packed. The entire lot was swarming with bees and many were excavating nest tunnels. Female mutillids were scurrying over the area and exploring nest tunnels of the bees. Male mutillids were flying over the lot and running on the ground. Mating was frequent but brief. Four to 10 males clustered around a single female. This activity continued for weeks. This high concentration persisted for several summers. We estimated that there were 4,000 to 10,000 mutillids in sight at one time. Many specimens were preserved and series of both bees and wasps were sent to Dr. Mickel; U.S. National Museum; University of Kansas, and California Academy of Sciences.

The bees were identified at the U.S. National Museum as *Melissodes pallidesignata* Cockerell and the mutillids as *Pseudomethoca propinqua* (Cresson). Another bee, *Triepeolus wyomingensis* Cockerell, was fairly abundant in the area and it may be a parasitic species. These identifications

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²504 S. Third St., Hamilton, Montana 59840

were made by Dr. Karl V. Krombein of the Smithsonian Institution. Dr. Mickel concurred in the mutillid identification.

Other records of mutillid abundance are not readily available but Mickel (1928, p. 17) states "During the summer of 1922 nearly 1,200 specimens of mutillids were collected. . .". This was in Minnesota. He also states (p. 39) "Approximately 10,000 specimens have been examined individually during the course of this work . . .".

REFERENCE

Mickel, C.E. 1928. Biological and Taxonomic Investigations on the Mutillid Wasps. United States National Museum Bulletin 143: 351 pages.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

c/o BRITISH MUSEUM (NATURAL HISTORY)
CROMWELL ROAD, LONDON, SW7 5BD

8 December, 1981

A.N.(S.) 120

The Commission hereby gives six months' notice of the possible use of its plenary powers in the following cases, published in *Bull. zool. Nom.* volume 38, part 4, 8 December 1981, and would welcome comments and advice on them from interested zoologists. Correspondence should be addressed to the Secretary at the above address, if possible within six months of the date of publication of this notice.

Case No.

- 2359 *Typus* Sellards, 1909 (Insecta, Protodonata), proposed conservation under plenary powers.
- 2148 *Capsus ater* Jakovlev, 1889 and *Lygaeus quadripunctatus* Fabricius, 1794 (Insecta, Hemiptera, Heteroptera), proposed nomenclatural validation.
- 2317 *Byrrhus semistriatus* Fabricius, 1794 (Insecta, Coleoptera, Byrrhidae), proposed conservation.

ITZN 59

The following Opinions and Directions have been published recently by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature*, volume 38, part 4, 8 December 1981.

Opinion No.

- 1188 (p. 239) *Aphis pyri* Boyer de Fonscolombe, 1841 (Insecta, Hemiptera), conserved.
- 1191 (p. 249) *Berytus consimilis* Horváth, 1855 (Hemiptera, Berytinidae), lectotype designation confirmed.
- 1192 (p. 252) *Lecanium acuminatum* Signoret, 1873, (Insecta, Homoptera, Coccidae), neotype designated.
- 1193 (p. 254) *Ceratophysella* Börner, 1932 (Insecta, Collembola), conserved.

Direction No.

- 109 (p. 276) Seven family-group names in Insecta, Heteroptera, placed on Official List
- 110 (p. 280) *Ixodes* Latreille, 1795 (Arachnida, Acarina), entry in Official List of generic names confirmed.

The Commission regrets that it cannot supply separates of Opinions or Directions.

R.V. MELVILLE
Secretary

CATORHINTHA MENDICA, A GREAT PLAINS COREID NOW ESTABLISHED ON THE ATLANTIC COAST (HEMIPTERA: COREIDAE)¹

E. Richard Hoebeke², A.G. Wheeler, Jr.³

ABSTRACT: *Catorhintha mendica* Stal, a coreid native to the Great Plains, is closely associated with the wild four o'clock, *Mirabilis nyctaginea* (Michx.) MacMill., a prairie plant established in the eastern U.S. via seed carried in railroad cars. *C. mendica* has invaded the East, following its host plant along railroad right-of-ways. Additional records for Michigan, Minnesota, Ohio, Pennsylvania and Wisconsin, and the first record for New York are given; the record for New York (Long Island) documents the spread of *C. mendica* to the Atlantic Coast.

The coreid, *Catorhintha mendica* Stal, is associated with the wild four o'clock, *Mirabilis nyctaginea* (Michx.) MacMill. (Nyctaginaceae) (Balduf 1942, 1957, 1962). In addition, populations of the coreid have also been found developing on *Mirabilis hirsuta* (Pursh) MacMill. at the Cayler Prairie Preserve in Dickinson County, Iowa, in 1977 (S. Kinsman, pers. comm.); this is a new host plant record for *C. mendica*. Both insect and *M. nyctaginea* are indigenous to the Great Plains, neither occurring originally east of western Illinois. In a carefully documented study, Balduf (1957) has shown that the plant moved eastward with rail traffic, its seed transported on freight cars loaded with surplus agricultural products originating in the plant's native range. From his own collecting and from examining museum specimens, Balduf was able to show that *C. mendica* invaded the eastern United States as its food plant became established along railroad right-of-ways. Presumably on its own powers of dispersal, the coreid bug had become established in eastern Illinois, Ohio, and Wisconsin by the 1940's (more recent Wisconsin records are given by Yonke and Medler, 1969). The easternmost locality available to Balduf was Lickdale (Lebanon County), Pennsylvania (about 77° 30' W longitude). Balduf did not give dates, but the Pennsylvania material was collected on 8 July 1942 (8 specimens) and 16 September 1951 (2 specimens) (deposited in the Pennsylvania Department of Agriculture collection, Harrisburg). The most recent eastern record is based on a specimen taken in 1970 near Luray (Page County), Virginia (Hoffman 1975).

An examination of specimens in the U.S. National Museum collection (USNM) shows that *C. mendica* actually had reached Ohio, Wisconsin and Minnesota as early as 1910, much earlier than stated by Balduf. Recent

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collecting shows that *C. mendica* is established along the railroad in different areas of Pennsylvania and that this coreid now has extended its range to the Atlantic coast. The records that follow are based on specimens from the collections of the USNM and the Pennsylvania Department of Agriculture (PDA) and on personal collecting; voucher specimens from our collecting have been deposited in the collections of Cornell University (Ithaca, NY) and the PDA. All known distribution records in the eastern U.S., including those listed below, are mapped in Figure 1.

MICHIGAN: *Ingham County*, East Lansing, Michigan State University campus. 21 July 1981, nymphs and one adult on *M. nyctaginea* in gardens, Daniel K. Young. *Wayne County*, 7 October 1939, Beebe. (USNM).

MINNESOTA: *Big Stone County*, 20 July 1910, H.G. Barber colln. (USNM).

NEW YORK: *Suffolk County*, Rt. 21 south of Yaphank, Long Island, 30 May 1981, nymphs and adults on *M. nyctaginea*, E.R. Hoebeke and A.G. Wheeler, Jr.; same locality, 29 August 1981, nymph and adult on *M. nyctaginea*, T.J. Henry and A.G. Wheeler, Jr.

OHIO: *Mercer County*, Durbin, 24 May 1915, H.G. Barber colln. (USNM).

PENNSYLVANIA: *Erie County*, Erie, 1 August 1969, Clifford Barry coll., ex: light trap (PDA). *Franklin County*, NE Chambersburg, 16 July 1974, B.R. Stinner and A.G. Wheeler, Jr. *Dauphin County*, Hershey, 18 June 1979, nymphs and adults on *Mirabilis nyctaginea*, T.J. Henry and A.G. Wheeler, Jr. *Union County*, near Lewisburg, 10 June 1980, nymphs and adults on *M. nyctaginea*, A.G. Wheeler, Jr. *Cumberland County*, Enola Railroad Yards, 13 August 1980, on *M. nyctaginea*, A.G. Wheeler, Jr. *Wyoming County*, Tunkhannock, 30 July 1981, on *M. nyctaginea*, A.G. Wheeler, Jr.

WISCONSIN: *Crawford County*, Prairie du Chien, 29 August 1927, F.M. Uhler (USNM). *Dane County*, Madison, 18 July 1916, J.C. Hambleton (USNM).

The spread of *Mirabilis* resulted from the development of agricultural areas in the prairie states which began shipping produce to the eastern population centers over newly completed railways during the 1850's. This traffic was an available means of dispersal for *Mirabilis* which began appearing along the railroads in the east between 1880 and 1900 (Balduf, 1957). By the early 1940's the specialist coreid *C. mendica* had become established along the railroad as far east as eastern Pennsylvania. The bug now has followed its host plant along railroad right-of-ways to the shore of Lake Erie and to the Atlantic coast (Long Island).

Faunal changes occur continually but rarely can be traced accurately; too often the intensive collecting and survey work necessary to delineate changes in range simply are not done. Balduf's study is unique for documenting the railroad as the dispersal agent for *Mirabilis nyctaginea*, whose establishment provided a pathway of invasion for its intimate associate *Catorhintha mendica*.

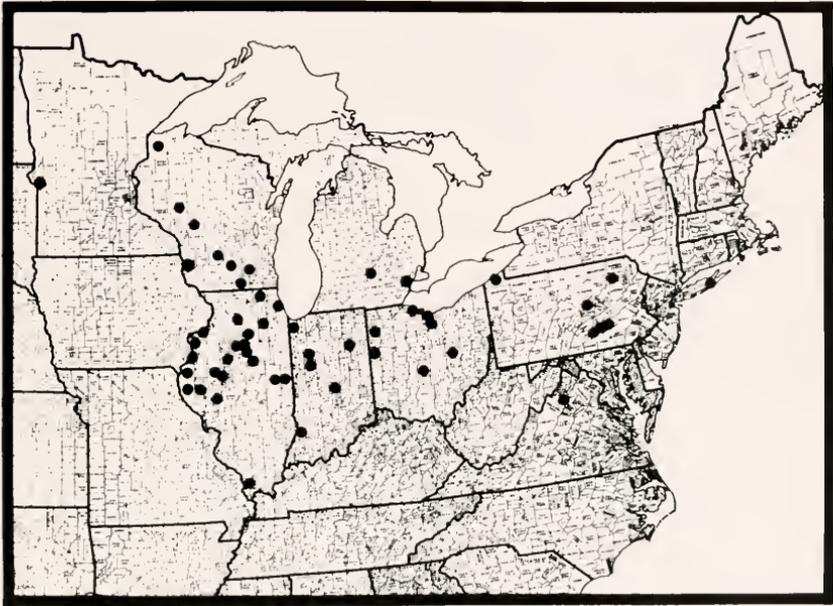


Figure 1. Distribution of *Catorhintha mendica* in the eastern United States.

ACKNOWLEDGMENTS

We wish to thank Daniel K. Young (Michigan State University, East Lansing, MI) for new collection data for *C. mendica* and for checking records in the MSU collection. We are also grateful to the following institutions and the individuals in charge for checking their collections for current records for *C. mendica*: Pennsylvania State University, State College, PA - K.C. Kim and Verda Haas; U.S. National Museum, Washington, D.C. - T.J. Henry; American Museum of Natural History, New York, NY - R.T. Schuh; and New York State Museum, Albany, NY - T.L. McCabe. We thank Sharon Kinsman (Cornell University) for allowing us to cite her unpublished observations, and John E. Rawlins and L.L. Pechuman (Cornell University) for their critical review of the manuscript.

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SUPPLEMENT TO AN ANNOTATED CHECKLIST OF MISSOURI LEAF BEETLES (COLEOPTERA: CHRYSOMELIDAE): NEW STATE RECORDS AND HOST PLANT ASSOCIATIONS^{1,2}

Edward G. Riley, Wilbur R. Enns³

ABSTRACT: Fifteen species of leaf beetles (Coleoptera: Chrysomelidae) are reported from Missouri for the first time. Significant host data are reported for these and other species.

Since the completion of our earlier list (Riley and Enns 1979) three additional collecting seasons have passed. Collecting efforts during this time have been oriented toward specialized plant communities in the more outlying areas of the state, particularly glade and prairie habitats of southwestern Missouri. The additional field work resulted in the discovery of 15 leaf beetle species previously unknown from Missouri. Also reported here is one species which was unintentionally omitted from our earlier list. These additions bring the total number of chrysomelid species and subspecies known from Missouri to 351. Host plant information which is new or thought otherwise useful to subsequent investigators is also reported. The specimens discussed in this paper are deposited in the collection of the first author and the Wilbur R. Enns Entomology Museum, University of Missouri-Columbia.

Cryptocephalinae

Cryptocephalus calidus Suffrian. NEW STATE RECORD. Missouri records: 11 specimens (males) from Boone, Crawford, Livingston, Pettis and Phelps Counties, taken in June and July. Due to the difficulty in recognizing this species, as mentioned in our earlier paper, we are reporting here only records from male specimens. This species is very similar in appearance to, and often collected with, *Cryptocephalus venustus* (Fab.). Dr. Richard E. White (USNM) has confirmed this determination.

Cryptocephalus tinctus LeConte. NEW STATE RECORD. Missouri records: 13 specimens from Boone, Crawford, and Stone Counties,

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taken during August and September. The 12 Boone and Crawford County specimens were taken at black lights.

Cryptocephalus trivittatus Olivier. NEW STATE RECORD. Missouri records: 2 specimens from Stoddard County, taken during June by sweeping.

Chlamisinae

Neochlamisus tuberculatus (Klug). NEW STATE RECORD. Missouri records: 3 specimens from Barry County, taken during early June. These specimens were collected by sweeping an unidentified *Vaccinium* species growing in a powerline clearcut at Roaring River State Park.

Eumolpinae

Colaspis suggona Blake. Adults of this species are very common on prairie habitat of southwestern Missouri during early June. Large numbers have been encountered defoliating *Tephrosia virginiana* and *Ceanothus ovatus*.

Paria sexnotata (Say). In our earlier paper, we reported having seen only a single specimen of this species from Missouri. It has since been collected by beating *Juniperus virginiana*, and is especially common in May on junipers growing in glade communities (Benton County, near Warsaw). The series of specimens available show great variation in the pronotal punctation, ranging from deeply impressed, oval punctures to semi-strigose or strigose punctures which are often confluent at sides. This variability suggests that *Paria juniperi* Blatchley may not be distinct from *P. sexnotata*. *Paria juniperi* was described as having the pronotal punctures very coarse, confluent and strigose. It is also known to occur on *Juniperus*.

Chrysomelinae

Calligrapha (Acalligrapha) praecelsis (Rogers). NEW STATE RECORD. Missouri records: Three specimens were discovered in the Wilbur R. Enns Entomology Museum, UMC, from St. Louis, Missouri (ex G.W. Bock collection). One specimen is dated 5-7-94.

Calligrapha (Calligrapha) philadelphia (Linnaeus). NEW STATE RECORD. Missouri records: 24 specimens from Taberville Prairie, St. Clair County. These specimens were collected during early May from *Cornus drummondii*.

Calligrapha (Calligrapha) rhoda Knab. Missouri records: 10 specimens of this species were collected at Roaring River State Park (Barry Co.) during early May from *Corylus americana*. Blatchley (1910) gave the distribution for *Calligrapha rhoda* var. *walshiana* Blatchley as Indiana and Missouri. Wilcox (1972) also cited this record. These literature records were inadvertently omitted from our earlier list.

Chrysomela lineatopunctata (Forster). NEW STATE RECORD. Missouri records: 100+ specimens from Morgan and St. Clair Counties, taken during May and June. All specimens, except one, are from Taberville Prairie (St. Clair Co.) where they were found breeding on prairie willow, *Salix humilus*, during early May.

Galerucinae

Luperosoma parallelum (Horn). This species has been found in large numbers on two separate occasions near Warsaw, Missouri (Benton Co.) during July. The beetles were feeding on *Psoralea tenuiflora*.

Scelolyperus liriophilus Wilcox. This species is more common in Missouri than indicated on our earlier list. Records exist (series including males) for Barry, Benton, Marion and Taney Counties. The beetles have been commonly taken in the Ozark region of the state by sweeping forest understory vegetation. They have been repeatedly found on the flowers and leaves of smoke tree, *Cotinus obovatus*, and blatternut, *Staphylea trifolia*, during early May.

Alticinae

Kuschelina fimbriata (Forster). NEW STATE RECORD. Missouri records: One specimen from St. Clair County, taken during May. This specimen was collected while sweeping vegetation of a sandstone glade habitat near Collins, Missouri (E.G. Riley colln.).

Disonycha admirabilis Blatchley. In our earlier paper we reported on 3 specimens which carried labels reading "on *Schrankia*". Recent collecting has confirmed the beetles' association with this plant. The adults of *D. admirabilis* are often common in May on *Schrankia uncinata*, especially where it grows on prairie habitat of southwestern Missouri. On one occasion larvae were observed in association with adults on this plant.

Chaetocnema alutacea Crotch. NEW STATE RECORD. Missouri

records: 100+ specimens from Vernon County, taken during June. These beetles were taken on two separate occasions by sweeping prairie habitat near Gay Feather Prairie, 4 miles west of Montevallo, Missouri.

Chaetocnema cribrifrons LeConte. NEW STATE RECORD. Missouri records: 60 specimens from Barton, Benton, Callaway, Lawrence, Pettis, St. Louis, Taney and Vernon Counties, taken during May and June, primarily by sweeping prairie habitat.

Chaetocnema subviridis LeConte. NEW STATE RECORD. Missouri records: 76 specimens from Holt County, taken during June. These specimens were collected on two occasions by sweeping grasses growing in a cemetery, 1.2 miles south of Mound City, Missouri. This area is comprised of loess mound habitat.

Systema corni Schaeffer. NEW STATE RECORD. Missouri records: 70 specimens from Crawford County, taken during August. These specimens represent a single series which was taken by sweeping dogwood, *Cornus florida*, over a two-day period. The beetles were not abundant. Dr. Eric H. Smith (Field Mus. Nat. Hist., Chicago) has confirmed this determination.

Glyptina brunnea Horn. This species has been found feeding on the terminal growth of *Euphorbia maculata*.

Glyptina cyanipennis Crotch. We recorded this species as feeding on *Euphorbia dentata* in our earlier paper. Since then it has also been discovered feeding on *Euphorbia heterophylla*.

Glyptina ferruginea Blatchley. A series of 100+ specimens was collected in June from *Euphorbia obtusata* in Randolph County. Damage was evident on the plants and the beetles were observed feeding. This is the fourth *Glyptina* species known to feed on *Euphorbia*.

Aphthona texana Crotch. NEW STATE RECORD. Missouri records: 6 specimens from Holt, Lawrence, Pettis and Texas Counties, taken from May to July. One specimen is labeled "on red clover".

Hispinae

Anisostena kansana Schaeffer. NEW STATE RECORD. Missouri records: 96 specimens from Bates, Dade, Pettis and Vernon Counties,

taken during June and July. These beetles feed on the prairie grass, *Tripsacum dactyloides*. During July, adults, larvae and pupae were taken from blotch mines in the leaves of this grass.

Anisostena nigrita (Olivier). NEW STATE RECORD. Missouri records: 13 specimens from Barry, Stone and Taney Counties, taken during May and June by sweeping grasses of glade communities.

ACKNOWLEDGMENTS

We would like to thank the Missouri Department of Natural Resources and the Missouri Department of Conservation for permitting collecting in Missouri state parks and prairie preserves, respectively. Thanks also to Doug LeDoux, UMC, for numerous host plant determinations and to Drs. E.U. Balsbaugh and Eric Smith for comments on and corrections of this manuscript.

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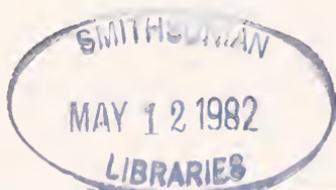
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(Continued on inside of back cover)

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FIRST RECORD OF *HYDROVATUS HORNI* CROTCH FROM THE ANTILLES WITH NOTES ON ITS KNOWN DISTRIBUTION AND STATUS (COLEOPTERA: DYTISCIDAE)¹

Paul J. Spangler,² Alberto Vega³

ABSTRACT: *Hydrovatus horni* Crotch is reported for the first time from Cuba. distinguishing characters and a typical biotope are illustrated, the habitat is discussed, and its known distribution in Texas, Mexico, Guatemala, and Cuba is summarized. Also a lectotype is designated for *Hydrovatus major* Sharp which is shown to be a synonym of *H. horni*.

Through a cooperative program between the Institute of Zoology, Systematics Section, of the Academy of Sciences of Cuba and the Smithsonian Institution, we collected aquatic Coleoptera and other aquatic insects from 4-14 May 1981 in Cuba. Among the specimens collected was an attractive species of the dytiscid genus *Hydrovatus*. This distinctive beetle was much larger than the common species of *Hydrovatus* known from the New World. A review of the genus revealed that this was *Hydrovatus horni* described by Crotch in 1873 from specimens from Texas and described later as *Hydrovatus major* by Sharp in 1882 from specimens from Guatemala. We wish to report, for the first time, *Hydrovatus horni* in the Antilles, to illustrate the distinctive characteristics of the species, to describe its habitat, to summarize its known distribution, to designate a lectotype for *H. major*, and to report that the latter is a synonym of *H. horni*.

Hydrovatus horni Crotch

Figs. 1-6

Hydrovatus horni Crotch, 1873:378.

Hydrovatus major Sharp, 1882:335 [NEW SYNONYMY]

Diagnosis. — Form (Fig. 1) broadly oval; strong convex dorsally, moderately so ventrally. Length 3.7 mm; greatest width 2.7 mm. Head reddish-brown. Thorax reddish-brown except a piceous transverse macula along posterior margin on middle third of pronotum. Elytra reddish-brown with discal area of each elytron black; with a large reddish-brown macula basally in humeral area and another reddish-brown macula near base and close to elytral suture; with a reddish-brown C-shaped mark on apex of left elytron and a reversed C on right elytron; these C-shaped maculae merge laterally with the reddish-brown elytral margins. Head, thorax, and elytra microreticulate; venter mostly without microreticulation between

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punctures. Head with a few small punctures in a broadly U-shaped pattern between the eyes; pronotum coarsely sparsely punctate; elytra coarsely and very densely punctate; mesosternum and metasternum coarsely, densely punctate. Elytron each with a short, distinctive, deep, submarginal groove near base (Fig. 2). Male genitalia as illustrated (Figs. 3-5). The large size, color pattern, and submarginal elytral groove will readily distinguish *H. horni* from all other species of *Hydrovatus* presently known from the Western Hemisphere.

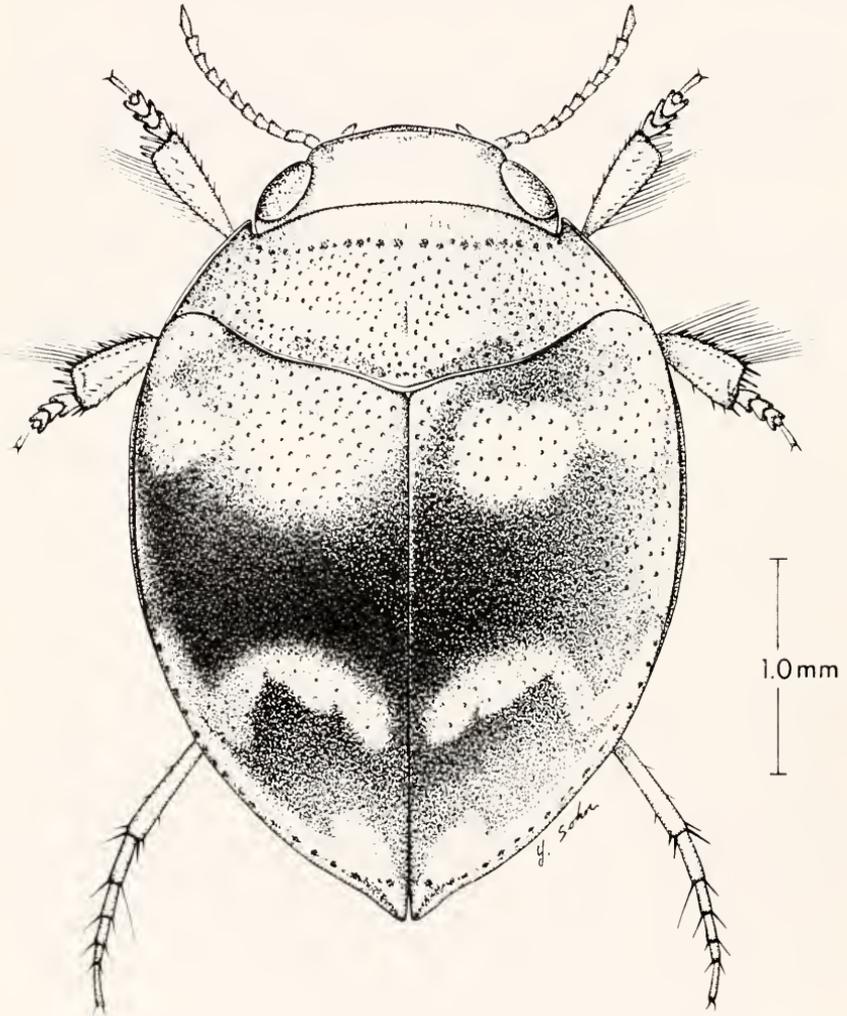


Fig. 1. *Hydrovatus horni* Crotch: habitus view.

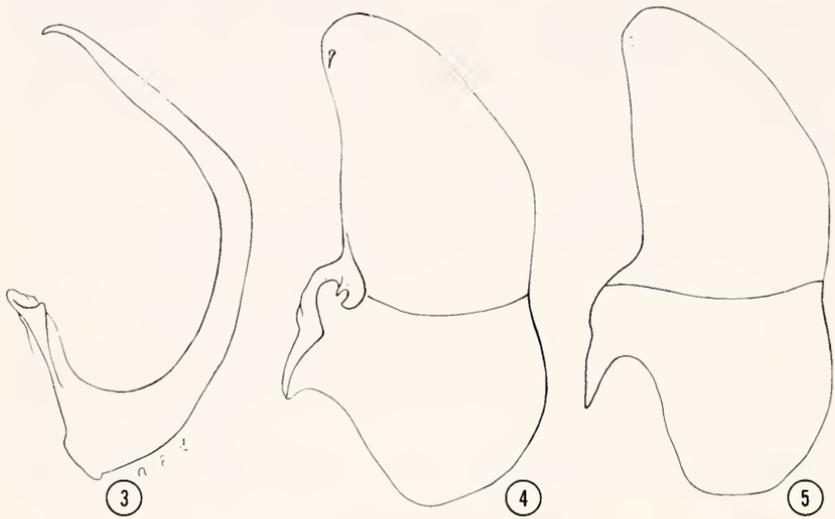
Discussion. — Sharp (1882) in his magnum opus on the Dytiscidae of the world did not redescribe *H. horni* as he did other species in the genus, but in his description of *Hydrovatus major* he stated "It is closely allied to *Hydrovatus horni*, Crotch." Sharp, evidently, did not have access to Crotch's type-material nor other specimens of *H. horni*, but compared his Guatemalan specimens to Crotch's published description; otherwise he undoubtedly would have recognized that his specimens were the same species described previously by Crotch.

Habitat. — Our specimens of *Hydrovatus horni* were collected from the weedy margins of a pasture pond (Fig. 6) which also contained mats of the water hyacinth *Eichornia crassipes* (Mart.); the substrate of the pond was mud.

Known distribution of *Hydrovatus horni*. — Published type-locality given as "Texas". Additional records: UNITED STATES: Texas: [No additional locality data], Belknap Colln., 1 female (USNM); Kingsville, C.T. Reed, 1 female (USNM); McAllen, 7-2-38, D.W. Craik, 1 male (USNM); Jim Wells Co., 7-24-38, J.G. Shaw, 1 male (USNM). MEXICO: Campeche: Campeche (21 mi. E.), 27 July 1964, Paul J. Spangler, 2 females (USNM); Jalisco: Magdalena (7 mi. N), 28 July 1963, Paul J. Spangler, 3 males, 3 females (USNM); Tamaulipas: San Jose, April 1910, J.D. Sherman Coll'n., 1 male, 1 female (USNM). GUATEMALA: Published type-locality of *H. major*, Duenas, 1879, G.C. Champion, 23



Fig. 2. *Hydrovatus horni* Crotch: submarginal groove in elytron, lateral view, 24X.



Figs 3-6 *Hydrovatus horni* Crotch, male genitalia: 3, median lobe, lateral view; 4, right paramere, medial view; 5, left paramere, lateral view; 6, biotope, pasture pond near Motel Los Jazmines, Vinales, Cuba.

syntypes (BMNH); Izabal: Morales (1 mi. N), 16-18 Aug. 1965, Paul J. Spangler, 1 male, 8 females (USNM). CUBA. Pinar del Rio: Vinales, near Motel Los Jazmines, 7 Feb. 1981, P.J. Spangler and A. Vega, 6 males, 6 females (ASC & USNM). ASC = Academy of Sciences of Cuba; BMNH = British Museum (Natural History); USNM = U.S. National Museum of Natural History, Smithsonian Institution.

Type-data (*H. major*). — The Sharp collection in the British Museum (Nat. Hist.), London, contains 23 syntypic specimens under the name of *H. major*. Six of these were examined. These are glued onto three cards with two specimens on each card and each card attached to a pin. At the lower left corner of each card is the number 1122. Beneath each card are three labels which state as follows: Label 1—"Duenas Guatemala G.C. Champion". Label 2—"B.C.A. Col. I. 2. *Hydrovatus major* Sharp". Label 3—"Syntype" [a round label]. One pin bearing a pair of specimens also bears a label "TYPE". The male on the left side of the card with a male sex symbol beneath it was dissected for comparison of its genitalia with that of the Cuban specimen illustrated (Figs. 1-5) and was found to be the same. The genitalia from this male has been placed in glycerine in a microvial pinned beneath the "TYPE" label. Because Sharp did not designate type-specimens in his *Biologia Centrali-Americana* treatise, the type-label obviously was added later, but it has not been validated through publication. Therefore, this male is here designated as the lectotype. A label stating "Lectotype male, *Hydrovatus major* Sharp, Spangler des. 1981" was attached to the pin bearing the male. An additional label was attached as follows: "*H. major*" Shp. (= *H. horni* Cr.) fide P.J. Spangler."

ACKNOWLEDGMENTS

For financial and logistical support for our fieldwork, we extend our thanks to Dr. Fernando Gonzalez Bermudez, Director, Institute of Zoology of the Academy of Sciences of Cuba. We also express our gratitude to Dr. Ratael Alayo, Marbelia Rosabel, and Dr. Donald Davis for their assistance and companionship in the field. For a Fluid Research Fund Award for airfare to and from Cuba for P.J. Spangler we are also very grateful to Mr. S. Dillon Ripley, Secretary, Smithsonian Institution.

The syntypic specimens were made available by Mr. Mick Bacchus, British Museum, (Natural History), London, and his kind assistance is gratefully acknowledged.

For the pen and ink drawings, we thank Mr. Young Sohn, Smithsonian Institution biological illustrator (Fig. 1) and Miss Anne Laey, biological illustrator (Figs. 3-5). We also thank Mrs. Susann Braden, Smithsonian Institution scanning electron microscopist, for the micrograph, and Mrs. Phyllis Spangler for typing the manuscript.

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**COMPSOCRYPTUS JAMIESONI, A NEW
ICHNEUMONID FROM CALIFORNIA
(HYMENOPTERA)¹**

Sal Nolfo²

ABSTRACT: *Compsocryptus jamiesoni*, n. sp. is described from Alviso (Santa Clara County), California.

Compsocryptus jamiesoni, n. sp.

Male — Fore wing 11 mm. long; mesoscutum with punctures moderately coarse and strong, separated by an average of 0.5 their diameter.

Ferruginous. Area on the middle of frons and vertex, occiput, apical 0.4 of flagellum, sutural markings of thorax, black; hind tibia infusate apically; base of third tergite fuscous; wings yellowish with three transverse dark brown bands.

Female — Fore wing 9.5 mm. to 10 mm. long; temple at midheight about 0.82 as long as eye, moderately convex; ovipositor about 6.1 as long from nodus to apex as it is deep at nodus. Ferruginous. Base of third tergite and narrow areas along some of thoracic sutures black; apical 0.45 of flagellum fuscous; wings brownish yellow with three transverse dark brown bands; hind tibia infusate apically.

Holotype — ♀, Alviso (Santa Clara County), California, June 23, 1981, Dean Jamieson, in Salt Marsh. (This holotype is on indefinite loan from the Entomology Museum, North Carolina State University, Raleigh, to the United States National Museum, Wash., D.C.). Paratypes — 2♀, 2♂, Alviso, California, from June 23-29, 1981, Dean Jamieson.

This species closely resembles both *Compsocryptus aridus* and *Compsocryptus calipterus*. Because the female has sparse hairs on the second tergite, it keys to *Compsocryptus aridus* in Townes (1962) keys. The female is similar to *Compsocryptus aridus* but differs in having the body color ferruginous rather than fulvous, dark markings on the wings broader, and a slightly larger average size. Except for the sparse hairs on the abdominal tergite, the male is similar to *Compsocryptus calipterus* but lacks the dark area at the apex of the hind femur. *Compsocryptus aridus* are found in deserts. *Compsocryptus jamiesoni* inhabit salt marsh areas.

ACKNOWLEDGMENTS

I wish to thank Dean Jamieson for providing the 5 specimens examined. I am also grateful to Dr. Henry Townes, of the American Entomological Institute, whose advice was most helpful.

REFERENCE

Townes, Henry, 1962, U.S. Nat. Mus. Bull. No. 216, pt. 3, pages 278-306.

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²1419 Valley Rd., Garner, North Carolina 27529

STUDIES OF NEOTROPICAL CADDISFLIES, XXXI: FIVE NEW SPECIES FROM ARGENTINA (TRICHOPTERA)¹

Oliver S. Flint, Jr.²

ABSTRACT: Four new species of Hydroptilidae are described and figured: *Neotrichia salada* (Argentina and Paraguay), *N. palma* (Argentina and Paraguay), *Oxyethira argentinensis* (Argentina), and *O. santiagensis* (Argentina). *Oecetis paranensis* (Argentina, Brazil and Paraguay), family Leptoceridae, is also described and figured. All species are newly discovered to occur in the northern third of the Province of Buenos Aires, Argentina, and some are recorded from as far north as central Brazil.

In December of 1979, my wife and I travelled to the Province of Buenos Aires, Argentina, to gather material for the proposed "Fauna y Flora Acuaticas del Area Platense". Thanks to the extensive help of Drs. R.A. Ringuelet and J.A. Schnack of the Instituto de Limnologia and R.A. Ronderos of the Departamento de Zoologia, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, we were able to travel extensively throughout this area for a month. Unfortunately the month was unseasonably cold, which, coupled with several severe thunderstorms, reduced the number of nights that good collections were made. Nevertheless, 17 species were taken in the area for the first time, of which, five species are undescribed. To make the names available for the Fauna Platense, they are described here.

Family Hydroptilidae

Neotrichia salada, new species

Figures 5-8

This species is closely related to the recently described *N. tubulifera* Flint (1980), with which it may occur. The clearest difference between the two is in the shape of the clasper. In *salada* the clasper is nearly truncate in both lateral and dorsal aspects and apex dorsally bears a distinct dark point. In *tubulifera* the clasper tapers to an acute angle in both lateral and ventral aspects and there is no dark point. There are other less well marked differences in other parts of the genitalia, most especially the aedeagus.

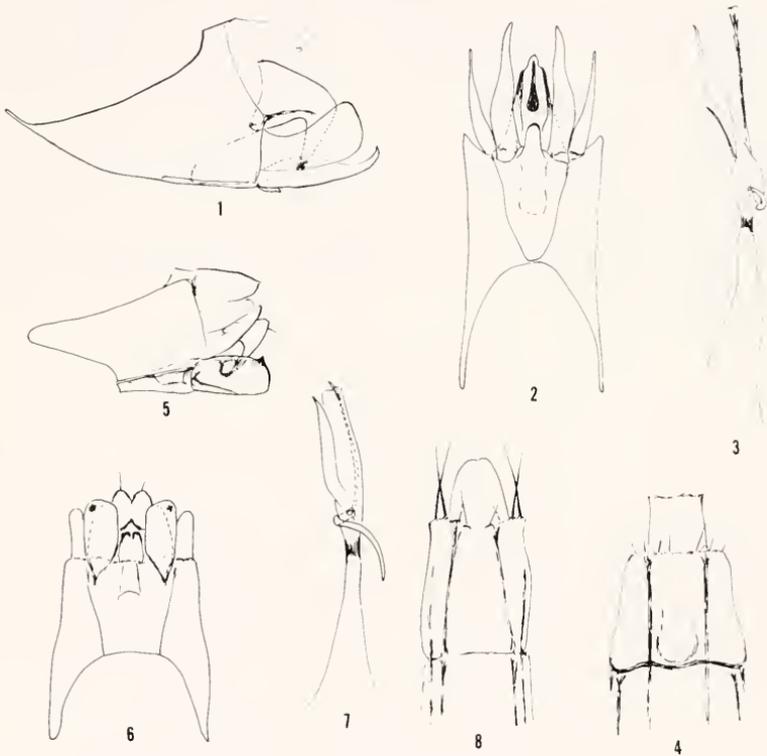
Adult. — Length of forewing, 1.5-2mm. Color grayish brown, legs and body stramineous; forewing with alternating streaks of gray and stramineous hair. Male genitalia: Ninth segment anteriorly with long lateroventral lobes; with a pair of dark, ventral, bracing rods between

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anterior and posterior margins. Bracteole membranous, indistinct; elongate. Subgenital plate with an elongate apex directed ventrad between claspers; apex bilobed in ventral aspect with 2 short setae. Clasper elongate, more or less rectangular in outline; with a darkened apicodorsal point. Aedeagus with a conical base, with a spiral process at midlength; apical half with a mesal ejaculatory duct and a lateral, swordlike process. Female genitalia: Eighth sternum elongate, membranous, without surface features, posterior margin with setae, 2 lateralmost pairs very large, darkened and conspicuous.

Material. — Holotype, male: Argentina, Pcia. Buenos Aires, Río Salado, Rt. 3, south San Miguel del Monte, 7 Dec. 1979, C.M. & O.S. Flint, Jr. USNM Type 100227. Paratypes: same data, 22 ♂, 64 ♀; Arroyo Pescado, Rt. 11, 15 km. east La Plata, 20 Dec. 1979, C.M. & O.S. Flint, Jr., 1 ♂, 4 ♀; Río Parana de las Palmas, Lima, 16 Dec. 1979, C.M. & O.S. Flint, Jr., 1 ♂. Pcia. Entre Ríos, Río Parana Ibicuy, Puerto Ibicuy, 10 Dec. 1979, C.M. & O.S. Flint, Jr. 1 ♂. Pcia. Chaco, Riacho Barranqueras, Puerto Vilelas, 5 Dec. 1973, O.S. Flint, Jr., 4 ♂, 30 ♀. Paraguay, Asuncion, 30 Dec. 1972, L. Lautenschlager, 3♂.



Figs. 1-8. *Neotrichia palma*, n.sp.: 1, male genitalia, lateral; 2, male genitalia, ventral; 3, aedeagus, lateral; 4, female genitalia, ventral. *N. salada*, n.sp.: 5, male genitalia, lateral; 6, male genitalia, ventral; 7, aedeagus, lateral; 8, female genitalia, ventral.

Neotrichia palma, new species

Figures 1-4

This, another species of the *noteuna* group, is clearly related to *salada* n. sp. It is readily differentiated from this species by longer claspers whose tips are very slender. In addition there are differences in the shape of the subgenital plate and bracteole.

Adult. — Length of forewing, 2mm. Material completely decolorated, in alcohol. Male genitalia: Ninth segment with anterior margin produced into long, lateroventral lobes ending in a pointed process; with a pair of dark, ventral, bracing rods between anterior and posterior margins, posterior margin produced into a small lobe between clasper bases. Bracteole elongate, enlarged apically. Subgenital plate with an elongate apex directed ventrad between claspers; apex slightly produced in ventral aspect. Clasper elongate, apical half slender and elongate in both lateral and ventral aspects. Aedeagus with a conical base, narrowed before midlength; with a spiral process at midlength; apical half with a darkened linear structure (the ejaculatory duct?) and a lateral, swordlike process. Female genitalia: Eighth sternum about as long as broad, lightly sclerotized with a distinct basomesal bulge; posterior margin with a row of indistinct pale setae.

Material. — Holotype, male: Argentina, Pcia. Buenos Aires, Río Parana de las Palmas, 18 Dec. 1979, C.M. & O.S. Flint, Jr. USNM Type 100228. Paratypes: same data, 2 ♀. Paraguay, Asuncion, 30 Dec 1972, L. Lautenschlager, 3 ♂, 20 ♀.

Oxyethira argentinensis, new species

Figures 13-14

This is another member of the primarily Neotropical *zeronia* group, perhaps most similar to *O. macrosterna* Flint (1974). It may be recognized by the small dorsolateral point on the eighth segment, the shapes of the subgenital plate and claspers, and especially by the distinctive subapical twisted plates of the aedeagus.

Adult. — Length of the forewing, 2mm. Color pale brown; forewing with a few darker brown maculae. Seventh sternum with a distinct posteromesal point. Male genitalia: Eighth segment deeply cleft both midventrally and midorsally; dorsolateral margin bearing a small point, apex slightly produced. Ninth sternum produced anteromesally, without processes. Subgenital plate elongate, slightly curved in lateral aspect; in ventral aspect sclerotized laterally, apex acute; with a pair of small membranous processes laterally. Claspers sharply pointed in lateral aspect; in ventral aspect emarginate mesally. Aedeagus tubular, slightly inflated basally; apex divided into twisted plates, tip a membranous lobe, with a pointed, spinelike dorsal sclerite.

Material. — Argentina, Pcia. Buenos Aires, Arroyo Pescado, Rt. 11, 15km. east La Plata, 20 Dec. 1979, C.M. & O.S. Flint, Jr. USNM Type 100229. Paratypes: Same data, 28 ♂. Pcia. Río Negro, Lago Pellegrini, northeast Cipolletti, 17 Feb. 1978, C.M. & O.S. Flint, Jr., 1 ♂.

Oxyethira santiagensis, new species

Figures 11-12

This is another species of the *zeronia* group (Marshall, 1979), related to *O. lagunita* Flint (1980). It is easily recognized by the strong, rodlike processes from the ventral margin of the ninth sternum, as well as major differences in all other parts of the genitalia, especially the aedeagus with its apical filament.

Adult. — Length of forewing, 2mm. Color brown; forewing irregularly mottled with lighter and darker brown maculae. Seventh sternum with a small apicomeral point hidden in a brush of setae. Male genitalia: Eighth segment forming a tube enclosing genital capsule, venter deeply excised posteromesally, posterior margin entire dorsally. Ninth sternum prolonged anteroventrally, distinctly asymmetrical; posteroventral margins bearing a pair of stout, long and slightly curved processes. Subgenital plate and claspers in lateral aspect basically C-shaped, with dorsal and ventral arms close together; in ventral aspect the subgenital plate has a V-shaped posteromesal excision, and the claspers have their posterior margin almost truncate. Aedeagus tubular, enlarged basally; apex asymmetrically produced to one side, bearing a membranous lobe and slender, twisted filament.

Material. — Holotype, male: Argentina, Pcia. Buenos Aires, Rio Santiago, Palo Blanco, Berisso, 23 Nov. 1979, C.M. & O.S. Flint, Jr. USNM Type 100230.

Family Leptoceridae

Oecetis paranensis, new species

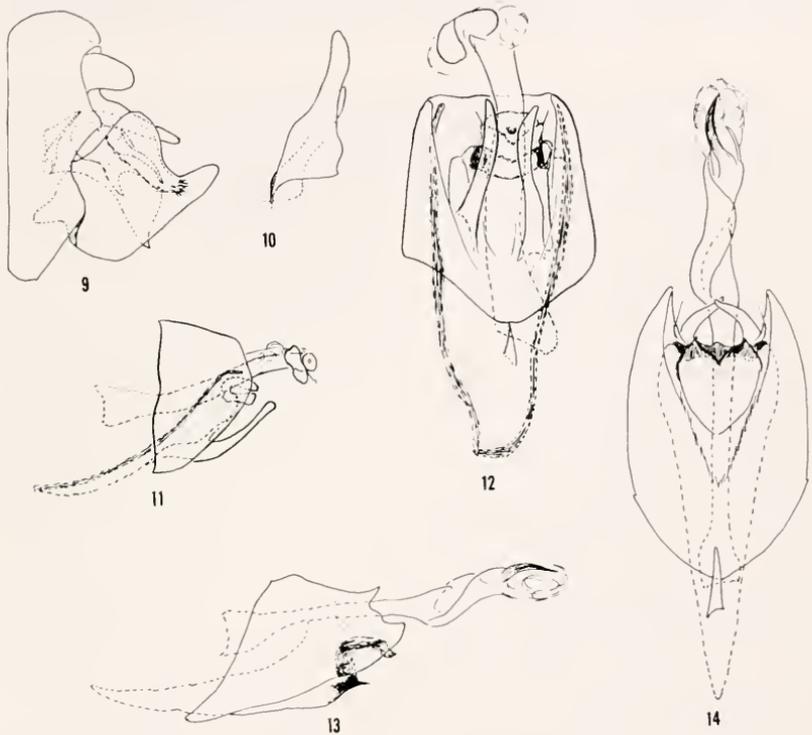
Figures 9-10

This species would appear to be related to *O. inflata* Flint (1974), known from Surinam. It is however, easily recognized by the form of the male genitalia, especially the claspers which bear an apicoventral process and the aedeagus with its well developed internal spine.

Adult. — Length of forewing, 6-9mm. Color brown; forewing covered with golden-brown hairs, veins with white hair interrupted by fuscous spots at furcations, margin with fuscous spots at ends of veins with white hair between spots. Forewing with R_{2+3} forked at \underline{g} ; hindwing with R_{2+3} forked well before margin, M forked basad of $\underline{j-m}$, Cu_1 deeply forked. Male genitalia: Ninth segment annular. Tenth tergum membranous, deeply divided mesally, lateral lobes divergent and constricted apicad. Cercus an elongate lobe. Clasper with a broad rounded dorsal lobe and a narrow, terete apicoventral lobe. Aedeagus terete, with apicoventral margin produced; internally with a strong dark spine, a U-shaped sclerite, and a small membranous lobe capped by a cluster of spicules.

Material. — Holotype, male: Argentina, Pcia. Chaco, Riacho Barranqueras, Puerto Vilelas, 5 Dec. 1973, O.S. Flint, Jr. USNM Type 100231. Paratypes: Same data, 2 σ , 2 f ; Pcia. Misiones, Arroyo Coati, 15 km. east of San Jose, 18-19 Nov. 1973, O.S. Flint, Jr., 8 σ , 10 f ; Arroyo Saura, 9 km. north of L.N. Alem, 20 Nov. 1973, O.S. Flint, Jr., 1 σ , 1 f ; Arroyo Liso, 8 km. west of General Guemes, 19 Nov. 1973, O.S. Flint, Jr., 1 f . Pcia. Buenos Aires, Rio Parana de las Palmas, Lima, 16 Dec 1979, C.M. & O.S. Flint, Jr., 1 σ . Pcia. Entre Rios,

Río Parana Ibicuy, Puerto Ibicuy, 10 Dec. 1979, C.M. & O.S. Flint, Jr., 2 ♂, Paraguay, 3.9 km. south of Villarrica, 2 Dec. 1973, O.S. Flint, Jr., 1 ♂, 8 ♀; Arroyo Tapiracuay, San Estanislao, 27 Nov. 1973, O.S. Flint, Jr., 55 ♂, 51 ♀; Río Aquidaban, Cerro Cora, 29 Nov. 1973, O.S. Flint, Jr., 2 ♂, 8 ♀. Brazil, Edo. Amazonas, BR319, 102 km. southwest of Manaus, 30 July 1979, J. Arias, et. al., 1 ♂.



Figs 9-14. *Oecetis paranensis*, n.sp.: 9, male genitalia, lateral; 10, clasper, ventral. *Oxyethira santiagensis*, n.sp.: 11, male genitalia, lateral; 12, male genitalia, ventral. *O. argentinensis*, n.sp.: 13, male genitalia, lateral; 14, male genitalia, ventral.

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- . 1980. Studies on Neotropical Caddisflies, XXVI: New Species from Argentina (Trichoptera). Rev. Soc. Ent. Argentina 39: 137-142.
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BOOK REVIEW

A Catalogue/Checklist of the Butterflies of America North of Mexico. Lee D. Miller and F. Martin Brown, Memoir #2, Lepidopterists' Society, 1981. Available from Ron Leuschner, 1900 John Street, Manhattan Beach, CA 90266. Paperbound \$5 members, \$8.50 non-members; hard cover \$10 and \$17. Make checks payable to the Lepidopterists' Society.

I remember when I began working in the Andes five years ago. I approached with dread the need to learn an entire new fauna with strange, unfamiliar names like *Yramea cytheris* or *Lymanopoda nivea*, but I bit the proverbial bullet. I have been working on the North American butterfly fauna for twenty-five years and I thought I knew it pretty well until I opened this book and found once again that I was confronted by a set of strange, unfamiliar names. *Lycaena thoe*, the Bronze Copper I so prized in my youth, was now *Hylolycaena hyllus*; the Falcate Orange tip which I learned as *Anthocharis genutia* had become *Falcapica midea*; and even the Tiger Swallowtail was now *Pterourus glaucus*, not *Papilio glaucus*.

The Miller and Brown *Memoir* is a prodigious piece of scholarship which will be indispensable to all students of the North American butterflies because it pulls together type-locality and location-of-type data never before available in one place and because it is so monumental a bibliographic treasure-house. But it will get just about everyone angry. There is scarcely a subgenus in the diurnal Lepidoptera that the authors do not elevate to generic rank. On the other hand (and blessedly), they keep *Vanessa* together, dispensing with the "resurrected genera" of Field's revision. A great many of S.H. Scudder's long submerged generic names, like *Basilarchia* and *Satyrodes*, are back. One can praise the splitting for its temperance when one compares this to the new *Butterflies of the Rocky Mountain States*, by Clifford Ferris and the same F. Martin Brown. In the *Memoir* the *glaucus* and *troilus* groups are "lumped" in *Pterourus*, but in the Rocky Mountain book the *troilus* group is *Pterourus* and the *glaucus* group is *Euphoades*!

I have not tried to do a frequency distribution of the numbers of species per genus in this work vs. its predecessor, the dos Passos checklist, but the direction of movement seems clear. Is the tendency toward generic fragmentation a result of increases in our knowledge, or of global revisions of the affected groups? Generally not; it is a result of an attitude. Butterfly taxonomy is converging in attitude on the bird taxonomy of the past couple of generations, and anyone unfamiliar with that can see for him/herself by opening any of the Peterson *Field Guides* to birds. The butterflies have not yet been fragmented at the family level like the birds, but it's probably coming. Needless to say, there is no "right" or "wrong" in all of this. The concept of the genus is as fuzzy as it could possibly be, and if some authorities think subgenera are intolerable they will raise them all to genera, just as some of the foremost cladists have decided that parallel evolution is not a useful concept and sunk it as a synonym of convergence. All of these changes act to the discomfiture of those of us who are getting old enough to think that the way we learned it must be better. But *Pterourus* . . . ?

The splitting of *Papilio* has been attempted many times and never holds up. It will probably not hold up this time either. Some of the generic reassignments may indeed hold up in the context of global revision; we shall see. Personally, I jumped for joy when the old "catch-all" genus *Thecla* was sundered by Clench, but I am not convinced *Lycaena* deserves the same treatment. The uncritical inclusion of K. Johnson's mysterious new *Mitouras* from the Pacific Northwest, which may or may not be specifically distinct, seems inconsistent with the decidedly carping tone of many of the footnotes, a tone seemingly calculated to irritate various people.

Continued on page 53

FIRST HOST RECORD FOR *PAROXYNA DUPLA* (CRESSON) (DIPTERA: TEPHRITIDAE)^{1,2}

Robert Lavigne³

ABSTRACT: The fruit fly, *Paroxyna dupla* (Cresson) was reared from blossoms of *Erigeron peregrinus* collected in the Snowy Range Mountains of Wyoming. A second species, *Tephritis signatipennis* Foote, was reared from the same plant species. Both host records are new.

Paroxyna dupla (Cresson) was described in 1907 from two specimens collected in Buelah, New Mexico and is now known to be widely distributed throughout the western United States and Canada (Novak 1974). It has been recorded at altitudes up to 3657 m on Medicine Bow Peak in Carbon County, Wyoming. Until now, its host plant has remained unknown (Wasbauer 1972, Novak 1974).

While investigating the behavior of robber flies, the author observed blossoms of *Erigeron peregrinus* (Compositae) with discolored disc flowers in a clearing 3 miles NW of Centennial, Wyoming in the Snowy Range Mountains, elevation 2613 m. Since this apparent injury resembled that previously observed in *Erigeron pumilis* blossoms which contained the puparia of *Tephritis araneosa* (Coquillett) (Lavigne 1965), several discolored blossoms were examined. Each was found to contain brown puparia. I speculated that these puparia might be those of a species of tephritid since members of the genus *Erigeron* are known to be hosts of this family of flies (Stegmaier 1968).

Subsequently 41 discolored blossoms were transported to the laboratory and placed in individual numbered vials stoppered with foam tube plugs (Gaymar identi-plugs[®]) manufactured by Gaymar Industries, Inc., One Bank Street, Orchard Park, New York 14127.

The blossoms were collected on July 27, 1980 and during the period Aug. 1-6, 108 adults of *Paroxyna dupla* emerged in the vials, 56 males and 52 females. The number emerging from individual blossoms varied from 1 to 12 with a mean of 2.6. The close correlation of male and female numbers are further support for the concept promoted by Hamilton (1967) that "the two sexes are usually produced in approximately equal numbers".

Additionally, 13 parasites (*Habrocytus* sp.) (Hymenoptera: Pteromalidae) and 1 unidentified braconid emerged from the blossoms. The parasitism rate was 10.7%. An examination of numbers of puparia, adult tephritids and

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parasites leads to the inescapable conclusion that each host was attacked by one parasite. Parasites apparently emerged through the apex of the puparia in the same manner as did the adult tephritids, i.e., by breaching the lines of cleavage around the anterior extremity of the puparium.

Blossoms were dissected to determine the actual number of puparia in order to ascertain emergence success. Out of 128 puparia only 9 contained dead pupae and, assuming one parasite per puparium for a total of 23, the data indicate an emergence success of 82 percent.

Based on an examination of discolored tissues and tunnels containing frass, it is apparent that larvae fed on developing seeds.

Three female specimens of a second species, *Tephritis signatipennis* Foote, were reared from the same series of blossoms of *E. peregrinus*. Only one fly was reared from each blossom, which contained a single puparium. This tephritid previously has been associated only with *Machaeranthera canescens* (Pursh) Gray according to Wasbauer (1972).

ACKNOWLEDGMENTS

The author wishes to express appreciation to Dr. Ronald Hartman, Rocky Mountain Herbarium, University of Wyoming, Laramie for identifying *Erigeron peregrinus*, to Dr. R.H. Foote, Systematic Entomology Laboratory, USDA, SEA, Beltsville, MD for tephritid identifications, and to Dr. C.M. Yoshimoto, Biosystematics Research Institute, Agriculture Canada, Ottawa, Ontario for parasite identifications.

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COLLECTION OF *EUKLASTUS HARTI* METCALF IN WISCONSIN (HOMOPTERA: DERBIDAE)¹

Harold L. Willis²

ABSTRACT: Twenty-nine adult *Euklastus harti* Metcalf were collected from a rotten elm log in southwestern Wisconsin during summer 1980. Observations on ecology and behavior are provided.

During the summer of 1980, I collected 29 adult *Euklastus harti* Metcalf from a decaying American elm (*Ulmus americana* L.) log in southwestern Wisconsin. The collection data are: Iowa Co., 10.6 km north, 5.5 km west of Dodgeville (SW 1/4 NW 1/4 Sec 25, T 7N, R 2E); 10 Aug. 7♂; 17 Aug., 6♂, 2 ♀; 23 Aug., 3♂, 1♀; 31 Aug., 5♂, 3♀; 7 Sept., 1♀; 21 Sept., 1 ♀. Specimens are housed at the U.S. National Museum, Smithsonian Institution, Washington, D.C. (12 ♂, 7♀), the Snow Entomological Museum, University of Kansas, Lawrence (4 ♂, 1♀); the University of Wisconsin, Madison (3 ♂); and the author's collection (2 ♂).

The ecology of the collecting locale, a dry southern hardwood forest, has been described by Curtis, 1959. The moist, rotted wood in which the specimens were collected contained a variety of fungi and a growth of moss on the remaining bark of the log. Search after 21 September failed to produce more specimens. One female was collected on a fallen box elder (*Acer negundo* L.) about 210 m from the rotten elm log. Since the box elder was neither moist nor rotten, it is assumed that the *Euklastus* did not emerge from it.

Males and females are sluggish and sit or walk with their large spotted wings held nearly vertically, with the flat surfaces facing forward (Fig. 1). Occasionally they were observed with their wings folded roof-like over the abdomen. If disturbed, they jump-fly. They are weak fliers.

Euklastus belongs to the tribe Sikaianini of the Derbidae, a mostly tropical group of fulgorids of about 25 species in 5 or 6 genera, ranging from the Philippines and northern Australia to Fiji to the Seychelles Is. and West Africa to the Caribbean and eastern North America (Fennah, 1952; Metcalf, 1945). *E. harti* has been collected in southern Illinois, North Carolina, and Maryland (Wilson & McPherson, 1980; Kramer, personal communication). Previous collections have totaled only 1 - 6 specimens (Kramer, personal communication).

My series of *E. harti* differs somewhat from the original description and figures in Metcalf 1923. The species was described from a single male

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specimen, which is now in very poor condition, with abdomen, legs, and wings missing (Kramer, personal communication). My relatively uniform series differs from Metcalf's description by having (1) scattered vague brownish spots on a whitish body rather than a general tawny color; (2) 10-13 rosy red spots along the costal wing margin rather than a few; and (3) white wing veins rather than yellow, and dark brown wing spots, not tawny (although Metcalf correctly calls them fuscous at the beginning of the description). Also, the wing venation (Fig. 2) differs greatly from Metcalf's

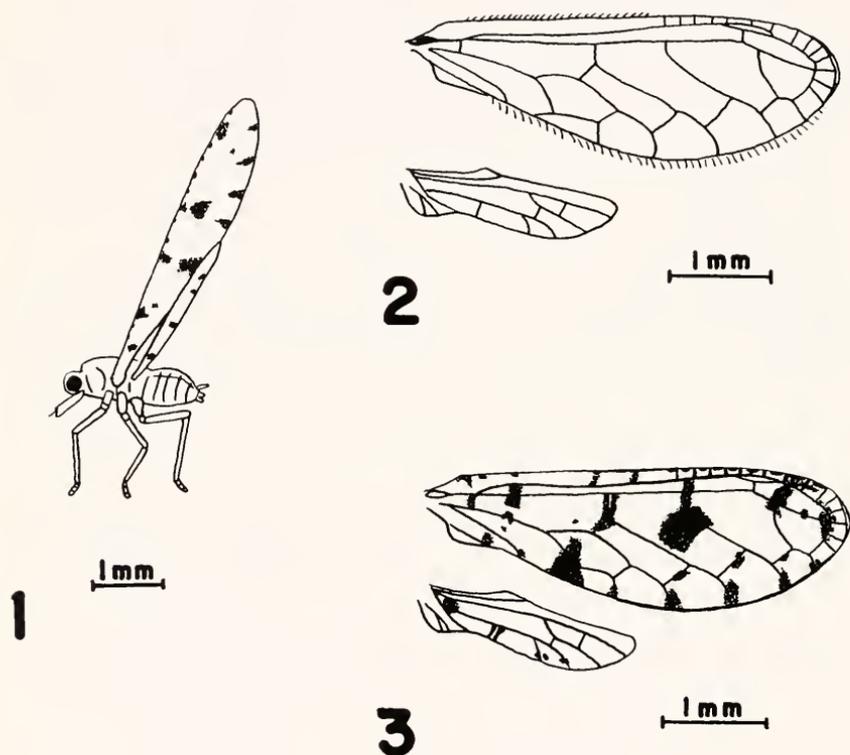


Fig. 1. Male *E. harti*, lateral aspect, showing "wings up" posture.

Fig. 2. Venation of front and hind wings of a female *E. harti*. Note the row of waxy scales along the costal margin and the fringe of wax along the posterior margin, present in fresh specimens only.

Fig. 3. Fully developed spotting pattern of *E. harti*. The dark areas along the costal and posterior margins and along the radius are rosy red; other spots are fuscous.

Fig. 520 (his Fig. 23 agrees closely). Ball (1928) called this discrepancy to Metcalf's attention, with Metcalf (1928) replying that the two figures were drawn from the type specimen, which he no longer had. The wing spotting pattern is variable, with smaller spots sometimes absent; Fig. 3 shows a fully developed pattern. Fennah (1952) characterized *Sikaiana* (which he synonymized with *Euklastus*) as having hind wings $1/3$ the length of the front wings. In my series they are nearly $1/2$ as long.

ACKNOWLEDGMENT

Dr. James P. Kramer, SEL-USDA, Smithsonian Institution, Washington, D.C., determined the specimens and provided other assistance.

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Continued from page 48

The acid test will be whether journal editors require authors to conform to the new authority. If so, there will be massive complaint; if not, massive confusion. Opposition to name changes should be based on something besides nostalgia, but there is no denying they hurt, especially in such large doses. They have been so frequent in the birds that any sane ornithologist has long preferred the common names, which are much more durable. (Even there, the American Ornithological Union changes *them* too to bring them into conformity with new splits and lumps, but rarely are entirely new coinages sprung.) Alexander B. Klots summed it up wryly in the *Field Guide to the Butterflies* when he noted that the male Monarch must smell just as sweet to his lady, whether we call him *Anosia* or *Danaus*. For the record, he's still *Danaus* in this volume.

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CREATING AND MAINTAINING CULTURES OF *CHIRONOMUS TENTANS* (DIPTERA: CHIRONOMIDAE)¹

Zenaida Batac-Catalan, David S. White²

ABSTRACT: A modified procedure for continuous culture of *Chironomus tentans* Fabricius, which requires equipment generally available in biological laboratories, is presented. The substrate on which the larvae are reared consists of acetone-treated and boiled paper towels. Liquefied vegetable diet is used for more uniform distribution of food in the culture.

Methods exist in the literature for rearing and maintaining cultures of several genera and species of Chironomidae (Biever 1965, Yount 1966; Credland 1973; Downe and Caspary 1973; Gallepp 1979; also see reviews by Fittkau et al. 1976; Merritt et al. 1978) including *Chironomus tentans* (Sadler 1935; Hall et al. 1970). Major difficulties in methodology have been both biological (usually low survivorship) and physical. Even the best methods require construction of special tanks and cages and then may take a considerable period of trial and error through a lack of specific detail in published methods. It is not unusual that a year or more may elapse before some methods produce enough individuals for experimental needs.

Chironomus tentans, a hardy species, has proven ideal in ecological and physiological studies, as a toxicological test organism in the laboratory, and may be used as a food source for other aquatic organisms. In designing the methods used, we have relied on basic principles, hints from the literature and three years of our own trial and error. Equipment needed is minimal and generally available in most types of biological laboratories. The methods should be applicable to any of the tube-dwelling, filter feeding or grazing Chironomidae (Leathers 1923).

The quantities given below will create one "continuous" culture in a standard 38 l (10 gal.) aquarium. We do not recommend larger aquariums as they prove to be much less productive per unit area. Aquariums as small as 4 l (1 gal. glass jars) can be used effectively. One culture should yield up to 20 larvae per day. This is equivalent to 180 mg of 3rd instar or 300 mg of 4th larval instar.

Substrate: *C. tentans* prefers a soft, flocculent substrate (Sadler 1935) which can be artificially duplicated by ground and shredded paper toweling. To achieve suitable texture and to remove impurities, the paper is soaked in acetone and then boiled. If the chironomid larvae are to be used in tests with

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²Great Lakes Research Division and School of Natural Resources, 1081 NU, University of Michigan, Ann Arbor, MI 48109. Contribution No. 327 from the Great Lakes Research Division.

toxic organic compounds, any residual acetone left in the toweling will affect the results even if present only in trace amounts. In this case all the acetone must be removed by keeping the paper in boiling water for at least 48 hours with four or five complete changes of water. It may be desirable to process large batches of paper at one time which then can be kept frozen until needed (R. Mazzone, pers. comm.).

Soak 12 sections (approx. 50 gms) of Scott[®], Nibroc[®] or an equivalent type of brown paper hand towel (26x10 cm folded two-ply) in enough acetone to keep them wet in a closed glass container for at least 30 minutes. Squeeze out the acetone and replace it with a fresh amount for a second and third 30 minute period. If a Soxhlet acetone extractor is available, the acetone may be reused. Rinse the towels in distilled water or carbon-filtered water four or five times until the strong odor of acetone is removed. Reboil the paper in distilled or carbon filtered water for 1 hour or until most of the color is removed — brown towels will remain a light tan. Finally, cut or tear the towels into smaller pieces and shred to a coarse pulp using a blender.

Aquarium assembly: A simple aquarium and adult capture system is given in Fig. 1b. The aquarium is of a standard 38 l (10 gal.) size measuring approximately 26x41x21 cm. The bag (1-2 mm coarse mesh cloth) will effectively contain emerging adults even when loosely fitted to the aquarium. Access to the inside of the bag is through two overlapping flaps that may be closed and fastened by a few pins. Strings attached to the four corners are tied to any fixed structure above the aquarium to hold the bag in place.

Starting cultures: In a 38 l aquarium, place 10 l of carbon-filtered or conditioned tap-water (water exposed to the atmosphere and aerated for 3-4 hours.) Add the shredded towel, 1 ml of prepared food (see below), and mix thoroughly. Allow 1 hour of settling time which should produce a substrate layer 2.5-4.0 cm thick. Carefully add enough additional water to create a 3 cm clear layer over the substrate. If any substrate is resuspended during one of the steps, allow time for it to resettle. The air supply to the tank should be at a rate that does not resuspend the substrate. This may be done by suspending an airstone at a level just below the surface of the water. (Fig. 1b). Two or three egg masses obtained by the method below may now be placed very gently on the surface of the substrate.

Food and feeding: Several types of food have been used in maintaining larval Chironomidae with varying degrees of success (Biever 1965). We have chosen the following composition because it can be liquified and thus more uniformly distributed in the culture. Food is prepared by blending 20 gm "Tetra[®] Conditioning Food, Vegetable Diet for Tropical Fish" with 200 ml distilled or carbon-filtered water. Prepared food should be kept

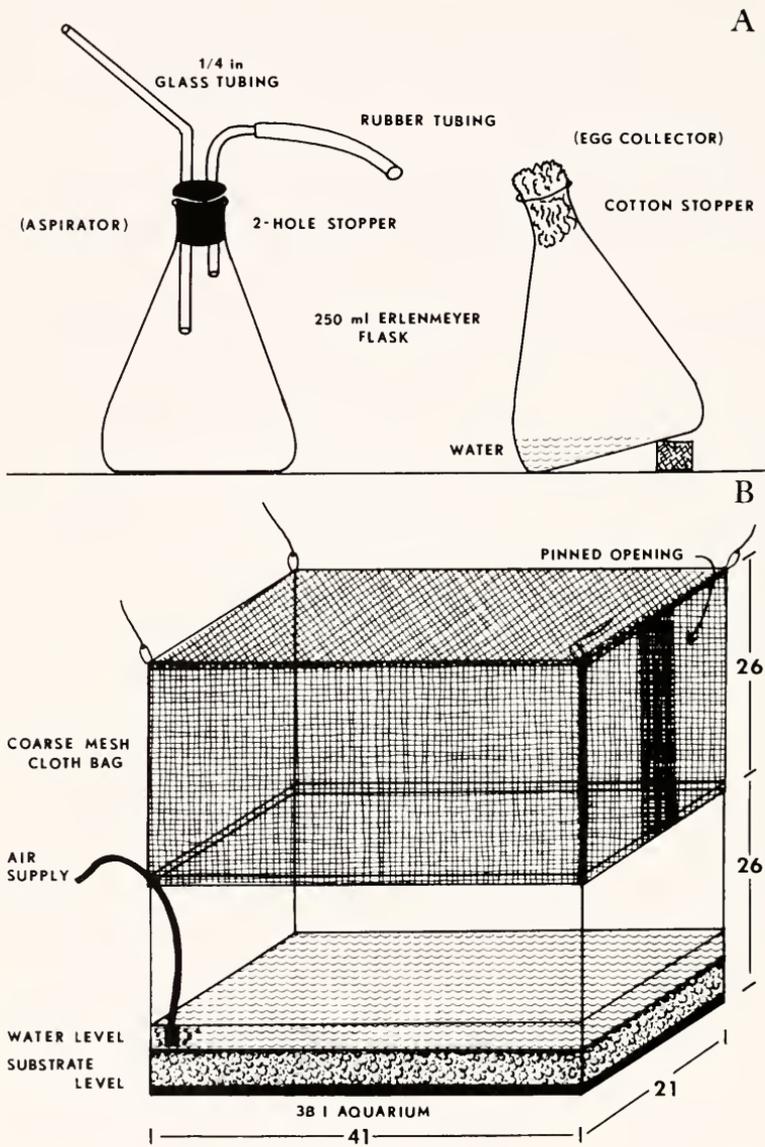


Fig. 1. Equipment employed for forced matings and egg collection of *Chironomus tentans* (A), and oblique view of established culture aquarium with adult capture bag (B), measurements for aquarium and bag are in centimeters.

refrigerated. Shake the mixture well and add about 1 ml at the start of each culture and after every change of water. The amount of food added depends on the density and age of the larvae. If too much food has been added, the water will appear cloudy the next day. If the water remains cloudy, it should be replaced.

Maintaining cultures: Because nutrients and byproducts build up quickly, at least part of the water should be changed every 4-7 days. Surface water is siphoned off down to a level just above the substrate. Freshly prepared water plus 1 ml of food is added slowly until the original depth is reached.

Continuing and starting new cultures: At 21 C, egg masses hatch 2-3 days after deposition, 1st instars appear in 3-4 days, 2nd instars in 6-8 days, 3rd instars are present after 12-14 days, 4th instars appear around the third week, and adults begin to emerge after 4-5 weeks. The generation of larvae will be continuous to some degree if left undisturbed because a small percentage of the adults will mate and some egg masses will be deposited in the culture. To maintain healthy cultures, a more forced type of mating is recommended. Adults are aspirated into a dry 250 ml Erlenmeyer flask (Fig. 1a) which is then loosely stoppered with cotton (Fig. 1a). Three or four pairs of males and females should produce enough eggs to begin a new culture. Adults are left to mate in the dry flask for several hours, then a volume of 50 ml of conditioned water is gradually added. The flask is set at a slight angle so that most of the water is at one side. Eggs are deposited before dawn, so the age of the mass can be determined. Eggs may be used to restock old cultures, start new ones, or used in experiments that require this life stage. A new egg mass should be added to ongoing cultures every 2-3 days for maximum harvest and emergence rates.

If maintained as above, a culture should be productive for about 6 months. After that time the old culture should be discarded.

ACKNOWLEDGMENTS

We wish to thank J. Kawatski of LaCrosse, Wisconsin for supplying the original stock of *Chironomus tentans*. Jarl Hiltunen of the U.S. Fish and Wildlife Service, Ann Arbor, and Clifford Rice and Michael Winnell of the Great Lakes Research Division critically reviewed the manuscript and their comments are greatly appreciated.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

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CROMWELL ROAD, LONDON, SW7 5BD

ITZN 11/4
(A.N.(S.) 121)

12 March, 1982

The Commission hereby gives six months' notice of the possible use of its plenary powers in the following cases, published in the *Bulletin of Zoological Nomenclature*, volume 39, part 1, on 11 March, 1982, and would welcome comments and advice on them from interested zoologists. Correspondence should be addressed to the Secretary at the above address, if possible within six months of the date of publication of this notice.

Case No.

- 2067 *Thrips rufa* Haliday, 1836 (Insecta, Thysanoptera, Thripidae): proposed ruling that this is a nomenclaturally valid name for the type species of *Aptinothrips* Haliday, 1836.
- 2169 *Phrynus* Lamarck, 1801 (Arachnida, Amblypygi): proposed conservation.
- 2305 *Agrotis redimicula* Morrison, 1875 (Insecta, Lepidoptera): proposed conservation from 1874.
- 2346 *Buprestis nana* Paykull, 1799, *non* Gmelin, 1790 (Insecta, Coleoptera): proposed conservation.
- 2351 *Papilio fatima* Fabricius, 1793 (Insecta, Lepidoptera): request for conservation under the plenary powers.
- 2355 *Attus otiosus* Hentz, 1846 (Araneae, Salticidae): proposed conservation under the plenary powers.

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BOOK REVIEW

Otte, D., 1981 *The North American Grasshoppers*. Vol. I *Acrididae Gomphocerinae and Acridinae*. Harvard University Press. 275 pp., 76 figs., 16 pls., maps. Price \$45.00.

The historically long overdue and eagerly awaited first volume of this three volume work has now appeared. Volume I covers forty-four genera in the subfamilies Gomphocerinae and Acridinae, a total of 127 species. Volume II will deal with a special favourite of Dr. Otte's, the Oedipodinae, while volume III will cover the Melanoplinae, Romaleinae and other similar groups. To produce a popular but accurate work for identifying a group of organisms inhabiting an area as great as Canada, the United States and Central America as far east as the Gulf of Panama is a daunting task. To the field naturalist the book must offer a means of quick identification with keys and clear illustrations. Equally, professional biologists studying ecology or physiology may criticize oversimplistic approaches and may demand details such as synonymic lists. To include these, however, may clutter the text making the book as unaesthetic and difficult to read as are most taxonomic papers. Dan Otte threads his way neatly through these difficulties and emerges with a beautifully produced book, profusely illustrated with a wealth of line drawings in the text and colour plates which are made by his skillful use of watercolour wash, ink and pencil. The colour plates are a particular triumph in this volume, since they present a soft natural look while subtly caricaturing the insects to highlight the diagnostic features in a way which a photograph seems unable to do.

Before the advent of this volume nothing of real worth had been produced for North America as a whole. The grasshopper faunas of the U.S.S.R., Europe including the Mediterranean, Africa, Madagascar, India, southeast Asia and Australia were however already covered by faunal works, but their quality is very variable. The only modern works are those on Europe (Harz, 1975) and Madagascar (Dirsh, 1962a, 1962b, 1963; Dirsh and Descamps, 1968). If they were works intended for widespread use they all suffer from being over technical. Only in the treatises on the fauna of Madagascar and Africa (Dirsh, 1965) are the illustrations of acceptable standard. Several of these books are hopelessly out of date, this being especially the case in the Kirby (1914) volume on the fauna of India. Dr. Otte sets new and very high standards which it is to be hoped will be emulated by future authors. For South America a growing body of work by Roberts, Descamps and Amedegnato will eventually provide the means by which a synthetic work can be compiled. At the revisionary stage, however, taxonomic treatment does not lend itself readily to popularization, since many of the procedures agreed to be necessary internationally, hinder the straight forward assembling of a recognition handbook. The new volume is a skillful compromise between a sufficiency of technical background and the clarity and brevity necessary to make a book which will appeal to a wide public, naturalists, laymen and professionals alike.

"The North American Grasshoppers" is revolutionary in having an author with the wits to take the study to a biogeographically realistic limit, the Gulf of Panama and West Indies, rather than the totally parochial and biologically meaningless political boundary between Mexico and the United States, which had been the cut-off line used by earlier authors. The introduction is an excellent pithy mix of information and warning. Where keys are not essential, here as elsewhere in the book, easily comparable, standardized, lists of characters are given. Text figures are inserted into the keys at the point they are needed. The colour plates are so outstanding that with some familiarity with the subfamily position, most species can be identified from the illustrations alone. Gone too are key couplets spread over acres of text. Technical matters such as type designation, synonymy and new taxonomy, are listed in appendices at the end of the book, leaving the text clear and uncomplicated. The treatment of each species includes sections on distribution (with map), recognition, habitat, behavior and life cycle. A list of the main references follows.

Among some of the major points of interest accented by the author is the loss in six species of *Orphulella* of their stridulatory pegs, a feature which in the past would have placed them in the Acridinae. *Stethophyma* is put in the Gomphocerinae and he draws attention to the special position of the *Hyalopteryx* genus group within the Acridinae. Dirsh (1975) has already drawn attention to the heterogeneous nature of many subfamilies such as the Acridinae. No doubt further regrouping of genera will be needed in the near future in other sections of the Acridinae.

Future volumes, will undoubtedly be as desirable as this one. The band-wing grasshoppers of the *Oedipodinae* are as colourful as butterflies and will present the author with a golden opportunity to indulge his artistic talents. The final volume will be the greatest challenge, since the many *Melanoplus* species of North American are at present most readily identified using the male genitalia and no one has yet analyzed their external characteristics in order to provide reliable key characters. Since the Romaleinae of Central American include some of the largest and most colourful grasshoppers in the world and will be illustrated in volume III, this will make the complete publication a real collectors item. The entire book will undoubtedly act as spur to advance in the study of physiology, ecology and genetics within groups of related genera. This gives North American biologists a chance to advance acridological science in a way which is otherwise only available to entomologists in the tropics, where working conditions and access to species are much more difficult.

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 ———, 1962b, *Ibid.* II Acrididae, Acridinae. *Bull. Brit. Mus. (nat. Hist.) Ent.*, 13: 243 - 286, 21 figs.
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 Dirsh, V.M. and Descamp, M., 1968 *Faune de Madagascar 26. Insectes Orthopteres Acridoidea. Pyrgomorphidae et Acrididae*. 312 pp., 132 figs. ORSTOM & CNRS, Paris publ. ausp. Gouvernement de la Republique Malgache.
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- 2364 *Simulium amazonicum* Goeldi, 1905 (Diptera, Simuliidae): proposed suppression of syntypes and designation of neotype.
 2369 *Damalis* Fabricius, 1805 (Insecta, Diptera): request for designation of type species.
 2320 *Aphelinus mytilaspidis* Le Baron, 1870 (Insecta, Hymenoptera, Aphelinidae): proposed conservation.

R.V. MELVILLE
Secretary

When submitting papers, all authors are requested to (1) provide the names of two qualified individuals who have critically reviewed the manuscript *before* it is submitted and (2) submit the names and addresses of two qualified authorities in the subject field to whom the manuscript can be referred by the editor for final review. All papers are submitted to recognized authorities for final review before acceptance.

Titles should be carefully composed to reflect the true contents of the article, and be kept as brief as possible. Classification as to order and family should be included in the title, except where not pertinent. Following the title there should be a short informative abstract (not a descriptive abstract) of not over 150 words. The abstract is the key to how an article is cited in abstracting journals and should be carefully written. The author's complete mailing address, including zip code number, should be given as a footnote to the article. All papers describing new taxa should include enough information to make them useful to the nonspecialist. Generally this requires a key and a short review or discussion of the group, plus references to existing revisions or monographs. Illustrations nearly always are needed. All measurements shall be given using the metric system or, if in the standard system, comparable equivalent metric values shall be included. Authors can be very helpful by indicating, in pencil in the margin of the manuscript, approximate desired locations within the text of accompanying figures, tables and other illustrations.

Illustrations: For maximum size and definition, *full page* figures, *including legends*, should be submitted as nearly as possible in a proportion of 4/6. Maximum size of printed illustration, including all legends, is 4½ x 6½ inches. Authors will be charged for all text figures and half-tones at the rate of \$6.00 each, regardless of size.

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(Continued on inside of back cover)

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THE EGG OF THE CADELLE, *TENEbroIDES MAURITANICUS* (L.) (COLEOPTERA: TROGOSITIDAE): FINE STRUCTURE OF THE CHORION¹

Richard T. Arbogast², Richard V. Byrd²

ABSTRACT: The chorion of the cadelle, *Tenebroides mauritanicus* (L.), egg was studied by scanning and transmission electron microscopy. The egg is elongate fusiform (1.18 x 0.30 mm), often slightly curved. The surface is covered by closely-spaced excrescences that constitute an interrupted outer layer of the chorion about 0.64 μm thick. Each excrescence consists of a globular electron-dense mass supported on electron-lucent trabeculae. The excrescences arise from a fibrous or crystalline layer of chorion about 0.19 μm thick. The chorion is devoid of aerophyles and lacks an air-filled intrachorionic network. There is normally a single micropylar opening on the anterior end of the egg, and this opening is usually surrounded by a reticulate pattern of petal-shaped or polygonal cells.

The cadelle, *Tenebroides mauritanicus* (L.), is a cosmopolitan pest of stored-grain and grain products. Its egg has been described briefly and figured by Back and Cotton (1926) and by LeCato and Flaherty (1974), but there have been no detailed studies of its chorionic structure, nor have there been any such studies of other trogositid eggs. The electron microscope study reported here was conducted as part of a project undertaken to characterize the eggs of stored-product insects and facilitate their identification.

Materials and Methods

Eggs were collected by confining adult beetles in petri dishes with rolled oats to which a small quantity of agar had been added to maintain moisture. Female cadelles will deposit their eggs loosely in food material, but they show a preference for inserting them in cracks and crevices and will oviposit more readily if such oviposition sites are available. Accordingly, each petri dish was provided with an oviposition block consisting of a small piece of file card sandwiched between two pieces of rigid plastic (2 to 3 cm square) held together with a rubber band. The card served to hold the edges of the plastic squares apart, and females oviposited readily in the crevice between them.

Eggs were removed from the blocks, washed by gentle agitation in a 1% solution of Triton X-100[®], rinsed in distilled water, and fixed overnight in

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²Stored-Product Insects Research and Development Laboratory, Agr. Res. Serv., USDA, P.O. Box 22909, Savannah, GA 31403.

1% osmium tetroxide in Millonig's buffer. For examination in the scanning electron microscope (SEM), the eggs were then rinsed in distilled water, air dried, mounted with double-sided tape on SEM stubs, and sputter coated with gold. They were examined in an ISI, M-7[®] SEM at 15 kV. Approximately 100 eggs were examined. Length and width were determined from a sample of 20 eggs. Measurements were made on the display screen of the microscope at X 50. Measurements are given as means \pm standard deviation.

For examination by transmission electron microscope, the eggs were rinsed in Millonig's buffer after fixation and dehydrated in a graded series of water-ethanol solutions followed by ethanol and propylene oxide. Initial infiltration in a 1:1 mixture of propylene oxide and embedding resin (Araldite 6005[®]) overnight was followed by two infiltration steps in pure resin, the first for 5 hrs. and the second overnight. After infiltration, the eggs were transferred to resin which was then cured at 48°C overnight. Sections were cut using a glass knife on a Porter Blum MT-2B[®] ultramicrotome and stained by flotation of grids on a 1% solution of uranyl acetate in water for 10 min. followed by flotation on Reynold's lead citrate for 3 minutes. The sections were examined in a Phillips EM-200[®].

Results and Discussion

The egg of the cadelle is slender ($1.18 \pm 0.05 \times 0.30 \pm 0.01$ mm), elongate fusiform, often slightly curved, opaque, and milky white in color (Fig. 1). When the egg is viewed by reflected light with a light microscope, it appears smooth and shining with a faint iridescence when illuminated from certain angles.

Examination of the egg at X 1,000 to 2,000 by SEM revealed a rough, granular surface texture (Fig. 2, 3). Higher magnification (Fig. 4, 5) showed that this texture is produced by closely-spaced excrescences of the surface which constitute an interrupted external layer of chorion about $0.64 \mu\text{m}$ thick (Fig. 6). Each excrescence consists of a globular, electron-dense mass supported on electron-lucent trabeculae (Fig. 5, 6). The surface of the chorion between excrescences is marked by tubercles similar in size to the globules that make up the electron-dense masses (Fig. 5). The excrescences and tubercles arise from a fibrous layer of chorion about $0.19 \mu\text{m}$ thick (Fig. 6). In thin sections, the fibers of this layer appear as bands with a periodicity of about 114 \AA oriented parallel, perpendicular, or at various angles to the surface of the chorion (Fig. 6, 7). In a survey of 45 species, Furneaux and MacKay (1972) found banding of this sort in the chorion of insects from six orders (Orthoptera, Odonata, Neuroptera, Hemiptera, Homoptera, and Coleoptera). They pointed out that these patterns suggest a crystalline arrangement of units which are about the same size as protein molecules

and showed by chemical analysis that the crystalline material is indeed protein. In the cadelle egg, there is a homogeneous layer about $0.06 \mu\text{m}$ thick beneath the fibrous chorion (Fig. 6, 7). The appearance of this layer in



Figs. 1-3. Egg of *Tenebroides mauritanicus*. a. Lateral view (X 55). 2. Anterior pole showing pattern of cells in the micropylar area (X 870). 3. Detail of the micropylar area showing the single micropylar opening (arrow) (X 1,755).

electron micrographs suggests that it consists of wax or other lipid. The vitelline membrane (Fig. 7) and serosal cuticle lie beneath this layer but usually become widely separated from it during fixation and dehydration.

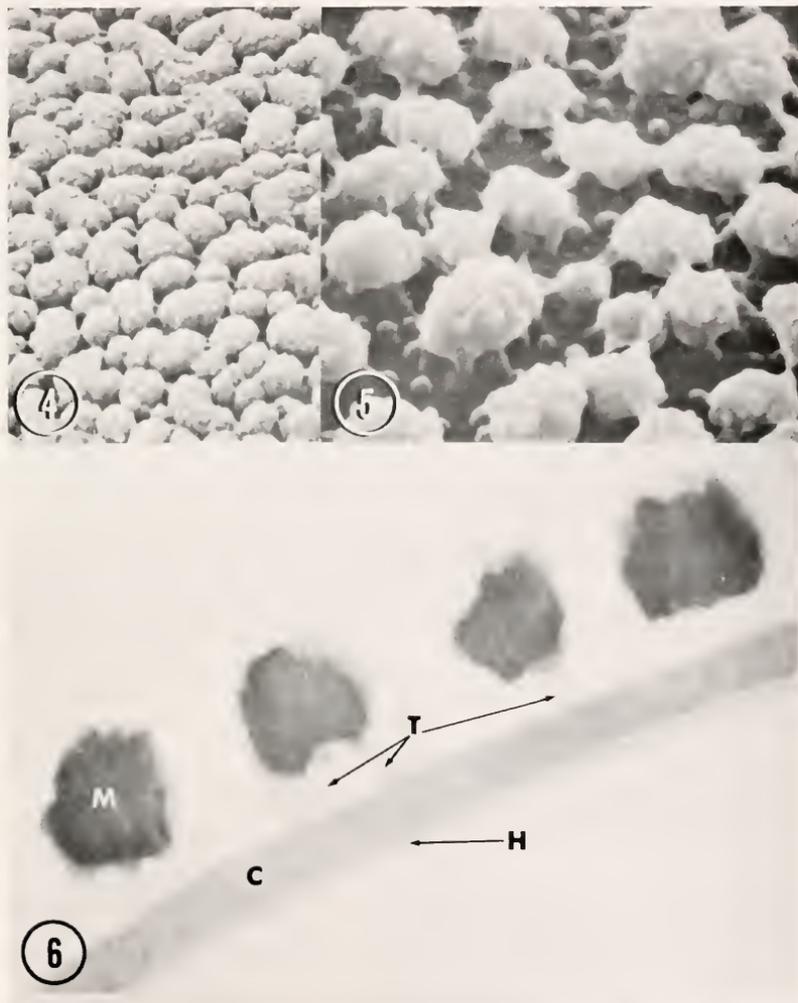
The chorion of the cadelle egg is devoid of aeropyles and lacks an air-filled intrachorionic meshwork. Apparently gases are exchanged directly through the thin shell and through the micropyle.

There is normally a single micropylar opening about $2\ \mu\text{m}$ in diameter near the anterior pole (Fig. 3), but a few eggs were observed in which there were two. The anterior end of the egg is marked by a reticulate pattern of petal-shaped or polygonal cells which fades out rapidly toward the equator and disappears a short distance from the pole. This pattern may be well-defined and more or less symmetrical about the micropylar opening (Fig. 2) or it may be faint and asymmetrical (Fig. 3). In a few eggs, it was barely perceptible or absent.

There is a considerable variation among beetles, even within families, in the complexity of chorionic structure. Some beetle eggs, such as those of certain staphylinids, have a thick chorion (10 to $>50\ \mu\text{m}$ thick) with elaborate respiratory systems of aeropyles and intrachorionic air spaces (Hinton, 1981). At the other extreme, the eggs of *Dermestes maculatus* DeGeer and *Dermestes ater* DeGeer (Dermestidae) lack a chorion and are enclosed only by the vitelline membrane (Furieux and MacKay, 1972). The egg of the cadelle is of a relatively simple type. In several respects it resembles the egg of the meloid beetle *Lytta viridana* LeConte described by Sweeney et al. (1968). Like the cadelle, the chorion of *L. viridana* is thin (0.2 to $0.3\ \mu\text{m}$ thick) and lacks aeropyles and a intrachorionic meshwork. Also, as in the cadelle, there is a homogenous layer, possible wax or other lipid, beneath the chorion, although this layer is thinner (100 to $150\ \text{\AA}$) than in the cadelle. The shell of *L. viridana*, however, consists only of a crystalline layer: there is no outer layer of excrescences as in the cadelle. In this respect the cadelle egg is more elaborate, but is simpler with respect to micropylar structure. The micropylar apparatus of the cadelle normally consists of a single unguarded opening near the anterior pole. That of *L. viridana* consists of a ring of openings around the anterior pole, each of which is covered by a U-, V-, or Y-shaped hood opening toward the pole (Sweeney et al., 1968; Church et al., 1970).

The chorion of the cadelle egg bears a striking resemblance to that of the psychid moths, *Luffia ferchaultella* Steph. and *Fumea casta* Pallas, as described by Chauvin and Barbier (1974). The eggs of these moths are unusual among Lepidoptera in the morphology and thinness of the chorion. The surface is covered by closely-spaced, nearly spherical papillae ranging from 0.2 to $0.5\ \mu\text{m}$ in diameter. These rest upon trabecula-like supports arising from a thin ($0.08\ \mu\text{m}$ thick) homogeneous layer. Thus, the outer layer of chorion is discontinuous as it is in the cadelle. Also as in the cadelle,

there is a homogenous layer, possible lipid, as much as $0.2\ \mu\text{m}$ thick beneath the chorion. Chauvin and Barbier pointed out the similarity between the chorion of these moths and that of the mosquito, *Culex pipiens* L., described by Hinton (1968) and interpreted as a respiratory plastron. They



Figs. 4-6. Egg of *Tenebroides mauritanicus*. 4. Portion of chorion near equator showing microtexture of the surface (X 4,870). 5. Detail of microtexture in the same region (X 14, 415). 6. Thin section of chorion (X 40, 420) showing globular masses (M) and trabeculae (T) of excrescences, the fibrous or crystalline layer of the chorion (C), and the homogeneous layer (H) beneath the chorion.

noted that although psychid eggs are not covered by water under natural conditions, the morphology of their chorion might be an adaptation to the high humidity which must exist within the pupal exuviae in which the eggs are deposited. Similarly, the chorion of the cadelle egg may be an adaptation to an existence in cracks and crevices where the egg could become covered with a film of water.

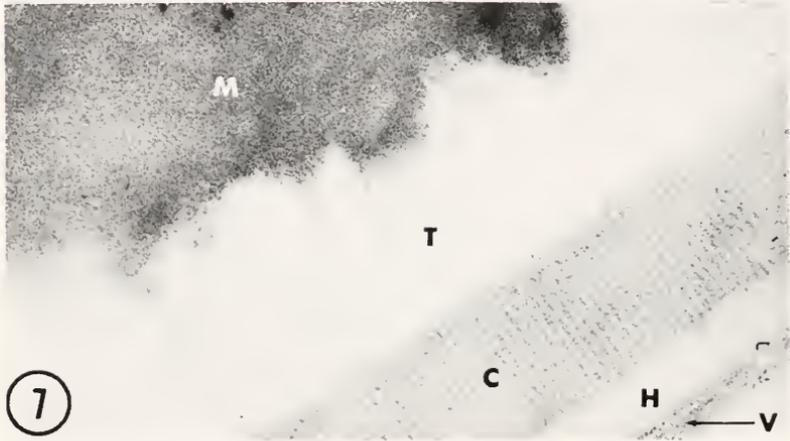


Fig. 7. Egg of *Tenebroides mauritanicus*: thin section of chorion (X 125,400) showing a portion of the globular mass (M) and trabeculae (T) of an excrescence, the fibrous or crystalline layer of the chorion (C) with banding perpendicular to the surface, and the homogeneous layer (H) and vitelline membrane (V) beneath the chorion.

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NOTES ON BIOLOGY OF *HYBOMITRA DAECKEI* (HINE) (DIPTERA: TABANIDAE)^{1,2}

Roy K. Sofield, Elton J. Hansens³

ABSTRACT: *Hybomitra daeckei* (Hine) was observed ovipositing on *Scirpus maritimus* L. and *Spartina alterniflora* Loisel. on a New Jersey salt marsh. Egg masses were also found on *Phragmites* and *Distichlis*. Larvae from these eggs were maintained as long as one year but did not pupate. Males hovered over the salt marsh in the morning and prior to hovering of *Tabanus nigrovittatus* Macquart.

Hybomitra daeckei (Hine) is a coastal species of horse fly which is found from Maine to Georgia (Thompson 1967). This is an early season species and has been observed during May and June in New Jersey. *H. daeckei* seldom bites humans but can be a significant pest on livestock (Pechuman 1972).

Hansens (1952) reported that adult *H. daeckei* emerge 7 to 10 days before *Tabanus nigrovittatus* Macquart, and may be useful in forecasting the emergence of *T. nigrovittatus*. The larval and pupal stages of *H. daeckei* were described by Tesky and Burger (1976) from a single specimen collected "on a small island in a large, shallow body of impounded slightly brackish water" at the Chinocoteague National Wildlife Refuge. Additional references to the immature stages of this species have not been found.

In June 1979, approximately 10 *H. daeckei* were observed ovipositing on *Scirpus maritimus* L. and *Spartina alterniflora* Loisel. in a salt marsh near Cedarville, NJ. Most of the females were in a head down posture while ovipositing. The ovipositing females were usually very tolerant of an observer approaching and handling the plant on which the fly was ovipositing. Ovipositing flies were easily captured, and in some cases, continued ovipositing on the plant after being placed in a container. We also found 23 other egg masses of this species, mostly on *Scirpus maritimus* but also on *Phragmites communis* Trin., *Spartina alterniflora*, and *Distichlis spicata* (L.). The *Scirpus* was in an area dominated by *Spartina patens* (Ait.).

The egg masses were usually one tiered with the eggs at an angle of about 60 degrees from horizontal. We found five egg masses in 1980, four

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on *Scirpus* and one on *Phragmites*. Those on *Scirpus* were 43-58 cm from the marsh surface (mean of 50 cm) and the egg mass on *Phragmites* was at a height of 73 cm. All egg masses were 4.5-13 cm from the end of the blade (mean of 7.3 cm). The number of eggs in three masses ranged from 240 to 500 with a mean of 418 eggs. The eggs were white when laid but turned brown after several hours.

The eggs hatched 5 to 7 days after being laid. During the incubation period, the eggs were kept in snap cap vials or petri dishes with wet filter paper. Petri dishes were unsatisfactory because many of the larvae crawled out soon after the eggs hatched. Of the 278 neonate larvae maintained in the laboratory, only 12 survived for a year before being adventerly destroyed. Larvae reached the 7th to 11th instars in 5 months. The larvae were then incubated at 4°C for two months to simulate overwintering. The temperature was returned to 27°C and one larva reached the 13th instar but none of the larvae pupated.

While it is possible that the larvae require 2 years to mature, they appeared to be fully grown after only 5 months in the laboratory. The requirements for pupation of *H. daeckei* are not known but must be different from those of *T. nigrovittatus* which pupates readily in the laboratory. Possibly for this early season species, increasing photoperiod triggers pupation.

We observed male *H. daeckei* hovering on 6 separate days from 28 May to 18 June (Table 1). Most of the observations were made on a *Spartina patens* marsh close to the ecotone, but one male was observed hovering in a stand of *Phragmites*. The duration of hovering was 5 to 65 minutes with an average of 37 minutes each day. Hovering began when the ambient temperature was as low as 17.8°C. Each day, the *H. daeckei* males began to hover about one hour before *T. nigrovittatus* males. Both species were observed hovering simultaneously only once, for a period of about 4 minutes. The males hovered at about the same height as the top of the marsh vegetation. During total calm the males faced in any direction while hovering, but in a breeze they faced into the wind. Copulation was observed once. The flies coupled in midair and then landed on a blade of grass, end to end. The pair was collected for oviposition.

Additional investigations are needed to define the larval habitat of *H. daeckei*. Larvae of this species have not been reported from salt marshes despite extensive larval surveys on the marshes in Massachusetts, Connecticut, Long Island, New Jersey, North Carolina and other areas along the eastern coast (Meany et al. 1976, Magnarelli and Anderson 1978, Freeman and Hansens 1972, Dukes et al. 1974). Emergence traps have been used on New Jersey salt marshes, but have been unsuccessful in collecting *H. daeckei* (Rockel and Hansens 1970). This species seems to have a restricted larval habitat. Our information on oviposition sites may assist future investigators in defining the larval habitat of *H. daeckei*.

Table 1. Time (EDT) of male *H. daeckei* hovering on a salt marsh near Cedarville, NJ.

Date	Hovering Observed	
	start	finish
28 May 80	0935	0940
4 June 80	0820	0925
5 June 80	0815	0900
11 June 80	0850	0905
13 June 80	0725	0825
18 June 81	0725	0745

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A POPULATION MODEL FOR FLEAS OF THE GRAY-TAILED VOLE, *MICROTUS CANICAUDUS* MILLER¹

Richard G. Robbins², G. David Faulkenberry³

ABSTRACT: Negative binomial probability distributions are successfully fit to observed frequency distributions of fleas on the gray-tailed vole, *Microtus canicaudus* Miller, in western Oregon. The host flea population is thus shown to be contagiously dispersed.

This is the second in a projected series of papers on the population dynamics of the fleas that parasitize the gray-tailed vole, *Microtus canicaudus* Miller, a field mouse that occurs in grassy, uncultivated areas between the Cascade and Coast Ranges of western Oregon and Washington. Earlier (Faulkenberry and Robbins, 1980), the odds ratio was used to measure the degree of association between different flea species on this vole. However, ecologists also recognize the predictive value intrinsic to a mathematical description or model of the dispersion of organisms in space, and in medical entomology such spatial relationships between hosts and their parasites are often expressed by the negative binomial (or Pascal) distribution (Bliss, 1953; Crofton, 1971a, b). The negative binomial is a theoretical frequency distribution or probability distribution that may be fit to frequency distributions observed in nature. Thus, Fisher (1941) successfully fit the negative binomial to Milne's (1943) frequency distributions for the tick *Ixodes ricinus* (Linnaeus) on sheep in England, thereby mathematically describing the dispersion of the parasite population on a particular host. More recently, Easton (1973) and Easton and Goulding (1974) fit the negative binomial to data for *Ixodes angustus* Neumann and larval trombiculid mites (chiggers) on various hosts in western Oregon. Yet, with the possible exception of Williams' (1964) work on J.L. Harrison's data for *Xenopsylla astia* Rothschild and *X. cheopis* (Rothschild) on the murine rat *Bandicota bengalensis* (Gray) in Rangoon, Burma, the present paper is the first published record wherein the negative binomial is successfully fit to data for fleas.

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Application of the Negative Binomial Distribution

Specifically, the negative binomial can arise (1) as a result of a series of exposures to parasites in which each exposure is random and the chances of acquiring parasites differ at each exposure, (2) as a result of nonrandom dispersion of parasites, (3) as a result of differences between individual hosts that affect the chances of acquiring parasites, and (4) as a result of a change with time in the chances of being parasitized (Crofton, 1971a). The negative binomial is described by two parameters, the mean and the exponent k , and is fit to contagious (over-dispersed or clumped) populations in which the variance always exceeds the mean. With combinatorial notation, the distribution takes the form:

$$p(x) = \binom{k+x-1}{k-1} (1-\theta)^x \theta^k \quad x = 0, 1, 2, \dots$$

where the mean is $k\theta/(1-\theta)$ and the variance is $k\theta/(1-\theta)^2$. When the dispersion parameter k is small, the degree of clumping is great and the variance is much larger than the mean, but as k increases the distribution approaches a Poisson series in which the variance equals the mean.

Among the many methods of estimating k from sample data are the following three given by Southwood (1978):

$$(1) \quad k = \frac{\bar{x}^2}{s^2 - \bar{x}}$$

$$(2) \quad \log \left[\frac{N}{n_0} \right] = k \log \left[1 + \frac{\bar{x}}{k} \right]$$

$$(3) \quad N \ln \left[1 + \frac{\bar{x}}{k} \right] = \sum \left[\frac{A_x}{k+x} \right]$$

where	\bar{x}	=	mean number of parasites per sample (host)
	s^2	=	variance
	N	=	total number of samples
	n_0	=	number of samples bearing no parasites
	\ln	=	Napierian logs
	A_x	=	the sum of all frequencies of sampling units bearing more than x parasites

Unless the mean is quite low, formula (1) is not reliable when $k \leq 3$, that is, when populations show a moderate degree of clumping. For this reason, formula (1) is usually used only to describe low density populations.

Formula (2) is applicable to most populations with very small means but to large ones only when there is extensive clumping. Generally, about one-third of the hosts must be free of parasites if the mean is below ten, and as the mean increases greater numbers of hosts must fall into the zero class. Formula (3) is considered a better estimator than either (1) or (2) but is also subject to bias when the mean is very small and k very large.

Once values of k have been obtained, the negative binomial population model can be fit in three ways to the observed frequency distribution. First θ is estimated by $k/(k + \bar{x})$, then expected frequencies are calculated by:

$$P_x = \frac{\gamma(k+x)}{x! \gamma(k)} \cdot \left(\frac{\bar{x}}{\bar{x}+k} \right)^x \cdot \left(\frac{k}{k+\bar{x}} \right)^k$$

where P_x is the probability of a host bearing x parasites and the values $x!$ and $\gamma(k)$ are obtained from tables of factorials and of log gamma functions respectively (Southwood, 1978). Expected and observed frequency distributions are compared by a chi-square which has three fewer degrees of freedom than the number of comparisons that are made. Chi-square comparisons are considered strongest when expected frequencies are at least 1.

Results and Discussion

Table 1 compares the k , chi-square, and degree of freedom values for negative binomial distributions fit to observed frequency distributions of *Atyphloceras multidentatus* (C. Fox), *Catallagia charlottensis* (Baker), and fleas collectively on 377 comparable voles taken from ecologically similar sites to the north, south, and west of Corvallis, Oregon (for an account of sampling techniques and a list of all flea species obtained during this study, see Faulkenberry and Robbins, 1980, or Robbins, 1976). Because formulas (2) and (3) for the calculation of k must be made to balance by the method of iteration, all models were generated by computer. In order to obtain the best possible fit, each of the three observed frequency distributions was assigned two values of G , the expected frequency below which all classes were pooled. Of course, in the case at hand, pooling was only possible when G was set at 1 because all classes had expected frequencies greater than 0. In addition, each distribution was subjected once to truncation by removal of the zero class, which is by far the largest class in every case. In Table 1 the best chi-square value in each category is underscored.

It is clear that the fleas of the gray-tailed vole are very contagiously dispersed. All three formulas for k led to the best fit an equal number of times and only once was the difference between expected and observed

frequencies significant at $P < 0.05$. On the other hand, the fit of the negative binomial to the frequencies for zero and one flea per host was seldom close — an indication of top-heaviness in these classes. Consequently, the best distributions were almost always truncated.

Table 1. Comparison of k , chi-square, and degree of freedom values for all negative binomial distributions.

	G = 1; not truncated	G = 0; truncated	G = 0; not truncated
<i>Atyphloceras multidentatus</i>	$k_1 = 0.41384$	$k_1 = 1.50700$	$k_1 = 0.41384$
	$X^2 = 2.1868355$	$X^2 = \underline{1.5863500}$	$X^2 = 2.8879404$
	df = 3	df = 7	df = 8
	$k_2 = 0.35500$	$k_2 = 2.08000$	$k_2 = 0.35500$
	$X^2 = \underline{1.8917037}$	$X^2 = 1.9245513$	$X^2 = \underline{2.5099838}$
	df = 3	df = 7	df = 8
	$k_3 = 0.36202$	$k_3 = 1.74250$	$k_3 = 0.36202$
	$X^2 = 1.9010235$	$X^2 = 1.6964298$	$X^2 = 2.5288784$
	df = 3	df = 7	df = 8
<i>Catallagia charlottensis</i>	$k_1 = 0.36196$	$k_1 = 0.46719$	$k_1 = 0.36196$
	$X^2 = 12.3286353$	$X^2 = 6.4885838$	$X^2 = 12.5538454$
	df = 6	df = 7	df = 8
	$k_2 = 0.45250$	$k_2 = 0.40000$	$k_2 = 0.45250$
	$X^2 = 12.3763963$	$X^2 = \underline{6.0815673}$	$X^2 = 12.7556870$
	df = 6	df = 7	df = 8
	$k_3 = 0.42405$	$k_3 = 0.40788$	$k_3 = 0.42405$
	$X^2 = \underline{11.8824064}$	$X^2 = 6.0885154$	$X^2 = \underline{12.1912021}$
	df = 6	df = 7	df = 8
All species	$k_1 = 0.50407$	$k_1 = 0.52748$	$k_1 = 0.50407$
	$X^2 = 14.7781608$	$X^2 = \underline{15.6730234}$	$X^2 = \underline{20.7273663}$
	df = 10	df = 17	df = 18
	$k_2 = 0.67375$	$k_2 = 0.70375$	$k_2 = 0.67375$
	$X^2 = 12.0033085$	$X^2 = 21.4046443$	$X^2 = 32.1796904*$
	df = 9	df = 17	df = 18
	$k_3 = 0.62230$	$k_3 = 0.62526$	$k_3 = 0.62230$
	$X^2 = \underline{11.6262368}$	$X^2 = 17.2498995$	$X^2 = 25.7152032$
	df = 9	df = 17	df = 18

*Significant at $P < 0.05$.

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This paper, like its predecessor, can truly be called a team endeavor, for its completion would not have been possible without the assistance of workers from several disciplines. We are especially grateful to Professor Gerald W. Krantz, Department of Entomology, Oregon State University, Corvallis, for providing the facilities to conduct this research. Sincere thanks are also due Dr. Emmett R. Easton, Plant Science Department, Agricultural Experiment Station, South Dakota State University, Brookings, and Dr. Wayne N. Mathis, Chairman, Department of Entomology, Smithsonian Institution, Washington, D.C., for their constructive reviews of the manuscript. Special appreciation is extended to Mr. Richard F. Hoyer, of Corvallis, who collected the voles used in this study. Dick is a first-class field naturalist with whom it was an honor to cooperate. Our thanks also to Dr. Edward J. Grafius, Department of Entomology, Michigan State University, East Lansing, for his patient instruction in the use of the OS-3 computer. Dr. Vernon J. Tipton and his colleagues at the Center for Health and Environmental Studies, Brigham Young University, Provo, Utah, kindly determined a synoptic series of the flea species discussed herein.

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NOTES ON NESTING BEHAVIOR OF *Ectemnius centralis* (CAMERON) (HYMENOPTERA: SPHECIDAE)¹

A. Hook²

ABSTRACT: Nesting behavior was recorded for the previously unstudied wasp, *Ectemnius centralis* (Cameron) in Texas. Female provisioned nests in decaying wood with an assortment of Diptera.

Ectemnius wasps are unusual in that they utilize diverse nesting habitats and prey on several insect orders (Bohart and Menke 1976). Most commonly they construct branching nests in rotten wood and prey on Diptera. This paper provides the first biological records for *Ectemnius centralis* (Cameron) which occurs in the southwestern U.S. and Mexico to Colombia and Trinidad.

Methods

Provisioning behavior and nest architecture were recorded from Kenedy Ranch, Kenedy Co., 5 mi. south and 10-15 mi. east of Sarita, Texas on 24 May 1979. Hunting behavior was observed during July 1980 along the Rio Grande River, near Castolon in Big Bend National Park, Texas.

Results and Discussion

Although I collected at various locations along the Rio Grande in Big Bend, *Ectemnius centralis* was only encountered between Castolon and Santa Elena Canyon, possibly because this area contained many fallen logs, a result of periodic flooding. Wasps were commonly observed hunting along the river bank, flying slowly past grass and seepwillow (*Baccharis* sp.). Females hovered next to such vegetation, then darted forward and grasped potential prey items, a hunting behavior similar to that reported for *Crabro argusinus* Packard (Matthews et al. 1979). Often prey were discarded, possibly because they were inappropriate, such as small bees.

Nests were located at Kenedy Ranch where females provisioned in a broken, dead limb of live oak (*Quercus* sp.). This horizontal branch was 60 cm in diameter, rested 50 cm above the ground, and had nest entrances

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located on the lower half. Provisioning was first noticed at 11:00 A.M., the wasps using pedal type 1 carriage (Evans 1962) when transporting prey to their open entrances. Two females were collected and their nests subsequently excavated. Nest A had 5 side burrows branching off a shallow main burrow, while nest B had 3 side burrows. Both nests were still being expanded. Side burrows ranged from 4.2 to 9.0 cm long including cell length. Considering 6 completed side burrows, 3 had 2 cells linearly arranged and 3 had single cells. This nest structure fits between "simple branched type" and "complex branched type" (Tsuneki 1960). Side burrows with completed cells were plugged with packed sawdust ranging from 1.7 to 4.8 cm long. Linear cells were separated by plugs ranging from 5 to 7 mm long. Cell dimensions ranged from 10 to 20 mm long by 5 to 11 mm wide. The number of prey in completed cells ranged from 4 to 7, ($\bar{x}=5.3$, $n=6$). Prey were stored in a cell until a full complement was obtained, then oviposition and prey arrangement followed. The egg was attached to the throat of a fly which was placed farthest into the cell, with the remaining prey facing head inward. An assortment of prey was identified as follows; Stratiomyidae: *Nemotelus trinotatus* Mel.; Bomblidiidae: undetermined; Sarcophagidae: *Blaesoxipha hamata* (Aldrich), *B. hunteri* (Hough), *Sarcodexia* sp.; Muscidae: *Orthellia caesarion* (Meigen), *Coenosia* sp.; Tachinidae: *Pseudomyothyria ancilla* (Wlk.), *Paralipse infernalis* (Tns.), *Spoggosia* sp.

Ectemnius centralis nesting biology is similar to that of the majority of *Ectemnius* species studies (Krombein 1963; Tsuneki 1960); that is nests are in rotten wood and the prey consists of Diptera. However, a number of species outside of North American are known to nest in the ground and to use other types of prey (Bohart and Menke 1976).

ACKNOWLEDGMENTS

I would like to thank J.E. Gillaspay for taking us to the Kenedy Ranch site and the authorities of the U.S. National Park Service at Big Bend for their support. R.M. Bohart, Univ. of California, Davis, identified the wasp while R.J. Gagne, C.W. Sabrosky and W.W. Wirth of I.J.I.P.I., USDA determined the prey. This research was supported by NSF Grant BNS 76-09319 to H.E. Evans and a Sigman Xi R.E.S.A. Grant-in-Aid of Research.

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**NEW RECORD OF *TANYTARSUS*
(*SUBLETTEA*) *COFFMANI* (DIPTERA:
CHIRONOMIDAE) FROM NORTH CAROLINA¹**

Thomas J. Wilda²

ABSTRACT: The midge *Tanytarsus (Sublettea) coffmani* Roback 1975 is reported from North Carolina for the first time. Measurements of pupal structures are given which are generally lower than those reported in the species description.

Three pupal exuviae of *Tanytarsus (Sublettea) coffmani* Roback 1975 were collected from a small unnamed tributary of the West Fork of the Rocky River in Iredell County, located in the southern Piedmont of North Carolina. These collections, taken in October 1978, represent the first actual record of the taxon in North Carolina. The specimens reported in Roback's (1975) species description as having been collected near Salem, North Carolina, were actually collected near Salem, Oconee County, South Carolina.

Ranges of measurements taken from the three pupal exuviae are presented in Table 1. The majority of these measurements are lower than those reported by Roback (1975). The long clear filament described by Roback (1975) as mesad of the anal combs was obvious on only one specimen. The specimens were deposited in Duke Power Company's Macroinvertebrate Reference Collection.

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Table 1. Measurements of pupal structures from this study and from Roback's (1975) species description. The numbers in parentheses indicate the number of specimens from this study on which the structures could be measured. Roback (1975) gave several measurements of pupal characters which are not presented here.

Pupal Structure Measured	Roback 1975	This Study
Overall length	2.4 mm	2.0-2.2 mm (3)
Respiratory organ		
Overall length	300-350 μm	252-280 μm (2)
Dimensions of Base	167-204 μm long 22 μm wide	99-120 μm long (2) 18 μm wide (1)
Length of longest apical filament	148-167 μm	130-180 μm (2)
Length of shortest apical filament	about 78 μm	67-72 μm (2)
Paired ovoid spine patches at apex of sternite VIII		
Dimensions	26 x 13 μm	15 x 8 μm to 25 x 12 μm (3)
Number of spinules in each patch	about 48	20 to 35 (3)
Distance between patches	0.11 - 0.23 segmental width	0.4 segmental width
Dark spurs on lateral comb of anal fin		
Number	4 - 7	4 - 6 (3)
Length	about 6 μm	about 6 μm (3)
Number of longer filaments on lateral comb of anal fins	3 - 5	2 - 4 (3)

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AN ANNOTATED LIST OF TRICHOPTERA OF SEVERAL STREAMS ON EGLIN AIR FORCE BASE, FLORIDA^{1,2}

S.C. Harris³, P.K. Lago⁴, J.F. Scheiring⁵

ABSTRACT: The distribution and seasonal occurrence of adult Trichoptera along three small streams within Eglin Air Force is presented. The trichopteran fauna was represented by 56 species, seven of which are undescribed.

The Florida panhandle is known to support a number of disjunct northern populations and endemic species of plants and animals (Neill, 1957), but studies of aquatic insects in the area have been few. Several caddisflies, including *Cheumatopsyche petersi* and *Agarodes ziczac*, are thought to be endemic to this region (Ross et al., 1971; Ross and Scott, 1974).

Eglin Air Force Base is located in the Florida panhandle in portions of Walton, Okaloosa, and Santa Rosa Counties (Fig. 1). Since the early 1970's, base personnel have been engaged in gathering baseline environmental information for the watersheds of the area. These watersheds are primarily sandhills with a pine-oak association. As part of this environmental program, a survey and analysis of the macroinvertebrate fauna of several streams on the base was initiated.

Three streams in the eastern half of the base, Rocky Creek, Ramer Branch, and Bull Creek (Figs. 1 and 2), were collected from 1978 to 1980. Rocky creek empties into Choctawhatchee Bay while Ramer Branch and Bull Creek are tributaries to Titi Creek which empties into the Shoal River. Five sites on the upper portions of Rocky Creek and two each on Bull Creek and Ramer Branch were sampled for Trichoptera. All sites, with the exception of site 3, were located in wooded areas with fairly heavy canopy. Site 3 was situated in an open area immediately below a small impoundment. The streams were small and clear with moderate streamflow. Substrates were primarily sand except at site 3 where the bottom consisted of sand and

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gravel. Water quality was good at all sites, although pH and mineral content were low (Table 1).

Adult Trichoptera were collected using UV light traps (BioQuip Universal Trap) situated on the stream banks. Traps were operated from dusk to dawn at approximately monthly intervals. Specimens were collected dry and later preserved in 80% ethyl alcohol.

Annotated List of Species

Trichoptera were represented in the study area by 56 species in 26 genera and 14 families. Information for each species includes collection site, collection dates, and number of adult male specimens collected(). Only males of the species were identified, except as noted.

Hydropsychoidea

Philopotamidae

Chimarra aterrima Hagen. Sites 3, 5, 6. 20 April, 8 June, 19 Sept. (4)

Chimarra florida Ross. Sites 1-5, 8, 9. 14 March-19 Sept. (51) Most (80%) of the specimens were collected at site 3. A possible distribution factor could be the high amount of gravel intermixed with sand at this site.

Chimarra n. sp. All sites. 14 March-19 Sept. (219) This species is a member of the *Chimarra socia* complex which is currently being revised by PKL, SCH, and R.W. Holzentel of Clemson University.

Wormaldia moesta (Banks). Site 3. 8 June. (1)

Psychomyiidae

Lype diversa (Banks). Sites 1, 3. 16 Aug., 8 Nov. (3)

Polycentropidae

Neureclipsis melco Ross. Sites 1, 3-5, 8. 14 March-11 May, 19 Sept. (6)

Nyctiophylax affinis (Banks). Sites 1, 2, 8. 11 May, 8 June. (4)

Nyctiophylax n.sp. Sites 1, 2, 4, 5, 7. 25 April-11 May, 19 Sept. (10) Material being described by PKL and SCH.

Polycentropus cinereus Hagen. Sites 1-3. 14 March-20 April. (8)

Polycentropus n.sp. Site 5. 11 May. (1) Material being described by PKL and SCH.

Hydropsychidae

Cheumatopsyche n.sp. All sites. 20 April-19 Sept. (78) Material being described by PKL and SCH.

Cheumatopsyche pasella Ross. Sites 1-3, 8. 20 May-8 June. (16)

Cheumatopsyche petersi Ross, Morse, and Gordon. Sites 1-5, 7. 14 April-8 June, 19 Sept. (66) All but three specimens were collected at the lower Rocky Creek sites.

Cheumatopsyche pettiti (Banks). Sites 1-4, 6-8. 11 May-8 June, 19 Sept. (26)

Cheumatopsyche virginica Denning. Sites 1-8. 14 March, 11 May-19 Sept. (36) The largest numbers of specimens were collected at site 3.

Diptectrona modesta Banks. All sites. 11 May-19 Sept., 8 Nov. (41)

Hydropsyche decalda Ross. Sites 1, 3. 14 March, 20 April-8 June, 8 Nov. (41)

Hydropsyche ellisoma Ross. All sites. 14 March-19 Sept. (250) Most of the specimens were collected at site 3 during March and April.

Hydropsyche incommoda Hagen. Sites 1, 3, 5. 11 May. (3)

Macronema carolina Banks. Sites 1-6, 8. 20 April-16 Aug., 8 Nov. (89 males, 103 females) Greatest number of specimens were collected at site 3, primarily during the spring.

Rhyacophiloidea

Rhyacophilidae

Rhyacophila carolina Banks. Sites 1, 6. 5 May, 19 Sept. (3) Previously known only from the southern Appalachians.

Hydroptilidae

Hydroptila hamata Morton. Site 3. 8 June. (1)

Hydroptila latosa Ross. Sites 1, 3-5. 20 April, 8 June, 8 Nov. (67) The greatest numbers (65%) were collected at site 3 during June.

Hydroptila quinola Ross. All sites. 25 April-8 June, 19 Sept. (41) As with *H. latosa*, most of specimens collected at site 3 during June.

Hydroptila remita Blickle and Morse. Sites 1, 5. 20 May. (3)

Mayatrichia ayama Mosely. Sites 3, 4, 7. 11 May, 8 June, 19 Sept. (6)

Oxyethira elerobi (Blickle). Site 1. 8 June. (1)

Oxyethira glasa (Ross). Sites 3, 5. 11 May, 8 June. (3)

Oxyethira janella Denning. Site 5. 8 June. (1)

Oxyethira novasota Ross. Site 5. 8 June. (1)

Oxyethira setosa Denning. Site 3. 8 June. (1)

Oxyethira zeronia Ross. Site 3. 11 May. (1)

Limnephiloidea

Phryganeidae

Banksiola concatenata (Walker). Site 1. 11 May. (1)

Brachycentridae

Brachycentrus numerosus (Say). Sites 1-5. 14 March-11 May, 8 Nov. (31)

Micrasema n.sp. All sites. 20 April-8 June. (45) Species being described by J.W. Chapin. Edisto Experiment Stat. South Carolina. The majority of the specimens were collected at site 3.

Limnephilidae

Pycnopsyche scabripennis Rambur. Sites 1-5. 8 Nov., 6 Dec. (72 males, 83 females) 90% of the specimens were collected at sites 1 and 2.

Lepidostomatidae

Lepidostoma sp. Site 4. 11 May. (1)

Sericostomatidae

Agarodes crassicornis (Walker). Sites 1, 3. 11 May. (4)

Agarodes ziczac Ross and Scott. All sites. 14 March-19 Sept. (202) Primarily restricted to the headwater portions of the streams.

Molannidae

Molanna ulmerina Navas. Site 4. 8 June. (1)

Molanna tryphean Betten. All sites. 14 March-19 Sept., 8 Nov. (18)

Calamoceratidae

Anisocentropus pyraloides (Walker). Sites 1, 2, 4, 6, 9. 25 April-11 May, 16 Aug.-19 Sept. (11)

Leptoceridae

Ceraclea maculata (Banks). Sites 1-3. 11 May-8 June. (5)

Ceraclea nepha (Ross). Sites 3, 5. 20 April, 11 May. (3)

Ceraclea protonepha Morse and Ross. Sites 2, 3, 5, 6, 8. 20 April-8 June. (13)

Ceraclea tarsipunctata (Vorhies). Sites 3, 5. 25 April-11 May. (28)

Nectopsyche candida (Hagen). Site 3. 11 May-8 June. (5)

Nectopsyche exquisita (Walker). All sites. 14 March-8 Nov. (113) Most of the specimens (60%) were collected in May at sites 3 and 4.

Oecetis cinerascens (Hagen). Site 1. 8 Nov. (1)

Oecetis georgia Ross. Site 6. 19 Sept. (1)

Oecetis n.sp. Site 9. 20 May. (1) Species being described by J. Bueno-Soria, Instituto de Biología, Universidad Nacional Autónoma de México.

Oecetis osteni Milne. Sites 1, 3, 6. 11 May, 19 Sept. (3)

Oecetis sphyra Ross. Sites 3, 9. 8 June, 19 Sept. (3)

Trianenodes helo Milne. Sites 1, 5, 7, 8. 25 April, 20 May, 16 Aug., 19 Sept. (4)

Trianenodes ignitus (Walker) Sites 1, 3, 5, 6, 8. 20 May-8 June. (6)

Trianenodes n.sp. Site 1. 11 May, 8 June. (2) Species being described by K.L. Manuel, Duke Power Co., North Carolina.

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Table 1. Physicochemical water quality parameters, expressed as means, for three streams on Eglin Air Force Base, Florida. Rocky Creek readings were made monthly, July 1978-June 1979; Bull Creek and Ramer Branch readings were bimonthly, August 1979-June 1980.

Sampling site	Stream-flow (cm/sec)	Temperature (°C)	pH	O ₂ (mg/l)	Total alkalinity (mg/l)	Total hardness (mg/l CaCO ₃)	Chloride (mg/l NaCl)
Rocky Creek							
1	40.2	21.8	5.4	8.3	5.3	4.9	12.3
2	36.0	21.1	5.3	8.2	5.2	5.0	11.8
3	45.1	20.2	5.6	8.7	4.3	5.9	11.4
4	47.6	20.0	5.5	8.3	4.4	5.2	12.2
5	55.2	19.9	5.5	8.4	4.4	5.4	11.3
Bull Creek							
6	33.5*	19.3	5.4	8.3	3.9	5.5	11.3
7	45.7*	19.1	5.1	8.4	3.9	6.1	11.2
Ramer Branch							
8	45.7*	19.1	5.5	8.8	4.1	5.9	11.5
9	45.7*	19.3	5.4	8.6	3.5	5.8	10.9

*Single reading, 16 August 1979

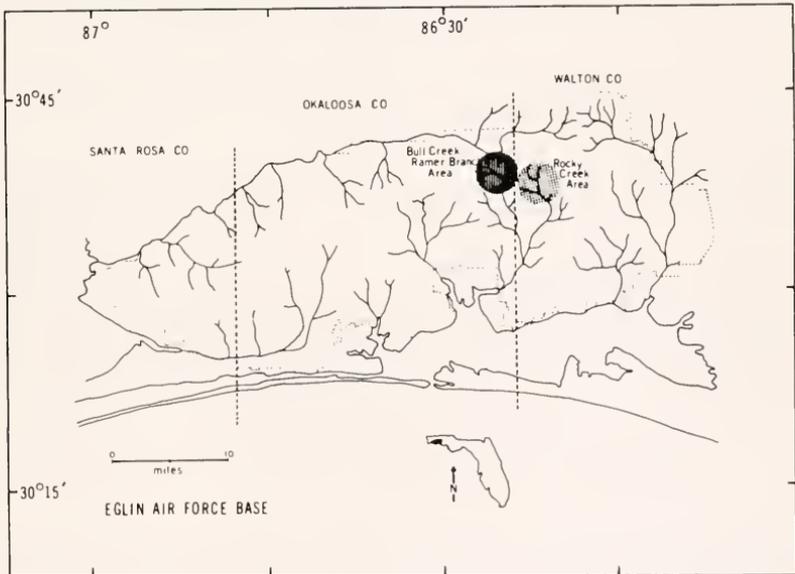


Figure 1. Study areas on Eglin Air Force Base, Florida.

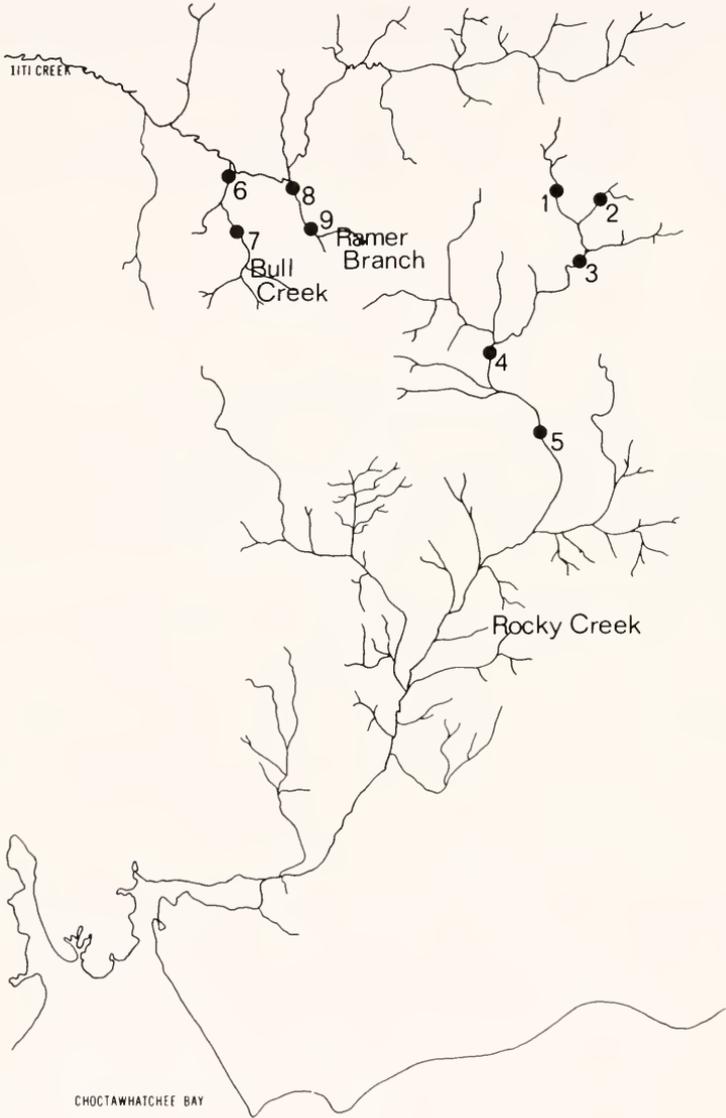


Figure 2. Sampling sites on Rocky and Bull Creeks and Ramer Branch on Eglin Air Force Base, Florida.

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GYNANDROMORPHS OF *MEGACHILE ROTUNDATA* (FAB.) (HYMENOPTERA: MEGACHILIDAE)^{1,2}

Roger D. Akre, E. Paul Catts, Richard S. Zack, E.C. Klostermeyer³

ABSTRACT: Two gynandromorphs of *Megachile rotundata* (Fab.) are described. One was a bilateral specimen and homologies of structures of the male and female external genitalia were determined.

Gynandromorphs are abnormal individuals exhibiting both male and female characteristics. Although bilateral gynandromorphs (that is, individuals with one side of the body male and the other female) are most easily and commonly recognized, specimens showing anterior-posterior differences or a mosaic of sexual characteristics also occur.

Gynandromorphic individuals have been reported for a number of insects and related organisms including grasshoppers (Ritchie 1978), moths and butterflies (Manley 1971, Schmid 1973, Riotte 1978), mosquitoes (Grimstad and DeFoliart 1974, Huang 1974, Mason 1980), black flies (Dang and Peterson 1979), wasps (Cooper 1959, Greb 1933, Whiting et al. 1934, Wilson and Woolcock 1960), bees (Ruttner and Mackensen 1952, Gordh and Gulmahamad 1975) and spiders (Roberts and Parker 1973). These individuals probably also occur in other groups. Various mechanisms have been proposed to explain this phenomenon including those by Greb (1933), Rothenbuhler et al. (1951) and Ruttner and Mackensen (1952). Wigglesworth (1972) presents a short discussion of the mechanisms leading to gynandromorphic individuals.

In the Pacific Northwest, farmers maintain large numbers of the alfalfa leafcutting bee, *Megachile rotundata* (Fab.), to provide pollination for alfalfa seed production. Because of its economic importance, a vigorous research project concerning the alfalfa leafcutter has been underway in Washington State since about 1961 (Klostermeyer 1964, Johansen and Eves 1966, Johansen and Klostermeyer 1967, Johansen et al. 1963). However, in the handling and examining of thousands of bees each year, only three gynandromorphic individuals have been discovered. While this indicates that these individuals rarely occur, few data are available for consideration. However, only one specimen was found among 2,657

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³Entomologist, Entomologist, Curator II, and Emeritus Entomologist, respectively.

individually examined females last year (1981, pesticide testing) for a ratio of 1:2,656. This compares to 1:10,000 for gynandromorphs in scolioid wasps, genus *Myzinum* (Krombein 1949) and 1:3800 for gynandromorphs in pompilids (Evans 1951). The first gynandromorph was a bilateral specimen, but unfortunately only a cursorial study, which did not include an examination of the external genitalia, was conducted (Gerber and Akre 1969). Since then, two additional gynandromorphs have been found. The purpose of this paper is to describe these two individuals and to relate the morphology of one of them to the evolution of insect genitalia (Smith 1969).

Specimen 1

A "gynandromorph" was collected 28 July 1972 as it emerged from a group of prepupae maintained in the laboratory at the Irrigated Agriculture Research and Extension Center, Washington State University, Prosser, WA. This specimen was placed in alcohol until examined 10 July 1981.

The specimen was thoroughly examined externally, and was dissected to examine the reproductive tract. Although not well preserved internally, it contained two definite ovaries. The external genitalia were female but were somewhat abnormal as only a single valvula 2 (gonapophysis 9) was present. All other sclerites were present and shaped normally (an illustrated description of normal genitalia is presented in Gerber and Akre 1969). Externally the specimen lacked scopal bristles from sterna 3-6 on the left side of the gaster, otherwise it was a typical female in coloration and morphology.

Specimen 2

The second specimen emerged 27 April 1981 from peeled cells produced in the Yakima Valley, Washington. These cells, containing prepupae of *Megachile*, were incubated in the laboratory, and emerging adults were being used in various experiments. Examination showed the specimen to be a bilateral gynandromorph with one side male, the other female (Figs. 1 and 2). It was killed 29 April and injected with Kahle's solution so the reproductive tract was preserved.

Head: The left side of the head was typically male with long, golden-yellow hair. The antenna had 13 segments. The right side of the head was covered with short, white hairs, and the antenna was 12 segmented; typical female characteristics. In addition, the right mandible was female with 4 sharply pointed teeth, while the left was typically male with 2 blunt teeth, and a medially-facing, sharp, subapical tooth (Gerber and Akre 1969). The



Fig. 1. Gynandromorph of *M. rotundata*. The left (male) antenna is longer. Fig. 2. Ventral view of specimen showing scopa (female character) on left side of gaster.

right, lateral ocellus was slightly displaced to one side (.52 mm) from the median ocellus compared to the other (.31 mm). The entire labio-maxillary complex was distinctly offset and originated on the female side of the head. The glossa (tongue) was hairy (Fig. 3) indicating these mouth parts were entirely female. Male glossae are always bare.

Thorax: The male/female sides of the thorax were reversed from that of the head. The right side (male) was covered with long, golden hair, the first coxa had a coxal tooth, and all 3 tarsi had bifid claws. The left side (female) had short, white hair, no prothoracic coxal tooth and the tarsal claws were all single (see Gerber and Akre 1969). The wings were of slightly unequal length; left front (female) 5.77 mm, the right front 6.18 mm.

Gaster: The gaster showed the most striking gynandromorphic features, especially the total absence of scopal bristles on the right side (male) (Fig. 2). The 5th sternum was normal, but the 6th was highly modified with a small sclerotized patch just lateral to the midline. A normal female has 7 externally visible sterna, the male only five, with the 6th and 7th lying underneath (dorsal to) the fifth. Thus, when these two unequal "halves" were fused together, displacement occurred. In this specimen, the 6th sternum on the male side was mostly membrane, with a small sclerotized patch, the 7th was probably represented only by membrane (Fig. 4).

Reproductive system: Typical females of *Megachile rotundata* have ovaries consisting of 6 ovarioles, 3 per side, while males have the testes fused into a single unit (Figs. 5a, b). Posteroventrally to the testes are paired dilations, the seminal vesicles, and the tract continues as small tubes, the paired vas deferens.

The gynandromorph had one ovariole on the left (female) side, containing at least 3 well defined oocytes/nurse cells (Fig. 5c). Basal to the oocytes, the oviduct continued as a single tube into the ovipositor. Issuing from somewhere near the base (connection inadvertently broken) was a single accessory gland, the Dufour's gland. In normal females the duct from the Dufour's gland and the duct from the poison gland reservoir continue into the sting bulb. The reproductive tract was not as well developed on the right (male) side. The most discernible structure was the nearly spherical seminal vesicle. The testis was represented by a short, slightly coiled tube issuing from the apical end of this dilation. A single vas deferens connected the tract to the base of the male genitalia (Fig. 5c). A small sheet of tissue was adnate to both the vas deferens and to the lateral oviduct, otherwise they were totally separate.

Genitalia: Normal Genitalia: Smith (1969, see also Smith 1970, Matsuda 1976), in discussing the evolution of insect genitalia, proposed that these appendages are primarily limb derivatives, and presented evidence indicating that mouth parts, thoracic legs, abdominal prolegs, and



Fig. 3. The glossa was hairy indicating the maxillary/labial complex was female. Fig. 4. Terminal segments of gaster showing genitalia. 5S=5th sternum.

genital appendages are homologous. [This topic has been somewhat controversial, particularly in regard to Hymenoptera genitalia, and has been subject to various interpretations (Michener 1944, Matsuda 1958)]. Hymenoptera retain a primitive condition for the ovipositor (female), and gonocoxites 8 (valvifer 1) give rise to the 1st pair of gonapophyses (valvulae I), while gonocoxites 9 (valvifer 2) gives rise to the 2nd pair of gonapophyses (valvulae II) anteriorly, and a pair of gonostyli (valvulae III, sting sheath) posteriorly. Gonapophyses 9 (valvulae II, stylet in honey bee sting apparatus terminology) are fused into an elongated trough which contains gonapophyses I (valvulae I, lancets of honey bee). Thus, the sting is a fairly rigid structure composed of gonapophyses 8 and 9; the sting sheath (gonostyli 9) is folded up out of the way when the sting is used (Snodgrass 1956, see also Akre et al. 1981).

Conversely, the male has lost all appendages of segment 8 (no gonapophyses 8), and gonocoxites 9 give rise to a pair of gonapophyses (penis valves). Gonostyli 9 (sting sheath of female) are modified into claspers, the gonocaspers or gonoforceps. The genital appendages are not rigidly articulated to tergite 9 as in the female which gives the phallus maximal flexibility in contrast to the fairly rigid sting.

Gynandromorph: Female: Gonapophyses 8 and 9 (valvulae I and II) originated on the female side, but extended across the male (right) side of the specimen (Fig. 4). The 7th tergum was removed exposing hemitergite 8 (identified by a spiracle in the posterior margin) which overlapped the 9th tergite (Figs. 6b,d). Gonocoxites 8 (valvifer I) and 9 (valvifer II) were shaped normally. Gonapophyses 8 and 9, however, were somewhat twisted near the distal end. These would typically fuse with the corresponding pair from the other side in a normal individual, but because these corresponding structures were lacking, the gonapophyses extended out over the male side.

Male: This extension of the female genitalia over the male side displaced the male-side genitalia and caused them to rotate ca. 180° (Fig. 6a). They appear in Fig. 4 in a position that suggests they also originated on the female side. However, dissection clearly shows that these structures originated on the male side, but the partial fusion of the unequal sclerites (♂, ♀) caused them to rotate into position. The 7th tergum of the male was mostly membrane (Fig. 6c). Hemitergite 8 (identified by the spiracle) was overlapped by 7, and had a narrow sclerotic bar connecting it to hemitergite 8 on the female side (Fig. 6e). The eighth sternum was somewhat modified, but still bore a short process from the proximal end. As in normal males, the 9th sternum was represented by a small sclerite lying dorsolateral to the 8th (Figs. 6c, e). The remaining genital appendages were rotated to a position dorsolateral to the 8th and 9th sterna. Gonostylus 9 (valvula III of female, gonoforceps) was easily identified by its shape (Figs. 6b, d). A small sclerite and a sclerotic bar at the base of gonostylus 9 represented the gonocoxite/

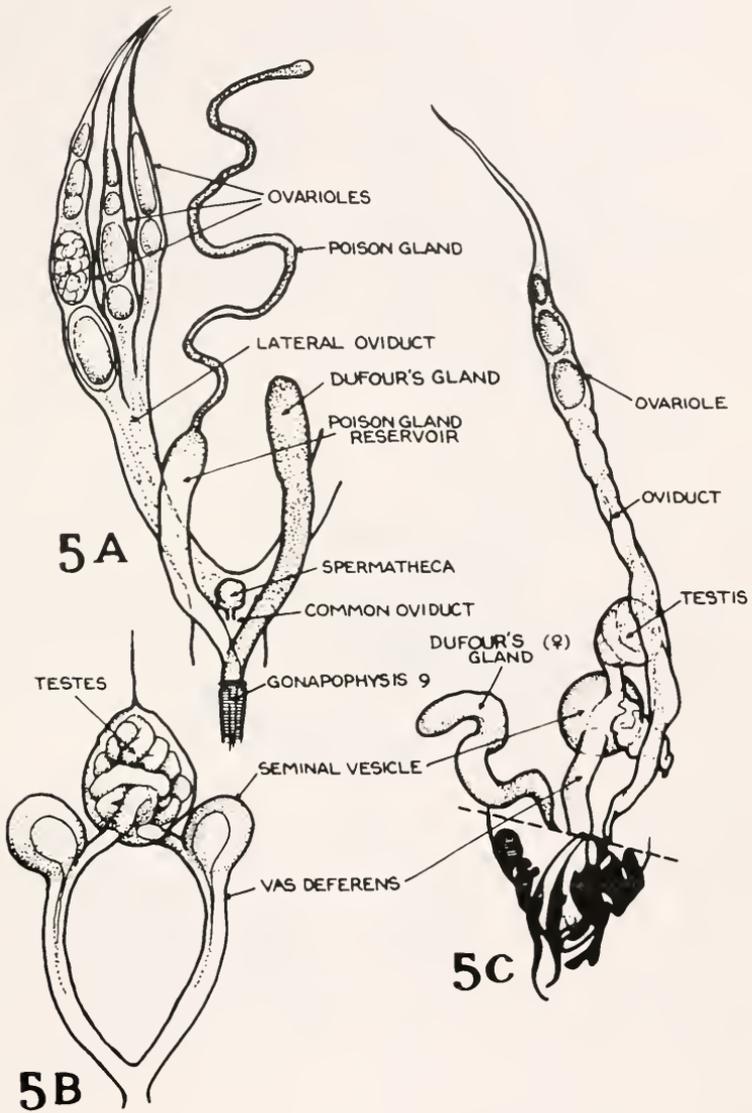


Fig. 5. Internal reproductive systems of *M. rotundata*. A. normal female. B. normal male. C. gynandromorph.

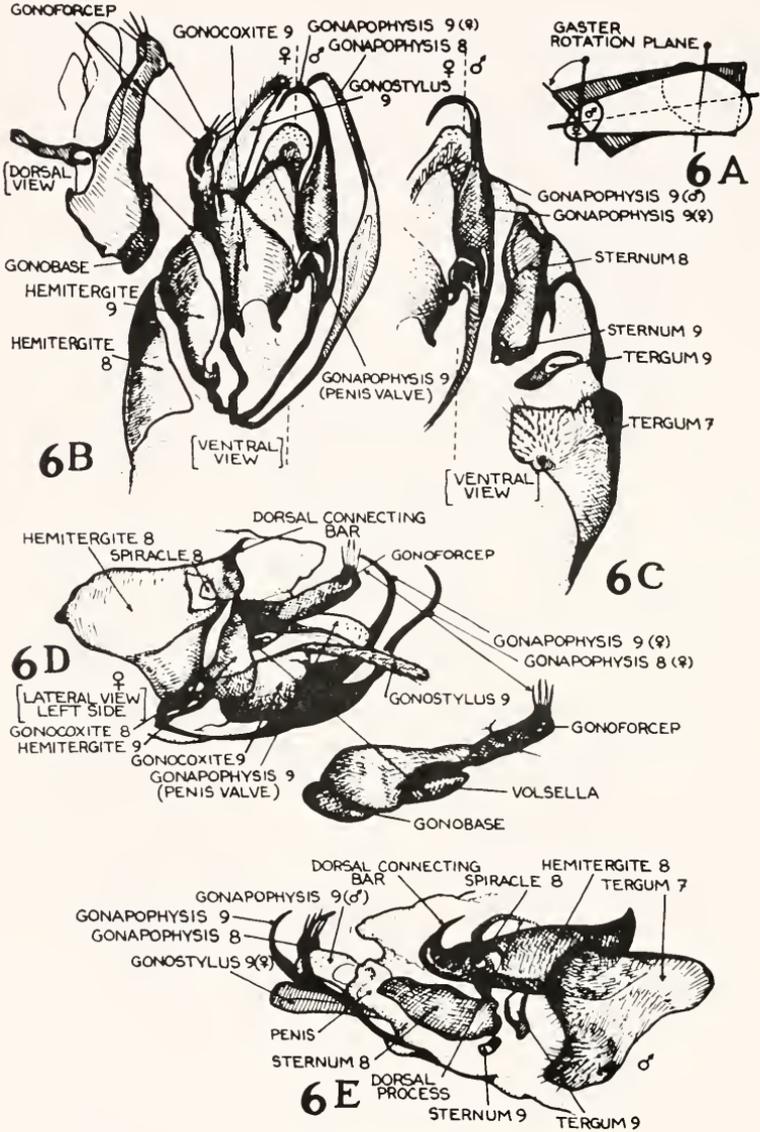


Fig. 6. External genitalia of gynandromorph. A. diagram indicating the longitudinal twist of the gaster. B. Ventral view of female half. C. Ventral view of male half. D. Lateral view of female half. E. Lateral view of male half.

gonobase (Gerber and Akre 1969) that forms a solid arch at the base of the genitalia in normal males (Fig. 6d). Medially to gonostylus 9 was gonapophysis 9, the penis valve (Figs. 6d, e). A membranous structure medial to this structure probably represented a malformed, partial penis (Gerber and Akre 1969, Fig. 6e).

Discussion

This bilateral gynandromorph offered a unique opportunity to evaluate Smith's (1969) hypothesis on male genitalic origin as it pertains to Hymenoptera. Our examination of this specimen supports Smith's interpretation. A summary chart follows:

Gynandromorph		
	♀ Side	♂ Side
gonocoxite 8 (valvifer I)	present	lost in pterygotes (represented by partial 8th sternum)
gonapophysis 8 (valvula I)	present (twisted)	lost
gonocoxite 9 (valvifer II)	normal shape	gonocoxite 9
gonapophysis 9 (valvula II)	present (twisted)	gonapophysis 9 (penis valve)
gonostylus 9 (valvula III)	present (sting sheath)	gonostylus 9 (gonoforcep)

ACKNOWLEDGMENTS

Sincere appreciation is due to Carl A. Johansen for recognizing the second specimen as a gynandromorph and for bringing it to our attention. He also supplied data on occurrence rates. Carl, C. Gillott, H.C. Reed, and R. Sites read the manuscript and made suggestions for improvement. We are also indebted to the two reviewers for suggested improvements.

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RECORDS OF SOME ECTOPARASITES FROM NIGERIA¹

John O. Whitaker, Jr.,² John G. Matthyse³

ABSTRACT: The purpose of this paper is to present information on a series of ectoparasites, mainly mites, from Nigerian small mammals.

Ectoparasites were collected from a series of mammals from Nigeria during an appointment by the junior author as Visiting Professor, University of Ibadan⁴. The present contribution is a continuation of a series "Preliminary Report on Mites Collected from Plants and Animals in Nigeria" (Matthyse 1978, Matthyse and Funmilayo 1979).

There are relatively few data on ectoparasites of Nigerian mammals, but some of the papers most relevant to the present study are Coffee and Retief (1972); Okereke (1968, 1970, 1971, 1973) who studied Nigerian Gamasina and described several new species; Zumpt and Elliot (1970) who described new species of Nigerian *Androlaelaps*; Sakamota et al. (1979) who described new species of *Haemolaelaps* from Nigeria; Till (1963) who monographed Ethiopian *Androlaelaps*; Keegan (1956, 1962) who gave information on 4 species of mites first found in Nigeria; Lavoipierre (1956) who described a new *Steatonyssus* from Nigerian bats; Fain (1970, 1971, 1972) who summarized information on African myocoptid and listrophoroid mites; and Pearse (1929) who collected information on ectoparasites of several species of Nigerian rodents and insectivores.

Materials and Methods

Parasites were collected from wild mammals, mainly caught in traps, in or near Ibadan from January through August, 1975. They were collected by first manipulating the fur while viewing it under a dissecting microscope. Each animal was then washed in an aqueous detergent solution, after which the liquid was filtered through a Buchner funnel. Parasites were then picked off the filter paper while viewing through a dissecting microscope. The ectoparasites were preserved in 70% alcohol, cleared and stained for 5 days

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to 2 weeks in Nesbitt's solution containing acid fuchsin, mounted in Hoyer's Solution and the coverslips were ringed with Euparal. Help in identifications was given as follows: Laelapidae, W. Calvin Welbourn (Acarology Laboratory, Ohio State University); ticks and fleas, Nixon A. Wilson (University of Northern Iowa); linstrophoroid and other parasitic mites, Alex Fain (Institut de Médecine Tropical Prince Leopold, Antwerpen, Belgium); free-living mites, Evert E. Lindquist (Research Branch, Biosystematics Research Institute, Agriculture Canada, Ottawa); lice, K.C. Emerson (2704 N. Kensington St., Arlington, Virginia). The chiggers and a few other mites are not included because they have not yet been identified. The ticks were mainly immature and have not as yet been identified beyond genus.

The host animals were identified by Dr. Oluwadare Funmilayo, Department of Agricultural Biology, University of Ibadan, Ibadan, Nigeria.

Results and Discussion

Parasites were identified from a few individuals of each of several species of rodents, plus two shrews, *Crocidura manni* and *Crocidura* sp., from Nigeria (Table 1). Several species of fleas, anoplurans, and mites were taken, along with a few ticks and chiggers.

Siphonaptera

Only two species of fleas, *Xenopsylla aequisetosus* and *X. cheopis*, were taken during the present study. Both were from *Cricetomys gambianus*. Pearse (1929) took these same two species from rodents and *Crocidura* from Nigeria, along with two other species of fleas.

Anoplura

Five species of sucking lice were found, each on a different mammal species. Pearse (1929) reported *Polyplax reclinata* from *Crocidura manni* and *P. abyssinica* Ferris from *Arvicanthis mordax* from Nigeria. We are not aware of previous records from Nigeria of the lice *Hoplopleura chippauxi*, *H. intermedia*, or *H. somereni*.

Acarina: Ixodidae

Ticks of three genera (*Ixodes*, *Haemaphysalis*, and *Rhipicephalus*) were found during the present study.

Laelapidae

Several laelapid mites were found during the present study, primarily of three genera, *Andreacarus*, *Androlaelaps*, and *Laelaps*. *Andreacarus petersi* was first described from parasitic insects from the giant rat, *Cricetomys gambianus* (Radford, 1953). However, Tipton (1960) suggested that they might normally parasitize the rat itself, and this was the case as indicated by present data and by Clifford and Keegan (1963) who also

examined specimens of this species from Nigeria. Okereke (1971) stated that *A. petersi* and *A. zumpti* Taufflieb are true rodent parasites in Nigeria.

Androlaelaps cricetomys was described by Zumpt and Elliott (1970) from *C. gambianus* from Nigeria. Okereke (1970) notes that *A. cricetomys* was known only from Northern Nigeria. Ours are the first records from Southern or Western Nigeria.

All of the mites of the subgenus *Echinolaelaps*, genus *Laelaps*, taken by us have been previously taken in Nigeria, and *L. litigiosa* and *L. dasymydis* Retief were described from there (Coffee and Retief, 1972; Okereke, 1973).

Okereke (1971) collected 20 species of gamasine mites from more than 1000 small mammals in the Ibadan, Nigeria, area. Nine of the species were the same as ours, as follows: *Laelaps (Echinolaelaps) muricola* on 13 hosts, *L. (Echinolaelaps) echidninus* on *Rattus rattus* only, *L. (Echinolaelaps) giganteus* on 8 hosts, but mainly on *Lemniscomys striatus* and *Arvicanthis niloticus*, *Laelaps roubandi* on 2 hosts, *Andreacarus petersi* and *A. zumpti* on *Cricetomys gambianus* only, *Androlaelaps murinus* on 11 hosts, *A. zulu* on 16 hosts and *A. galagus* on *Cricetomys gambianus* only.

Okereke (1973) in a further report on his Nigeria collections notes that *Echinolaelaps dasymydis* occurs primarily on *Dasymys incomtus*. Pearse (1929) found *Laelaps liberiensis* on Nigerian mammals.

We are not aware of previous records from Nigeria of the laelapid mite, *Laelaps lavieri*.

Atopomelidae

Six species of atopomelid mites were reported. Previous data on mites of this family from Africa were summarized by Fain (1972a). *Listrophoroides (Listrophoroides) aethiopicus* Hirst, 1923, was previously reported from several African localities, always on *Cricetomys gambianus*, the same host on which we found it. *Listrophoroides (Listrophoroides) dasymys* Radford, 1942, has been found always on species of *Dasymys* from several African localities. Matthyse and Funmilayo (in press) report *L. dasymys* from *D. incomtus* at Ibadan, Nigeria. *Listrophoroides (Afrolistrophoroides) teinophallus* Fain, 1970, was previously found on *Rattus (Mastomys) natalensis*, and this is the only host upon which we found it. *Listrophoroides (Afrolistrophoroides) scambophallus* Fain, 1970, was previously found on *Rattus (Mastomys) natalensis*, *Praomys tullbergi* and *Otomys* sp.; we found it on *M. natalensis*.

One species was listed in the *Listrophoroides (Afrolistrophoroides) mastomys* group. This form was previously reported from *Mastomys natalensis*, *R. erythroleucus* and *Thallomys paedulcus*. Our single specimen was from *Mus musculoides*. We found three specimens of *Listrophoroides uranomys* on an unidentified rodent. This mite is previously known only from *Uranomys ruddi* and *Acomys johannis*, except that Matthyse and Funmilayo report *L. uranomys* Fain, 1970, from *Uranomys foxi* at Ibadan, Nigeria.

Listrophoridae

Four forms in the family Listrophoridae were also reported. Data on this family were previously summarized by Fain (1971). *Afrolistrophorus dasymys* was found during the present study primarily on *Dasymys incomtus*, but a few individuals were found on *Lophuromys sikapusi*, *Praomys tullbergi* and *Rattus rattus*. Matthyse and Funmilayo (1979) also report *A. dasymys* from *D. incomtus* and *R. rattus*, but in addition from *Mus musculoides*, all from Ibadan, Nigeria. This species was previously known only from *Dasymys incomtus* from the Congo (Zaire) and from the Ivory Coast. Matthyse and Funmilayo (1979) report *Afrolistrophorus lophuromys lophuromys* Fain from *Lophuromys sikapusi* taken at Ibadan, Nigeria. The identification was made by Fain. The *A. lophuromys* (Radford, 1940) we report may be the same subspecies. *Afrolistrophorus lophuromys* and *A. congoicola* were known from several African localities and mammals. *Afrolistrophorus muricola* was previously known from *Mus*, *Rattus*, and *Crocidura* from the Ivory Coast; we found it on *Mus musculoides*.

The atopomelids *Listrophoroides* (*Listrophoroides*) *aethiopicus*, *Listrophoroides* (*Afrolistrophoroides*) *teinophallus*, *L. (A.) scambophallus* and *L. (A.) mastomys* and the listrophorid, *Afrolistrophorus muricola* are new records for Nigeria.

Glycyphagidae

Dermacarus from *Dasymys incomtus* was identified as probably *D. oenomys* Fain. Matthyse and Funmilayo (1979) report *Dermacarus oenomys* (identified by Fain) from *Dasymys incomtus* from Ibadan, Nigeria.

Other Mites

Nymphal mites of the family Uropodidae frequently attach to insects or other animals. A number of nymphal uropodid mites, *Trichouropoda* sp., was taken from *Cricetomys gambianus*. The genus *Ornithonyssus* is often represented in low numbers on small mammals, and four individuals were found on one host species during the study. Mites of the families Acaridae and Tarsonemidae are likely accidentals on the host.

Myobiidae

Radfordia ensifera is widespread on *Rattus rattus* and *R. norvegicus* over much of the world and on *R. rattus* specifically in Angola (Fain, 1972b), in South Africa (Zumt, 1961), and in Zaire (Fain and Lukoschus, 1977). *Radfordia hylomyscus* was described from *Hylomyscus simus* from the Ivory Coast by Fain (1972c). Neither of the myobiids had previously been recorded from Nigeria.

	<i>Crocidura manni</i>	<i>Crocidura</i> sp.	<i>Arvicanthis niloticus</i>	<i>Cricetomys gambianus</i>	<i>Dasymys incommis</i>	<i>Leggata musculoides</i>	<i>Lophuromys sikapusi</i>	<i>Mastomys natalensis</i>	<i>Mus musculoides</i>	<i>Praomys tullbergi</i>	<i>Rattus alexandrianus</i>	<i>Rattus rattus</i>	unidentified rodents
number of hosts examined	(1)	(1)	(2)	(6)	(7)	(1)	(1)	(6)	(2)	(9)	(1)	(13)	(3)
<i>A. galagus</i> (Lavoipierre, 1955)				1									
				2									
<i>A. murinus</i> Berlese, 1911					1								
					1								
<i>A. zulu</i> (Berlese, 1918)							1	1					
							3	1					
<i>Hypoaspis</i> nr. <i>machado</i> Aswegen & Loots, 1970			1										
			1										
<i>L. lavieri</i> Taufflieb, 1954						1							
						1							
<i>L. liberiensis</i> Hirst, 1925					1			3			1		
					6			10			3		
<i>L. roubaudi</i> Taufflieb, 1954					1								
					1								
<i>Laelaps (Echinolaelaps) dasymydis</i> Okereke, 1973					5								
					46								
<i>L. (E.) giganteus</i> Berlese, 1918			1										
			2										
<i>L. (E.) litigiosa</i> Coffee & Retief, 1972											5		
											28		
<i>L. (E.) muricola</i> Tragardh, 1910								2			2		
								24			10		
<i>L. (E.) echidninus</i> Berlese, 1887												1	
												1	
Macronyssidae													
<i>Ornithonyssus</i> sp.								1					
								4					
Uropodidae													
<i>Trichouropoda</i> sp.				2									
				34									
Listrophoridae													
<i>Afrolistrophorus dasymys</i> Fain, 1970					5		1			1		1	
					227		2			3		3	
<i>A. lophuromys congoicola</i> Fain, 1971							1						
							2						
<i>A. lophuromys</i> (Radford, 1940)							1						
							3						
<i>A. muricola</i> Fain, 1970									1				
									4				

	<i>Crocidura manni</i>	<i>Crocidura</i> sp.	<i>Africanthys niloticus</i>	<i>Cricetomys gambianus</i>	<i>Dasymys incontinentis</i>	<i>Leggata musculoides</i>	<i>Lophuromys sikapusi</i>	<i>Mastomys natalensis</i>	<i>Mus musculoides</i>	<i>Prionomys tullbergi</i>	<i>Rattus alexandrianus</i>	<i>Rattus rattus</i>	unidentified rodents
number of hosts examined	(1)	(1)	(2)	(6)	(7)	(1)	(1)	(6)	(2)	(9)	(1)	(13)	(3)
Atopomelidae													
<i>Listrophoroides (Listrophoroides)</i>													
<i>aethiopicus</i> Hirst, 1923					1								
<i>L. (Listrophoroides) dasymys</i>					2								
Radford, 1942					7								
<i>L. (Afrolistrophoroides)</i>					136								
<i>scambophallus</i> Fain, 1970								1					
<i>L. (Afrolistrophoroides)</i>								1					
<i>teinophallus</i> Fain, 1970								2					
<i>L. (Afrolistrophoroides)</i> "mastomys								8					
group"								1					
"								1					
<i>L. uranomys</i> Fain, 1970													1
													3
Glycyphagidae													
<i>Dermacarus</i> , probably <i>oenomys</i>					2								
					3								
Myobiidae													
								1					
								1					
<i>Radfordia ensifera</i> (Poppe, 1896)													3
													8
<i>R. hylomyscus</i> Fain, 1972													1
													5
Tarsonemidae													
<i>Tarsonemus</i> sp.										1			
										1			

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MELEXERUS, A NEW GENUS PROPOSED FOR *PSEUDANTHONOMUS HISPIDUS* CHAMPION (COLEOPTERA: CURCULIONIDAE)¹

Horace R. Burke²

ABSTRACT: *Melexerus* is described as a new monotypic genus containing *Pseudanthonomus hispidus* Champion. *Pseudanthonomus crinitus* Champion is synonymized with *hispidus* (NEW SYNONYMY). In addition to the generic description, the species is redescribed on the basis of a series of specimens. *Melexerus hispidus* is now known to occur in Cuba, El Salvador, Guatemala, Jamaica and Mexico. Photographs of the habitus are included and the male genitalia are illustrated.

The present paper represents a contribution to revision of the North and Central American weevils of the subfamily Anthonominae. Emphasis is presently being placed upon reviewing the status of each of the genus-group taxa in the subfamily. Several of the small supraspecific taxa of Anthonominae have already been treated (Burke 1964, 1968a, 1973, 1981a, 1981b; Burke and Ahmad 1967; Burke and Hafernik 1971). During the course of this continuing study it has been determined that the peculiar little weevil *Pseudanthonomus hispidus* Champion is not assignable to *Pseudanthonomus* Dietz or to any other described genus. While it is with some reluctance that I create another monotypic genus, there appears to be no other acceptable solution to the placement of the species. In addition to the description of the genus, some new synonymy is proposed and a revised description of *hispidus* is presented.

***Melexerus* Burke, New Genus**

Type Species: *Pseudanthonomus hispidus* Champion 1903:198, here designated.

Etymology: *Melexerus* is an arbitrary combination of letters and is considered here to be of masculine gender.

Description of Genus: Body above rather densely clothed with coarse, gray to ochreous scales intermixed on the dorsal surface, rostrum and legs with semierect to erect scattered, sharply pointed or bifid scales; length 1.7 - 2.1 mm. Rostrum moderately strongly curved in both sexes, slightly more so in females; equal in length to prothorax along dorsal midline in male and equal to or slightly longer than prothorax in female. Upper margin of lateral rostral groove well defined, extending against lower 1/3 of eye; lower margin of groove poorly defined. Funicle 6-segmented. Eyes strongly protuberant; height of eye equal to nearly 2 x width; separated in front by distance equal to width of rostrum at base. Head feebly constricted behind eyes. Prosternum with anterior margin slightly emarginate. Procoxae contiguous. Mesocoxae separated by distance equal to 3/4 width of a coxa. Mesosternum truncate posteriorly. Elytra at base distinctly broader than prothorax. Humeri strongly rounded.

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Abdominal sterna 3 and 4 *ca.* equal in length. Pygidium normally not exposed in either sex. Femora not strongly clavate; profemur bearing minute, sharply pointed tooth; mesofemur usually unarmed, occasionally with minute tooth; metafemur always unarmed. Tibiae short, straight, metatibia *ca.* 1/2 length of femur. Tibiae each bearing a minute apical mucro. Teeth on inside of tarsal claws each nearly as long as claw.

Discussion: *Melexerus hispidus* was originally placed in the genus *Pseudanthonomus* Dietz on the basis of the 6-segmented funicle and the upper margin of the lateral groove (referred to as "scrobe") extending against the lower anterior margin of the eye. This species is readily distinguished from the true *Pseudanthonomus* by the constricted head, erect scales on dorsum and legs, short tibiae, and protuberant and transverse eyes. Burke (1968b) mentioned that most of the species which Champion (1903) assigned to *Pseudanthonomus* on the basis of the 6-segmented funicle are not members of this genus; several will eventually be transferred to other genera, mainly *Anthonomus*. The vestiture of *M. hispidus* is similar to that of *Anthonomus* (*Anthonomochaeta*) *heterogenus* Dietz, a similarity also noted by Champion (1903). Otherwise the two species are quite different and do not appear to be especially closely related. *A. heterogenus* has a 7-segmented funicle, head not constricted, eyes round and not strongly protuberant, all femora unarmed, and tibiae nearly as long as the femora. The latter species also has the upper margin of the lateral rostral groove extending against the middle of the anterior margin of the eye while that of *M. hispidus* impinges on the lower margin of the eye. The erect scales on the elytra of *M. hispidus* are also much longer.

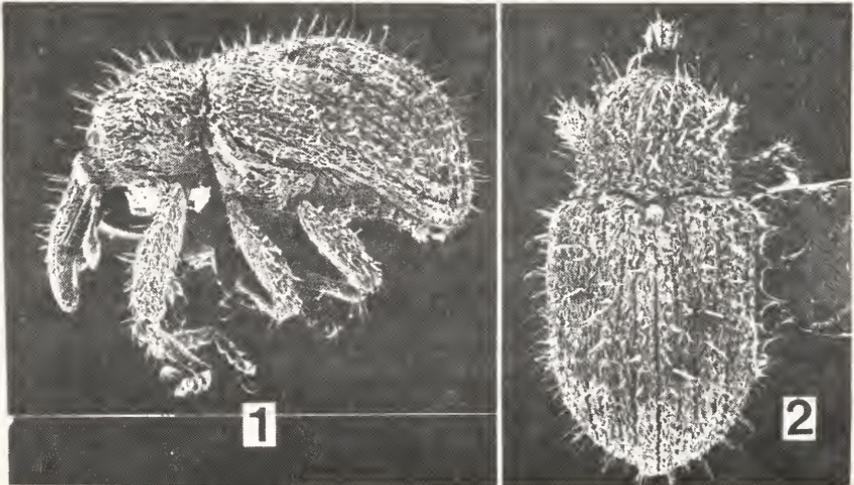


Fig. 1. Lateral view of male of *Melexerus hispidus* (Champion) from Tamazunchale, S.L.P., Mexico. Fig. 2. Dorsal view of same.

Melexerus does not seem to be closely related to any genus or generic group in the subfamily.

***Melexerus hispidus* (Champion), New Combination**
(Figs. 1-7)

Pseudanthonomus hispidus Champion 1903:198 (orig. desc.); Schenkling and Marshall 1934:72 (cat.); Blackwelder 1947:840 (cat.).

Pseudanthonomus crinitus Champion 1910:189 (orig. desc.); Schenkling and Marshall 1934:72 (cat.); Blackwelder 1947:840 (cat.) NEW SYNONYMY.

Body elongate-ovate: ca. 2 x longer than broad; length 1.7-2.1 mm (n=17). Integument dark reddish brown, becoming light reddish on rostrum and tibiae. Vestiture moderately dense, consisting of coarse, gray to ochreous prostrate scales intermixed with suberect to erect pointed scales on dorsum, rostrum and legs, presenting bristly appearance (Figs. 1, 2); ventrally scales decumbent. **Rostrum** (Figs. 6, 7) moderately strongly curved in both sexes but more evenly and slightly more strongly curved in female; as long as prothorax in male, may be slightly longer in female. Male with fairly dense covering of prostrate and suberect scales from base of rostrum to just anterior to point of antennal attachments; in female basal portion

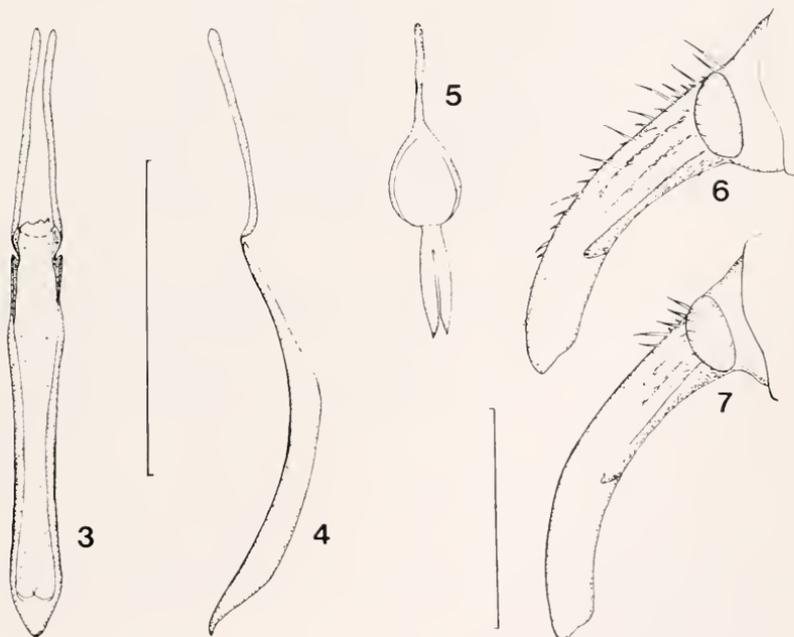


Fig. 3. Dorsal view of male median lobe, Tamazunchale, S.L.P., Mexico. Fig. 4. Lateral view of same. Fig. 5. Dorsal view of basal piece and parameres of male genitalia. Fig. 6. Lateral view of rostrum and head of male, El Salto, S.L.P., Mexico. Fig. 7. Same of female, San Salvador. Lines each equal to 0.5 mm.

of rostrum bearing only a few scattered scales. Rostrum of male distinctly tricarinate dorsally from base to point opposite antennal attachments; female with rostrum merely finely punctate dorsally, subcarinate laterally. Lateral rostral groove well defined dorsally; lower margin lying ventrally on rostrum, not distinct; upper margin impinging on anterior margin of eye at lower one-third; a few scattered elongate scales present in basal portion of lateral groove. **Antennae** attached just before middle of rostrum of female and slightly closer to the apex in male. Scape strongly enlarged in apical one-fourth; moderately strongly bent outward near apex. Funicular segment 1 strongly clavate, *ca.* equal in length to following 3 funicular segments combined; 2 varying from slightly shorter than to as long as 3+4; segment 3 slightly longer than 4; segments 4, 5 and 6 about equal in length, 6 broader. Club elongate-oval: as long as preceding 5 funicular segments combined. **Head** feebly constricted on sides and dorsally behind eyes. Eyes strongly convex, protuberant; height equals nearly 2 x greatest width; separated in front by distance equal to width of rostrum at base. Frons densely covered by coarse scales which conceal fovea. **Prothorax** 1.1-1.3 x wider than long; widest at base; sides more or less evenly converging to apex, with feeble subapical constriction; dorsal surface strongly convex. Coarse hairlike scales dense, completely obscuring integument. **Scutellum** strongly convex; width *ca.* equal to length; densely clothed with gray scales. **Elytra** distinctly wider at base than prothorax. **Humeri** strongly rounded. Sides parallel to past middle thence broadly rounded to apex. Dorsal surface strongly depressed at basal one-third, especially in area of intervals 2 and 3. Intervals strongly convex. Striae deeply impressed. **Procoxae** contiguous. **Mesocoxae** separated by distance equal to *ca.* three-fourths of width of a coxa. **Abdomen** with sternum 1 subequal in length to sterna 2+3; sternum 2 one-third shorter than 1; sterna 3 and 4 equal in length; sternum 5 same length as 2. Scales not as dense ventrally as dorsally. Pygidium not exposed in either sex. **Legs** with prostrate and erect scales sparse, not entirely obscuring integument. Profemur 3.3.-4.0 x longer than broad. Profemoral tooth minute, sharply pointed. Mesofemur usually unarmed, occasionally bearing a minute tooth. Metafemur without tooth. Tibiae short, straight; metatibia about one-half length of femur. Tibiae all minutely mucronate. Tarsal claws each with a long, inner tooth which reaches nearly to apex of claw. **Genitalia** with male median lobe (Figs. 3, 4) slender, membranous dorsally; endophallus bearing minute teeth near apex. Parameres (Fig. 5) elongate.

Discussion: The types of *hispidus* and *crinitus*, the former a female and the latter a male, were examined in the BM(NH) and *crinitus* is here considered to be a junior synonym of *hispidus*. There is considerable sexual dimorphism in the rostra of the two sexes, that of the female being more strongly curved, mostly bare, and relatively longer than that of the male. Based on examination of a larger series of specimens than was available to Champion, the other differences he mentioned appear to be due only to natural variation in the species. Specimens from Jamaica and Cuba differ from Mexican and Central American specimens by having many of the erect dorsal scales split at the apices. The significance of this difference is not apparent but I am unable to find other characters which would indicate that those specimens are specifically distinct from those in Mexico and Central America.

Except for the type localities, San Gerónimo, Guatemala for *hispidus* and San Salvador, El Salvador for *crinitus*, no other distributional data are available for this species in the literature; consequently, the following additional records are presented: CUBA: Soledad, Cienfuegos. JAMAICA:

Trelawny, Duncans. MEXICO: Nayarit-3 mi. NW Santa Maria del Oro. San Luis Potosi-Tamazunchale; 5 mi. SW Tamazunchale; El Salto. Sinaloa-10 mi. N. Mazatlan. Tamaulipas-2 mi. W. Neuvo Morelos; Tampico. Michoacan-20 mi. E. Morelia. Mexico-Tejupico; Temescaltepec.

The only information available on the plant associations of this species is that a specimen was found on a cynipid gall on *Quercus* sp. at Tampico, Mexico.

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AN OVERWINTERING SITE OF THE HOP LOOPER, *HYPENA HUMULI* (HARRIS)¹

Shigeru Kikukawa²

ABSTRACT: Overwintering adults of *Hypena humuli* (Harris) were collected near the entrance of a cave in Boone County, Missouri, in January 1981. The adults shared the cave with bats. Any possible relationship between the moth and the insectivore during winter, however, is unknown.

Overwintering patterns vary among insect species. Each species has adapted physiologically and ecologically to a particular overwintering site. Here, I report a moth found overwintering in a Missouri cave. The Holton cave, the site of the observation of Jan. 28, 1981, is located near Sturgeon in Boone County, Missouri. Many moths were resting on the upper wall of the cave. Fourteen moths collected from this cave were identified as the hop looper or hop-vine snout-mouth, *Hypena humuli* (Harris) (Noctuidae), by J.R. Heitzman, and are preserved in the Entomological Museum of the University of Missouri-Columbia.

The distribution of this cave population of *H. humuli* appeared to be restricted to the region within approximately 100 feet from the mouth of the cave. The insects were not found further inside the cave where several kinds of bats were also hibernating. In adopting cave hibernation, the moth has to encounter bat predators and may be under considerable predatory pressure in the late fall and early spring. Any possible strategy of avoiding predation is an open question at present.

H. humuli is a bivoltine species distributed over the United States and Canada (Holland, 1905). No other host than the hop plant is known (Howard, 1897). Howard (1897) suggested that the adults pass the winter in bark crevices and fence corners, or in old logs and stumps. Caves are now identified as one overwintering site for this species.

ACKNOWLEDGMENT

I am grateful to Mr. J.R. Heitzman for his identification of the moth.

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NEW RECORDS OF CAVE COLLEMBOLA OF MEXICO¹

José G. Palacios-Vargas²

ABSTRACT: Thirty-five species of Collembola are recorded from eleven Mexican caves, nest of *Pappogeomys tylorhynus* and the fur of *Neotomodon* sp. and *Peromyscus alstoni*. A brief discussion about their ecological classification is included.

RESUMEN: 35 especies de Collembola son registrados de 11 cuevas mexicanas, nidos de *Pappogeomys tylorhynus* y ejemplares colectados sobre *Neotomodon* sp. y *Peromyscus alstoni*. Se hace una breve discusión sobre su clasificación ecológica.

Mexican caves have one of the most abundant and diverse cavernicole fauna of any region in the world (Reddell, 1981). This is due to the existence of huge cave systems, and to the geographic position and diversity of climates and vegetational communities.

Although springtails are usually well represented in any Mexican cave, frequently being the most abundant food source for other arthropods, there are few papers dealing with cave Collembola in Mexico.

The first reference dates from Mills (1938) who recorded seven species from Yucatan caves. Bonet (1943, 1944, 1945, 1946, 1947), Bonet and Tellez (1947) described several species; Christiansen (1973) described and recorded five species of *Pseudosinella*; and Bonet (1953, 1971) discussed the cave fauna in Mexico and gave new records. The latest records are those of Reddell (1971, 1981), Hoffman *et al* (1980) and Palacios-Vargas (1980). A tentative classification of some cavernicole Collembola, based on ecological, morphological and geographical data was presented by Palacios-Vargas (1981).

Apparently, there are two or three groups of cavernicole Collembola in Mexico. One group of Mexican troglomorph species are closely related to species inhabiting soil and litter in the same area.

Another group represents taxa abundant in temperate North America both in caves and in soil, which have extended to the south; the third group represent Neotropical fauna that has moved to habitats in southern Mexican caves.

Epigeomorphs and ambimorphs are interesting because some of them are probably relicts that survived in the caves thanks to the stability of these environments.

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The new records of Mexican caves Collembola given in this paper may assist in understanding the origin, distribution and evolutionary relationships of this group.

It has been found that some of the springtails known as cavernicoles can also live in rodent nests and these are not restricted to caves, rather, they are associated with guano or rodent feces.

The material involved in this study included samples provided by Héctor Guzmán, Sociedad Mexicana de Exploraciones Subterráneas de México; the author's collections and specimens from other collectors who are mentioned with the locality data.

The cavernicole classification used here for the springtails mainly follows that of Christiansen (1962).

ONYCHIURIDAE

Mesaphorura krausbaueri Börner, 1901.

GUERRERO: Grutas de Cacahuamilpa. 17-V-1977, J.G. Palacios col.

SAN LUIS POTOSI: Aquismón: Hoya de Guaguas. 6-II-81, H. Guzmán, col.

**M. yosiii* Rusek, 1967.

VERACRUZ: Grutas de Atoyac. 6-XII-1981, V. Granados col.

GUERRERO: Grutas de Juxtlahuaca. 29-XI-1980, M.L. Jiménez col.

Mesaphorura sp.

EDO. DE MEXICO: Grutas de la Estrella. 27-V-80, J.G. Palacios, col.

Onychiurus encarpatus Denis, 1931.

QUERETARO: Sótano Otates. 7-IV-1981, H. Guzmán, col.*

HYPOGASTRURIDAE

Acherontides atoyacensis Bonet, 1945.

EDO. DE MEXICO: Ecatepec: Venta de Carpio. ex. nest of *Pappogeomys tylorhynus*, 27-VII-1980, V. Sosa col.

Acherontiella sabina Bonet, 1945.

D.F.: Ajusco. ex *Neotomodon* sp. y *Peromyscus alstoni*. April and May, 1978, E. Hentschel col.

VERACRUZ: Grutas de Atoyac. ex. guano. 12-XII-1981, V. Granados col.

Ceratophysella sp.

MORELOS: Cave at Km. 104, 5 FFCC México-Cuernavaca. 19-IV-1980 J.G. Palacios col.

Willemia persimilis Bonet, 1945

EDO. DE MEXICO: Venta de Carpio. ex. nest of *P. tylorhynus* 27-VII-1980, V. Sosa col.

GUERRERO: Gruta de Acuitlapán. 12-XII-1981, J.G. Palacios, col.

NEANURIDAE

Brachystomella parvula group (Schaeffer, 1896).

QUERETARO: Sótano Otates. 7-IV-1981, H. Guzmán col.

B. stachi Mills, 1934.

EDO. DE MEXICO: Venta de Carpio, ex. nest of *P. tylorhynus* 27-VII-1980, V. Sosa col.

*The species marked with an asterisk represent a new record for the country.

**Pseudachorutes subcrassoides* Mills, 1934.

QUERETARO: Jalpan: Sotano Tilaco. 23-XII-1980, H. Guzman col.

**Sensillanura* sp.

QUERETARO: Sótano Otates. 8-II-1981, H. Guzmán col.

ISOTOMIDAE

Ballistura sp.

GUERRERO: Grutas de Juxtlahuaca. 29-XI-1980, M.L. Jimenez col. 11-IV-1981, J.G. Palacios col.

Cryptopygus thermophilus (Axelson, 1900).

QUERETARO: Sótano Tilaco. 21-XII-1980, H. Guzmán col.

Folsomides americanus Denis, 1931.

GUERRERO: Grutas de Juxtlahuaca, 11-IV-1981, J.G. Palacios col.

QUERETARO: Sótano Tilaco. 21-XII-1980, H. Guzmán col.

F. angularis (Axelson, 1905)

GUERRERO: Grutas de Juxtlahuaca. 11-IV-1981, J.G. Palacios col.

Folsomina onychiurina Denis, 1931.

GUERRERO: Grutas de Juxtlahuaca. 11-IV-1981, J.G. Palacios col.

QUERETARO: Sótano Tilaco. 23-XII-1980, H. Guzmán col.

**Isotoma trispinata* MacGillivray, 1896.

EDO. DE MEXICO: Venta de Carpio, ex. nest of *P. tylorhynus* 27-VII-1980, V. Sosa col.

Isotomiella minor (Schaeffer) 1896.

VERACRUZ: Grutas de Atoyac. 6-XII-1981, V. Granados col.

**Proisotoma (Appendisotoma) dubia* Christiansen et Bellinger, 1980.

SAN LUIS POTOSI: Aquismón: Hoya de Guaguas. 6-II-1981, H. Guzman.

**P. minuta* Tullberg, 1871.

EDO. DE MEXICO: Venta de Carpio. ex next of *P. tylorhynus* 27-VII-1980, V. Sosa col.

ENTOMOBRYIDAE

Neorchesella mexicana Mari-Mutt, 1980 (Mari-Mutt det.)

TAMAULIPUS: Cueva Conrado Castillo. 19-IV-1980, P. Date col.

Lepidocyrtus sp.

GUERRERO: Grutas de Juxtlahuaca. 11-IV-1981, J.G. Palacios col.

Pseudosinella petrustrinatii Christiansen, 1973.

GUERRERO: Grutas de Juxtlahuaca. 16-II-1979, E. Martín and M. Cortés col.

P. violenta (Folsom) 1924.

HIDALGO: Grutas de Tolantongo. 6-IX-1980, A. Hidalgo col.

Pseudosinella sp. 1.

EDO. DE MEXICO: Venta de Carpio. ex. nest of *P. tylorhynus* 27-VII-1980, V. Sosa col.

Pseudosinella sp. 2

VERACRUZ: Grutas de Atoyac. 6-XII-1981, V. Granados col.

Seira sp.

VERACRUZ: Grutas de Atoyac. 6-XII-1981, V. Granados col.

CYPHODERIDAE

Cyphoderus sp. nov.

GUERRERO: Grutas de Juxtlahuaca. 11-IV-1981, J.G. Palacios col.

PARONELLIDAE

Paronella sp.

GUERRERO: Grutas de Juxtlahuaca. 6-III-1979, E. Martín and M. Cortés col.

Troglopedetes sp. nov. A.

GUERRERO: Grutas de Juxtlahuaca. 11-IV-1981. J.G. Palacios col.

Troglopedetes sp. nov. B.

VERACRUZ: Grutas de Atoyac. 6-XII-1981, V. Granados col.

NEELIDAE

Megalothorax minimus Willem, 1900.

VERACRUZ: Grutas de Atoyac. 6-XII-1981, V. Granados col.

SMINTHURIDIDAE

Sphaeridia sp. A.

EDO. DE MEXICO: Venta de Carpio. ex nest of *P. tylorhynus* 27-VII-1980, V. Sosa col.

Sphaeridia sp. B.

GUERRERO: Grutas de Juxtlahuaca. 11-IV-1981, J.G. Palacios col.

Discussion

The most abundant Onychiuridae belong to the group *Mesaphorura krausbaueri* and further studies should reveal endemic forms.

Acherontiella sabina was described by Bonet (1945) from caves of San Luis Potosí and was found in caves of Nuevo León and Tamaulipas. It also has been recorded from Kangaroo Rat nests (Christiansen and Bellinger, 1980), from Santa Fe, New Mexico; and here it is reported from the fur of the rodents *Neotomodon* and *Peromyscus alstoni*, from Ajusco, D.F. This leads us to think that some carvernicolé springtails, mainly those associated with guano, can be transported by accidental phoresis from one cave to another by the rodents.

Acherontides atoyacensis from Cueva de Atoyac, Veracruz (Bonet, 1945), has been found in one basaltic cave from Morelos State (Palacios-Vargas, 1981) and in Gruta de Aguacachil, Guerrero (Palacios-Vargas, 1982). Our new record from nests of *P. tylorhynus* implies that this species is not restricted really to caves but that it might be associated with the feces of rodents.

Ceratophysella sp. and *W. persimilis* are troglaxene, the first hemidaphic and the second euedaphic. All the neanurids seem to be troglaxene.

The family Isotomidae includes very few troglomorphs. Although this is the best represented family in the caves here in studied, the species represent a fauna which also lives outside the caves and they should be considered as ambimorphs or epigeomorphs.

N. mexicana and *Seira* sp. are troglaxenes. The undescribed Cyphoderids and Paronellids are better representatives of troglomorphs.

Neelids are euedaphic or ambimorphs and the Sminthurids troglomorphs belongs to *Arrhopalites* and *Pararrhopalites*, which were not found in the caves recorded in this paper.

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NEW SPECIES OF BOLIVIAN GYPONINAE (HOMOPTERA: CICADELLIDAE)¹

Dwight M. DeLong², Donald R. Foster³

ABSTRACT: Six new species of Bolivian Gyponinae, *Hecalapona villaria* n.sp., *Gypona saavedra* n.sp., *Gyponia tunaria* n.sp., *Folicana boliviana* n.sp., *Curtara audacitara* n.sp., and *Polana santana* n.sp. are described.

The genus *Hecalapona* and 38 new species were described by DeLong and Freytag (1975). A revisional study of the genus *Gypona* was published by DeLong & Freytag (1964). The genus *Folicana* was described by the same authors (1972). The genus *Curtara* was also described by the same authors, and 76 species and 6 subgenera were treated (DeLong and Freytag 1976). The same authors (1972) treated the genus *Polana* and placed 87 species, 73 described as new, in 10 subgenera. A species of *Hecalapona*, 2 species of *Gypona*, and a species each of *Folicana*, *Curtara* and *Polana* are described in this paper. All types are from Bolivia and are in the DeLong collection at the Ohio State University.

Hecalapona villaria n.sp.

(Figs. 1-5)

Length of male 9 mm, female unknown. Crown broadly rounded, more than 4/5 as long as middle as wide at base between eyes. Ocelli nearer eyes than median line and at 5/8 length of crown. Color yellowish green with a black spot on wing margin at apex of each claval vein.

Male genital plates 3 times as long as wide at middle, apices narrowed, rounded. Style with foot-like apex. The "heel" portion is ventral and rounded, the "toe" extends dorsally and is rounded at apex. Shaft of aedeagus rather broad laterally, bearing 5 apical processes; the median process curved basad on ventral side of shaft; the 2 lateral processes extend laterally and the 2 median processes extend caudally. Pygofer rounded apically.

Holotype male, Bolivia, Villa Tunari, 21-II-1981, Donald R. Foster coll.

H. villaria is related to *H. dellella* DeLong & Freytag but with the foot-like apical portion of style shorter and the toe-like portion broader.

Gypona saavedra n.sp.

(Figs. 6-10)

Length of male 9 mm, female 10.5 mm. Crown a little more than half as long as wide between eyes at base. Ocelli closer to median line than to eyes, closer to basal than to apical margin. Color brownish green scutellum more greenish. A faint, small, black spot behind each eye on pronotum at half length of pronotum. Forewings with apical portion more brownish.

Female 7th sternum broadly angularly excavated from lateral angles almost to base of segment, apex of median notch with a brown sclerotized plate.

Male genital plates twice as long as wide at middle, apices broadly rounded. Style with blade broad dorsoventrally, apical portion foot-shaped, with a broad rounded ventral "heel"

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³Consortium for International Development, Cochabamba, Bolivia.

and a dorsal "toe" which is pointed, with a filamentous apex. Aedeagal shaft rather broad, bearing 2 apical, laterally directed processes, almost half as long as shaft, and 2 very short subapical processes, 1/4 length of apical processes. Pygofer narrowed and rounded apically.

Holotype male, Bolivia, Saavedra, 9-VIII-'80, Donald R. Foster coll. Paratype female same data except 7-V-'80.

G. saavedra is placed in the subgenus *Gypona* and is related to *G. lingua* DeLong and Freytag from which it can be separated by the shorter subapical aedeagal spines and the longer, narrower apical portion of the style.

***Gypona tunaria* n.sp.**

(Figs. 11-15)

Length of male 9 mm, female 10.5 mm. Crown produced and broadly rounded, slightly more than half as long at middle, as wide between eyes at base. Ocelli closer to median line than to eyes. Color: crown green, ocelli red, pronotum green with a minute round black spot, each side, behind eyes, not quite half the length of pronotum, scutellum green, forewings pale greenish subhyaline with black areas at base of wing, along scutellum, and across basal portion of apical cells.

Female 7th sternum with a median, broadly rounded lobe which bears a squarish excavation at middle 1/9 width of segment and 1/4 distance to base, with a slight median notch.

Male genital plates 2 1/2 times as long as wide at middle, apex broadly rounded. Style long, slender, slightly curved ventrally, near middle, tapered to a long, slender, pointed apex. Aedeagus short, shaft bent dorsally at 3/4 its length, apex bluntly pointed. Pygofer with a finger-like process, each side, on inner dorsal margin.

Holotype male, Bolivia, Villa Tunari, 21-II-1981, D.R. Foster coll. Paratypes: 1 male, females same data as holotype; 1 male Chapiro, Bol. 26-V-1980.

G. tunaria is related to *G. tubulata* DeLong & Freytag and is placed in the subgenus *Gypona*. It can be separated from *tubulata* by the longer, tapered style and by the apically curved and tapered aedeagus.

***Folicana boliviana* n.sp.**

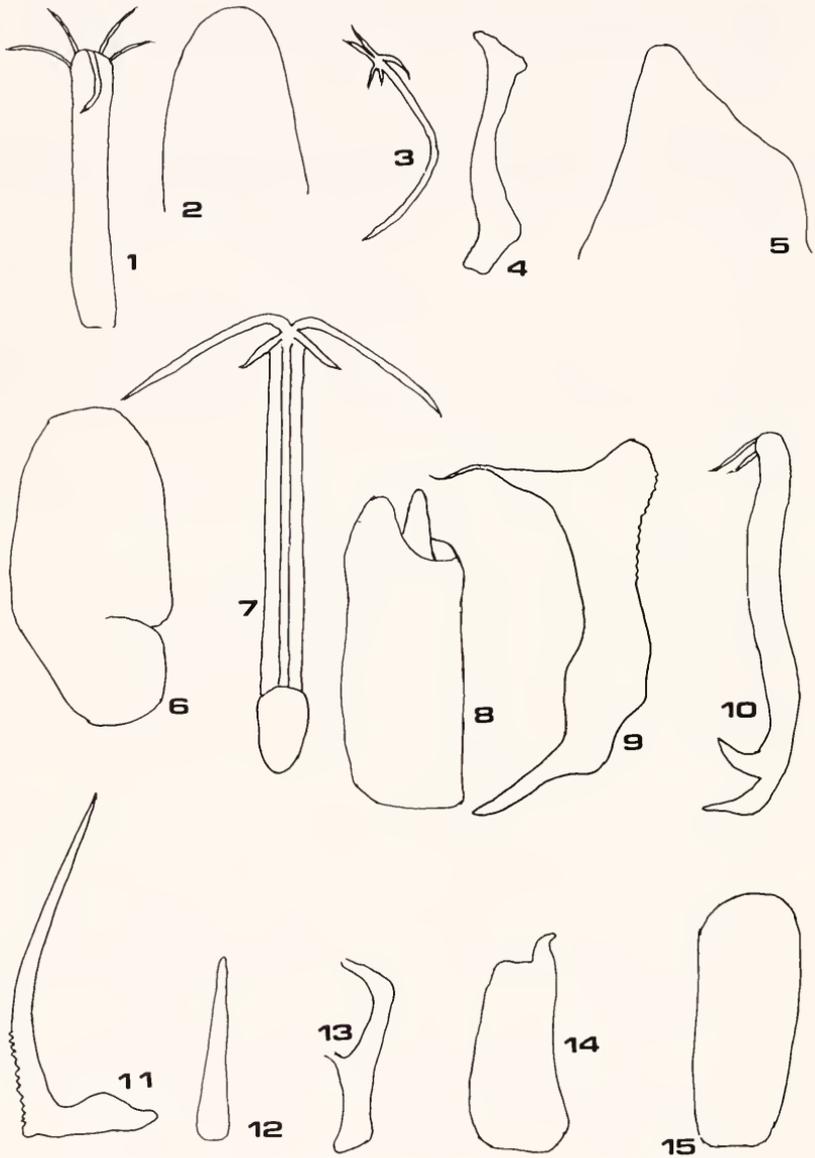
(Figs. 16-20)

Length of male 10 mm, female unknown. Crown broadly rounded, about twice as wide between eyes at base as long at middle. Ocelli much closer to posterior than to anterior margin, closer to median line than to eyes. Color, crown pale brownish. Pronotum with median longitudinal half dark greenish brown. Each lateral portion, behind eyes, pale grayish green. Scutellum brownish yellow, apical angles brown. The outer margin of the darker coloration on pronotum appears as a darker brownish longitudinal stripe which terminates on the basal angles of scutellum.

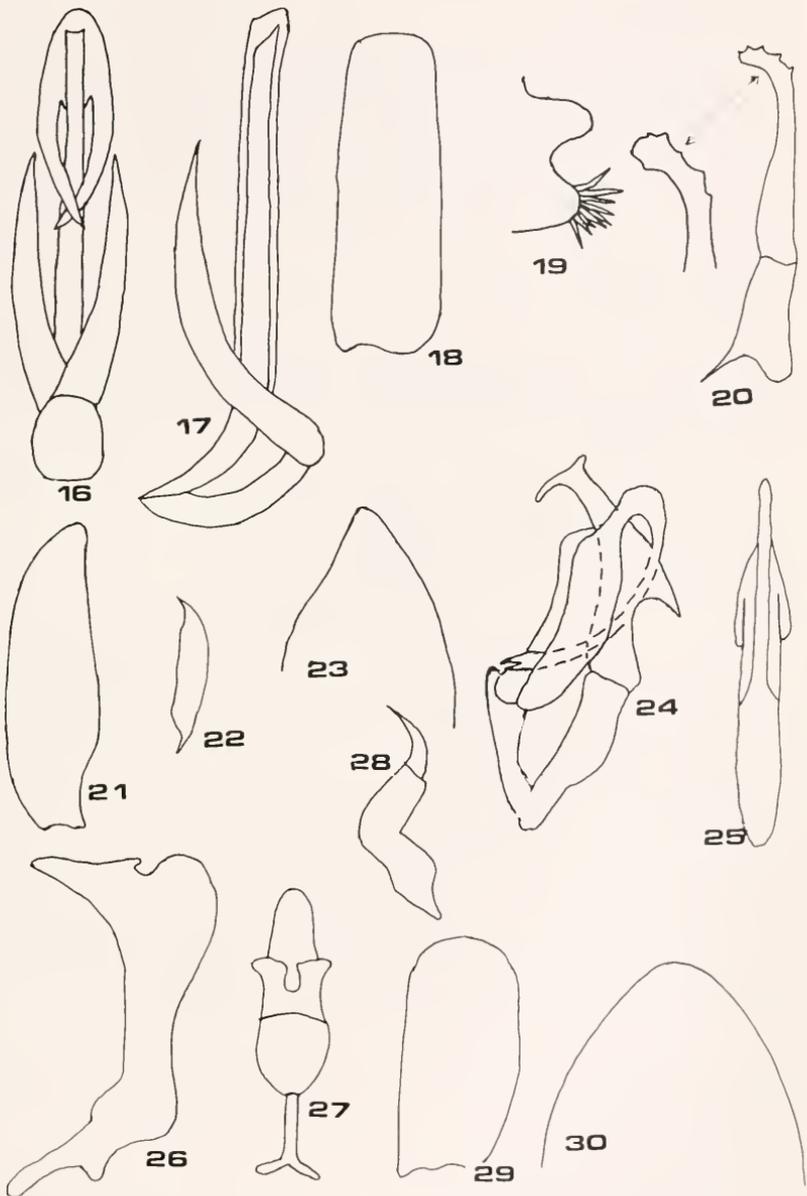
Male genital plates 3 times as long as wide at middle, apices broadly rounded. Style elongate, apical portion narrowed, apex curved dorsally, ventral margin of apical portion serrate. Aedeagus with paraphyses which extend more than 2/3 distance to apex and are pointed apically. Aedeagal shaft with apex angled and pointed at one side, apex enclosed by a slightly sclerotized sheath which extends about 1/3 distance to base, enclosing 2 apical processes.

Holotype male, Bolivia, Santa Cruz, 21-VII-1980, D.R. Foster coll.

F. boliviana is related to *F. acrita* DeLong & Freytag and can be separated from it by the angular apex of the aedeagal shaft, the slightly sclerotized apical capsule of the aedeagal shaft and the shorter, rounded



Figs. 1-5 *Hecalapona villaria* n.sp. 1. aedeagus ventrally, 2. plate ventrally, apical portion, 3. aedeagus laterally, 4. style laterally, 5. pygofer laterally, apical portion. Figs. 6-10 *Gypona saavedra* n.sp. 6. plate ventrally, 7. aedeagus ventrally, 8. pygofer laterally, 9. style laterally, 10. aedeagus laterally. Figs. 11-15 *Gypona tunaria* n.sp. 11. style laterally, 12. aedeagus ventrally, 13. aedeagus laterally, 14. pygofer laterally, 15. plate ventrally.



Figs. 16-20 *Folicana boliviana* n.sp. 16. aedeagus ventrally, 17. aedeagus laterally, 18. plate ventrally, 19. pygofer spine, laterally, 20. style laterally, with enlarged apical portion. Figs. 21-25 *Curtara audacitara* n.sp. 21. plate ventrally, 22. style laterally, 23. pygofer laterally, apical portion, 24. aedeagus laterally, 25. aedeagus ventrally. Figs. 26-30 *Polana santana* n.sp. 26. style laterally, 27. aedeagus and connective ventrally, 28. aedeagus laterally, 29. plate ventrally, 30. pygofer laterally, apical portion.

apex of the style.

Curtara audacitara n.sp.

(Figs. 21-25)

Length of male 8.5 mm, female unknown. Crown produced and rounded, 1/2 as long at middle as wide between eyes at base. Ocelli about equidistant between eyes and median line. Color pale gray with numerous black punctate spots. Pronotum yellowish gray on anterior portion with 2 reddish brown spots behind each eye, disc pale gray with numerous small black punctate spots. Scutellum dull yellowish, a small black spot each side at inner margin of basal angle, on anterior margin. Forewings pale gray, almost white, with black spots or dashes in linear arrangement along wing veins, most prominently along costal and claval veins. Veins of apical portion margined with pale brown.

Male genital plates 5 times as long as wide at middle, apex narrowed and rounded. Style narrow, curved ventrocaudally at apex, tip roundly pointed. Aedeagal shaft bearing a conspicuous pointed tooth on median ventral margin, apex foot-like with a ventral narrow, rounded "heel" and a dorsal narrow, rounded "toe". Paraphyses about equal width for entire length, median portion rod-shaped, terminating in spine-like processes. Pygofer narrow, bluntly pointed apically.

Holotype male, Bolivia, Puerto Villarael, 16-IV-'81, D.L. Foster Coll.

C. audacitara is placed in the subgenus *Curtara*. The aedeagal processes resemble those of *C. inflata* DeLong & Freytag from which it can be separated by the transverse apical portion of the aedeagal shaft and the almost uniform width of the paraphyses.

Polana santana n.sp.

(Figs. 26-30)

Length of male 8 mm, female unknown. Crown broadly rounded, not quite half as long at middle as wide between eyes at base. Ocelli nearer apical than basal margin of crown and about equidistant between eyes and median line. Color, crown, pronotum and scutellum reddish brown, with irregular blackish brown areas, basal angles of scutellum, black. Forewings reddish brown, veins and cross veins darker brown or black.

Male genital plates more than twice as long as wide at middle. Style broad dorsoventrally, apical portion foot-like with a broadly rounded "heel" and a bluntly pointed dorsal "toe". Apical margin of "foot" notched near middle. Aedeagus broad basally in ventral view, in lateral view curved ventrally, broader ventrally than caudally, apical third narrowed and pointed apically. Pygofer narrowed, rounded apically, without pygofer spine.

Holotype male, Bolivia, Santa Cruz, 21-V-1980 D.R. Foster coll.

P. santana is placed in the subgenus *Polanana*. It is related to *P. obliqua* DeLong and Freytag and can be separated from it by the absence of a pygofer spine, and the absence of aedeagal processes.

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DESCRIPTION OF LARVAL FORM AND NEW
DISTRIBUTION RECORD FOR *TUCKERELLA*
HYPOTERRA McDANIEL & MORIHARA
(ACARI: TUCKERELLIDAE)¹

B. McDaniel,² Eric G. Bolen³

ABSTRACT: A description of the larvae of *Tuckerella hypoterra* McDaniel and Morihara is given. The distribution of *T. hypoterra* is extended to include southwestern Glasscock County, Texas.

Tuckerella hypoterra previously was described only from adult specimens collected in South Dakota and Colorado (McDaniel et al. 1975). In this paper a description of the larval stage is given and the distribution of *T. hypoterra* is extended to include Texas.

Tuckerella hypoterra McDaniel and Morihara

Larvae: Caudum with 5 pairs of whiplike setae (7 are present on the adults) arising from tuberclelike setal bases. Posterior half of each whiplike seta moniliform, pilose; anterior portion plumose as in adults. Posterodistal element of duplex setae on tarsus I absent, anterodistal element very large. Rostrum and palpi approximately equal in length, palpi well-developed, bearing two apical setae similar to those of adults; stylets recurved basally, rostrum with two vertical setae placed above coxae of palpi, similar in structure to adult, rostrum not completely covered by extension of gnathosoma. Dorsum with typical fan-shaped setae characteristic of adult except smaller, distribution same as in adult except for the opisthonotum which has only 20 fan-shaped setae, 6 in a transverse series behind the suture marking delineation of metapodosomatic and opisthosomatic regions, 6 setae on opisthosonotal margin (Fig. 1) (adults have 8 setae in this location); opisthonotum with 2 rows of 4 medial setae, posterior row smaller than all other dorsal fan-shaped setae, submedian pair placed anteriorly to outer lateral pair. Ventral region with only 2 pairs of pilose seta, anal region with 3 pairs of pilose setae.

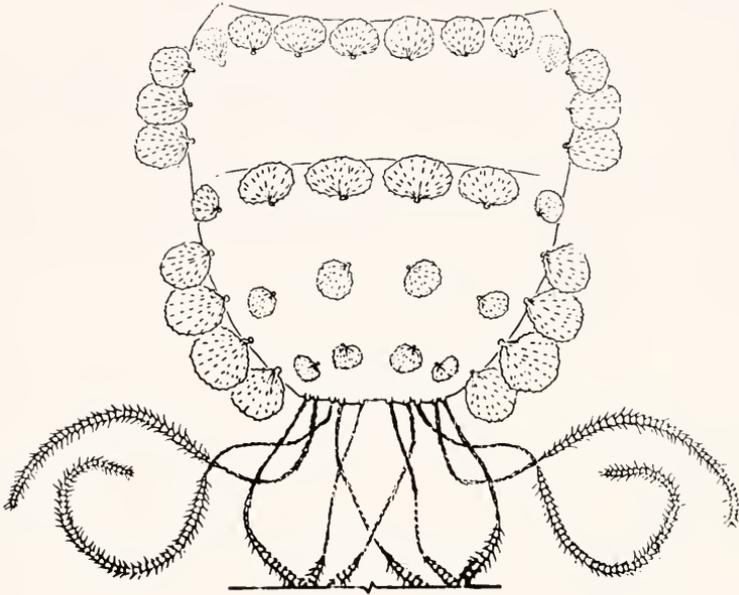
Habitat: The Texas specimens of *T. hypoterra* were collected 19 September 1981 in southwestern Glasscock County on the Wilkerson Ranch, 10 miles south of Garden City and 1.5 miles west of State Highway 33. The county lies in an econtonal region of the Southern High Plains and the Edwards Plateau characterized by a subtropical climate with annual averages of 16 inches of precipitation and 217 frost-free days. Soils at the collection site are silty clay loams of the Reagan Series; these are moderately alkaline, deep upland soils formed in calcereous loamy sediments of eolian origins. The habitat is heavily grazed rangeland dominated by a mesquite (*Prosopis* sp.) overstory and broomweed (*Xanthocephalum* sp.) understory; thin stands of grasses interspersed on exposed soil provide the only other

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vegetation. These conditions, particularly the extensive broomweed understory, reflect the proximity of a nearby windmill where cattle concentrate for water and thereby cause considerable disturbance to the range community.



1

Fig. 1. *Tuckerella hypoterra* McDaniel and Morihara Larval Opisthonotum.

ACKNOWLEDGMENTS

We appreciate the support of Organized Research from the College of Agricultural Sciences, Texas Tech University. Approved for publication by the Director, Agricultural Experiment Station, South Dakota State University, Brookings, as Journal Series No. 1805.

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A NEW GENERIC PLACEMENT FOR *HAPLOGONATOPUS AMERICANUS* PERKINS (HYMENOPTERA: DRYINIDAE)^{1,2}

M.K. Giri, P.H. Freytag³

ABSTRACT: *Haplogonatopus americanus* Perkins, a North American species of the family Dryinidae, is transferred to the genus *Dicondylus*. The morphological characters needed for the identification of this species are illustrated for the first time.

This paper is an attempt to clarify the proper generic placement of *Haplogonatopus americanus* Perkins. Perkins (1905) described the genus *Haplogonatopus* for three new species, *H. apicalis*, *H. moestus* (from Australia) and *H. americanus* (from America) on the basis of an undivided pronotum, 2-segmented labial and maxillary palpi. Olmi and Currado (1979), on reexamination of the type-species, *H. apicalis*, found that it had a 1-segmented labial palpi. On this basis they redescribed the generic characters of *Haplogonatopus* and excluded *americanus* from the genus.

Besides *Haplogonatopus*, *Dicondylus* was the only logical alternative genus for the placement of *americanus*. Richards (1939) described *Dicondylus* as having an undivided pronotum, 2-segmented labial palpi and a delphacid host. The type-species of *Dicondylus* (*bicolor* Haliday) was described as having 4-segmented maxillary palpi. The type-specimen of *americanus* has 2-segmented maxillary palpi as confirmed by Freytag's study of the female types. We have illustrated *americanus* (Fig. 1, 2 and 3) and compared it with the type-species of *Dicondylus*. The variation in the number of maxillary palpi has previously been reported for this genus as well as some of the other genera (Richards, 1939; Raatikainen, 1961; Freytag, 1977 and Olmi, personal communication). Raatikainen (1961) reported that the maxillary palpal segments of *Dicondylus helleni* Raatikainen varies from 2 to 3 segments. Because of the above mentioned facts, we transfer *H. americanus* Perkins to the genus *Dicondylus*.

Dicondylus americanus (Perkins), NEW COMBINATION

Haplogonatopus americanus Perkins 1905 p. 39. Described from a series of females collected from Ohio.

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Characters:**Male (Fig. 1)**

Length 1.8 to 2.6 mm. Winged with reduced venation. Body black, posterior ocelli farther from each other than each is from the anterior ocellus. Aedeagus long, bifurcated at apex and prominent (Fig. 3B). Tip of distivolsella has only one filament and 2 shorter spines. Dorsal processes of gonoforceps long, colorless, slightly curved, touching beyond middle, extending slightly beyond distivolsella with tips rounded and a few dentations.

Female (Fig. 2)

Length 2.2 to 3.1 mm. Apterous. Head with vertex depressed, labial and maxillary palpi 2-segmented (Fig. 3A). Antennae 10-segmented, first 2 and the last segments pale, remainder dark brown. Pronotum not crossed by a transverse impression (undivided). Mesonotum and metanotum yellowish brown. Femur has black tinge visible from side. Tibial spurs 1, 0, 1. Last segment of tarsus bearing 14 enlarged lamelliform setae in 3 groups; enlarged tarsal claw has a preapical tooth with a row of 5 enlarged setae (Fig. 3C and D). Propodum yellowish brown, with a pair of spiracles, and fine transverse striae, without evident pilosity. Abdomen mostly black (after feeding, banded, black and yellow because of the extension of abdominal sclerites).

We also examined the Holotype of *Dicondylus texanus* (Ashmead), a male from Texas, originally described as *Labeo texanus*. Both *americanus*

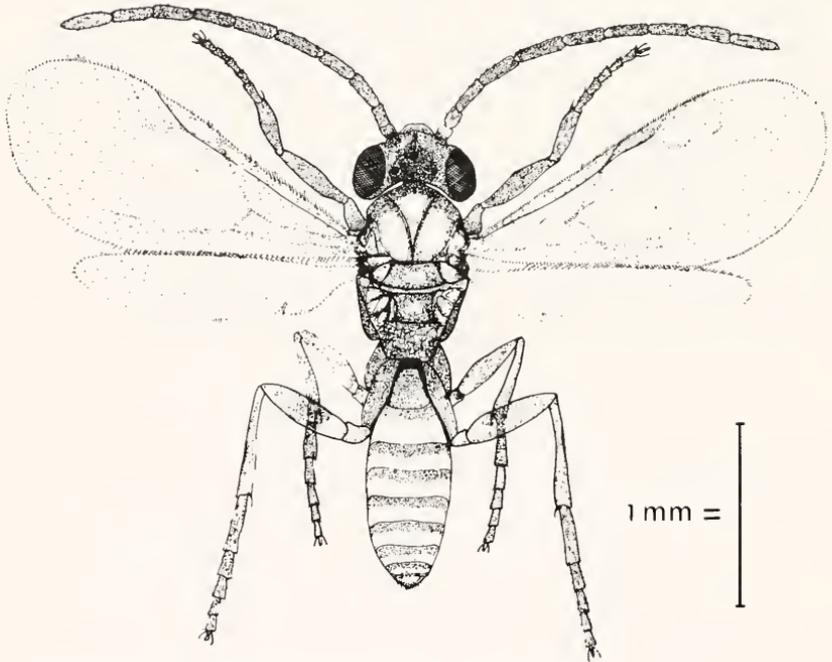


Fig. 1. Male *Dicondylus americanus* (Perkins), dorsal view.

and *texanus* have 2-segmented maxillary palpi and similar dorsal processes in the male genitalia. A good comparison of these two species could not be made at this time, because of the absence of adequate specimens, primarily females of *texanus*.

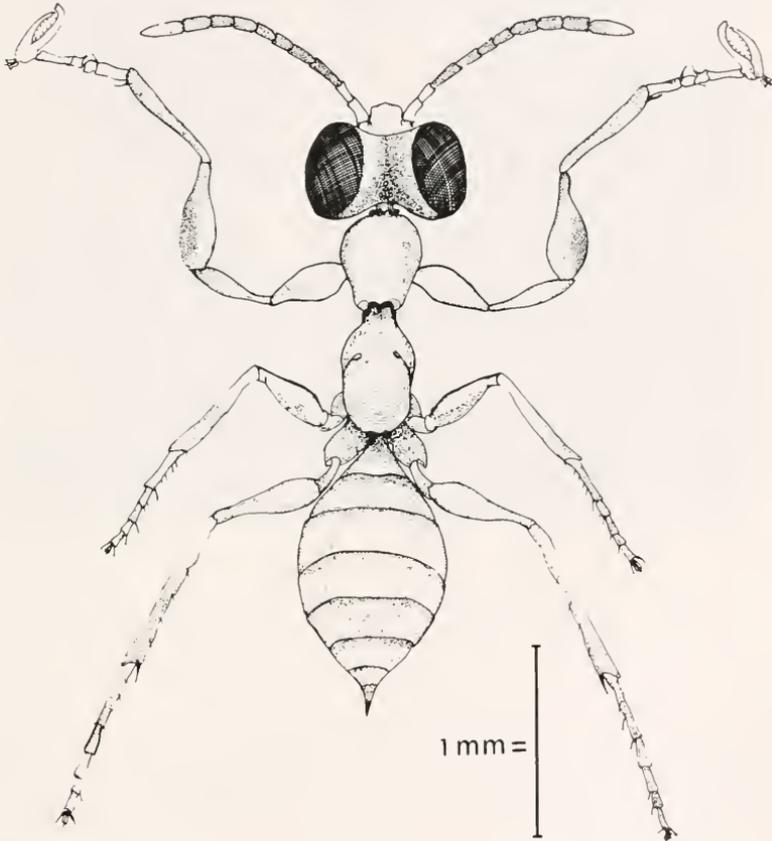


Fig. 2. Female *Dicondylus americanus* (Perkins), dorsal view.

ACKNOWLEDGMENT

We wish to thank A.S. Menke, Systematic Entomology Laboratory, USDA, for arranging the loan of type material from the National Museum of Natural History, Washington, D.C. Thanks are also due to M. Olmi, Department of Plant Protection, University of Viterbo, Faculty of Agriculture, 01100 Viterbo, Italy for his valuable suggestions, and G.M. Nishida, Bishop Museum, Honolulu, Hawaii, for permission to study the Perkins types.

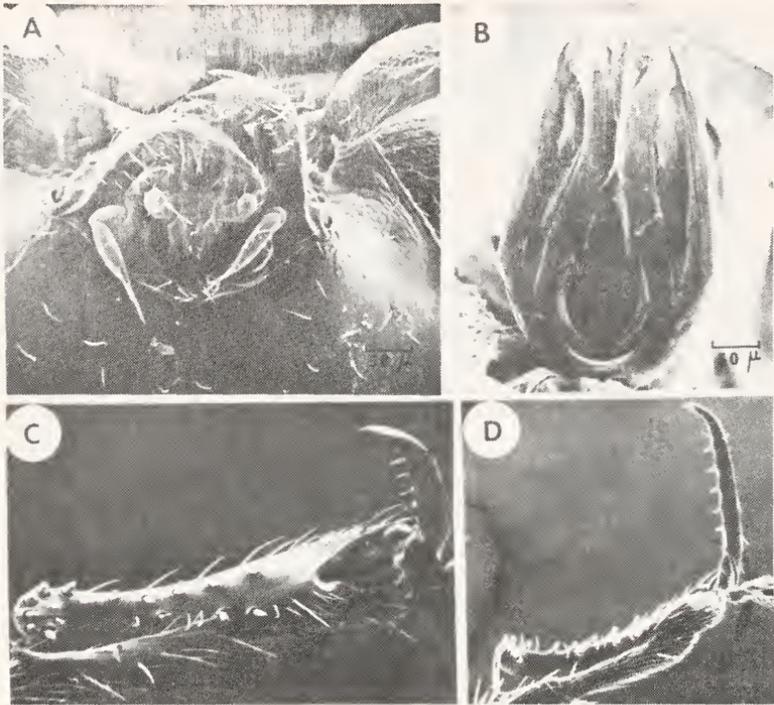


Fig. 3. A. Mouthparts of a female showing segmentation of palpi, ventral view.
 B. Male genitalia, dorsal view, showing curved dorsal processes and aedeagus.
 C. Female chela showing 5th tarsal segment with 14 enlarged setae.
 D. Female chela showing claw with a subapical tooth and 5 enlarged setae.

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NEW STATE RECORDS OF THE MAYFLY *LEPTOPHLEBIA BRADLEYI* NEEDHAM¹

Brad C. Henry, Jr.,² Boris C. Kondratieff³

ABSTRACT: *Leptophlebia bradleyi* Needham is newly recorded from New York, Oklahoma, Texas, and Virginia. This species was previously known from only Alabama, Florida, Georgia, and Louisiana.

The original description of *Leptophlebia bradleyi* was based on male imagoes collected in the Okefenokee Swamp, Georgia (Needham, 1932). Traver (1935) transferred *L. bradleyi* to the genus *Paraleptophlebia*. Berner (1950) discussed this species and noted its uncertain generic placement. Berner (1975) reassigned *bradleyi* to *Leptophlebia* based on adult and nymphal characters and described the nymph and female imago. Edmunds et al. (1976) retained *bradleyi* in *Paraleptophlebia* but noted Berner's (1975) transfer. Berner (1975) summarized the characters for separating *L. bradleyi* from *Paraleptophlebia*.

The previous known range of *L. bradleyi* was the southeastern states of Alabama, Florida, Georgia, and Louisiana (Needham, 1932; Berner, 1977). Recently we examined field-collected, and reared imagoes of this species from Long Island, New York, south central Oklahoma, central Texas, and Virginia. These records represent significant extensions of the known range of *L. bradleyi* far to the northeast and west. Kondratieff and Voshell (1981) briefly discussed *L. bradleyi* in Virginia.

Material Examined:

New York: Suffolk Co., Manorville, 12 April 1979, Darlene Massey, 5♂.

Oklahoma: Murray Co., Honey Cr. and I-35, 13 March 1981, B.C. Henry, 4♂.

Texas: Irion Co., W. Rocky Cr. at FM 853, 23 Jan. 1981, 5♂; 17 Dec. 1980, ♂ (reared); 18 Dec. 1980, 1 ♂ (reared); 23 Jan. 1981, 5 ♂, B.C. Henry. Travis Co., Barton Cr. at Bee Cave, 23 Dec. 1980, 1♂ (reared), 4♀ (2 reared), B.C. Henry.

Tom Green Co., Dov. Cr. on Tweedy Ranch 2 mi SW Knickerbocker, 19 Feb. 1981, 3♂, B.C. Henry. S. Concho R. at Christoval, 23 Dec. 1980, 11 ♂, Lynn McCutchen.

Virginia: Hanover Co., South Anna River overflow marsh, Co. Rt. 657, 21 March 1978, B.C. Kondratieff, 3♂.

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³Department of Entomology, Virginia Polytechnic Institute & State Univ., Blacksburg, VA 24061

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We would like to thank Dr. Lewis Berner, University of Florida for confirming our identifications and reviewing the manuscript. We would also like to thank Dr. Paul K. Lago, University of Mississippi for the New York record and Dr. J. Reese Voshell, Jr., Virginia Polytechnic Institute and State University for helpful suggestions with the manuscript.

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CHARLES P. ALEXANDER

One of the giants of taxonomic entomology, Dr. Charles P. Alexander, passed away on December 3, 1981. He was 92 years of age. Dr. Alexander was a retired professor of entomology at the University of Massachusetts at Amherst. He was even better known, worldwide, as an outstanding authority on crane fly (Tipulidae) systematics, having described and named over 10,000 species during his long career. His extensive collection has been transferred to the U.S. National Museum of Natural History in Washington, D.C.

Dr. Alexander was an almost life long member of the American Entomological Society and a frequent contributor of papers to both our Transactions and to Entomological News. Over his lifetime, he authored and published over 1000 papers containing the results of his extensive research.

He and his very supportive wife, Mabel, who passed away a little over two years ago, left a will which included bequests to over a dozen entomological societies and publications, including the American Entomological Society, to assist in the publication of the results of entomological research. Thus the influence of Dr. Alexander will live on for years to come, not only in his own published works, but in the published research of others.

BOOKS RECEIVED AND BRIEFLY NOTED

A DIRECTORY OF POLICIES ON ARTHROPOD COLLECTING ON PUBLIC LANDS. Gary A. Dunn. 1982. The Great Lakes Entomologist 15: 123 - 141.

Though not a book, this paper is an excellent guide to the policies and regulations on arthropod collecting and research on public lands.

A FAUNISTIC SURVEY OF THE ORGANISMS ASSOCIATED WITH ANTS IN WESTERN TEXAS. K.C. Neece and D.P. Bartell. 1982. Graduate Study #25, Texas Tech Univ., Lubbock, Tx. 36 pp. \$6.00 pbk.

A survey and study of myrmecophilous insects in Texas, west of the 100th meridian. Six orders of associates were collected with 20 ant genera.

TAXONOMIC STUDIES OF ENCYRTIDAE WITH DESCRIPTIONS OF NEW SPECIES AND A NEW GENUS (Hymenoptera: Chalcidoidea). Gordh & V.A. Trjapitzin. 1981. Univ. of Calif. Pub. in Entomology #93. U. of C. Press. 64 pp. \$7.00 pbk.

Several problem genera are treated to correct problems and deficiencies in encyrtid taxonomy in preparation for a revision of the Nearctic Encyrtidae.

FAUNAL AFFINITIES, SYSTEMATICS, AND BIONOMICS OF ORTHOPTERA OF CALIFORNIA CHANNEL ISLANDS. D.C.F. Rentz & D.B. Weissman. 1982. Univ. of Calif. Pub. in Entomology #94. U. of C. Press. 240 pp. \$22.00 pbk.

This monograph, the culmination of ten years of intensive research on the Orthoptera of the California Channel Islands and adjacent coast of southern California, reports on the unique combination of an interesting island system and a manageable and diverse group of insects.

WASPS OF GENUS TRYPXYLON, SUBGENUS TRYPARGILUM, IN NO. AMERICA (Hymenoptera: Sphecidae). Rollin E. Coville. 1982. Univ. of Calif. Pub. in Entomology #97. U. of C. Press. 147 pp. \$13.00 pbk.

Systematics of No. Amer. sphecid wasps of the genus *Trypoxylon*, subgenus *Trypargilum*, are examined. Biological habits of the subgenus are reviewed.

THE ROLE OF HYPERPARASITISM IN BIOLOGICAL CONTROL: A SYMPOSIUM. David Rosen. 1981. Div. Agric. Sciences, Univ. of Calif. Pub. #4103. 52 pp. \$3.00 pbk.

Six papers discuss defining and identifying hyperparasites, their occurrence among insects, key characteristics of better studied species, impact on primary parasites, and the practice of importation.

THE PENTATOMOIDEA (HEMIPTERA) OF NORTHEASTERN NO. AMERICA WITH EMPHASIS ON THE FAUNA OF ILLINOIS. J.E. McPherson. 1982. So. Illinois Univ. Press. 240 pp. \$30.00.

This comprehensive survey provides updated keys to the Pentatomoidea, illustrations of key characters, brief summaries of field life histories, distribution maps for each Illinois species or subspecies and an index of existing literature, current to 1981.

LOCOMOTION & ENERGETICS OF ARTHOPODS. C.F. Herreid II and C.R. Fournier, eds. 1981. Plenum Press. 546 pp. \$59.50.

This symposium report presents an overview of swimming, walking, and flying — the major methods of arthropod movement. Included are studies on mechanics and kinematics, on neuromuscular interactions and muscle biochemistry, on circulation and gas exchange, on temperature regulation, and on energetics.

BIOLOGY OF DESERT INVERTEBRATES. Clifford S. Crawford. 1981. Springer-Verlag. 314 pp. \$39.30.

An interesting and in-depth study of the ways in which invertebrate animals function in arid, and often stressful, environments. What these creatures do, how and when they do it, and how they manage to survive while doing it are questions that are addressed by the author.

A TEXTBOOK OF ENTOMOLOGY, FOURTH EDITION. H.H. Ross, C.A. Ross, and J.R.P. Ross. 1982. John Wiley & Sons. 696 pp. \$25.95.

This standard introductory text in entomology has had much of its material rewritten to reflect significant changes in entomological thought in recent years. The major aims of earlier editions are retained while added emphasis is placed on the relationships between insects and their environments and on their evolutionary relationships.

LARGE WHITE BUTTERFLY. THE BIOLOGY, BIOCHEMISTRY AND PHYSIOLOGY OF PIERIS BRASSICAE. John Feltwell. 1981. Dr. W. Junk BV Pub. 542 pp. \$98.00.

This book is designed for the research scientist as a resource to all relevant literature and as an introduction to all aspect of the biology of *P. brassicae*.

THE BIOLOGY OF CENTIPEDES. J.G.E. Lewis. 1981. Cambridge Univ. Press. 476 pp. \$69.95.

This comprehensive account of centipede biology provides a critical review of all work to date, covering anatomy, behavior, reproduction and life history, predators and parasites, physiology, ecology, and taxonomy.

When submitting papers, all authors are requested to (1) provide the names of two qualified individuals who have critically reviewed the manuscript *before* it is submitted and (2) submit the names and addresses of two qualified authorities in the subject field to whom the manuscript can be referred by the editor for final review. All papers are submitted to recognized authorities for final review before acceptance.

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ENTOMOLOGICAL NEWS

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(Continued on inside of back cover)

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A REVIEW OF THE SPECIES OF *PTILODACTYLA* IN THE UNITED STATES WITH DESCRIPTIONS OF THREE NEW SPECIES (COLEOPTERA: PTILODACTYLIDAE)^{1,2}

Victor Johnson, Paul H. Freytag³

ABSTRACT: Nine species of *Ptilodactyla* from the United States are discussed, with three being described as new. Two species are related to *angustata* Horn (*equilobata* Chapin, and *exotica* Chapin) and five species are related to *serricollis* (Say) (*isolaba* n. sp., *carinata* Johnson and Freytag, *nanoderma* n. sp., *acuta* Johnson and Freytag, and *hyperglotta* n. sp.). Distribution records are included for each species and a neotype is designated for *Ptilinus serricollis* Say. A key to all species is included.

Six species of *Ptilodactyla* are known from the United States (Johnson and Freytag, 1978). Three new species are added at this time, bringing the total to nine. Since records of this family are so few and many areas are not well collected, we believe there may still be several more undescribed species in North America.

All species of *Ptilodactyla* are very similar in size, coloration, and external body characteristics, so determinations are currently based on male genitalia, which readily separate all known species. Previous workers (Chapin, 1927; Horn 1880) have used the shape of the tarsal claws. We used tarsal claws (Johnson and Freytag, 1978) but found that the angle at which one views them leads to variable interpretations and makes comparisons difficult. We therefore have based our determinations only on the male genitalia. There are slight variations in the male genitalia but these do not interfere with identifications. Most variations are the position and length of the lateral lobes (parameres). These may cross or bend laterally and they may be the same length as the median lobe (aedeagus) or somewhat shorter. The illustrations (Figure 7-12) used in this paper place these lobes in the same position and represent a typical specimen of each species.

Females are very difficult to properly identify and were excluded from our study. Many have been collected and are in collections but few can be associated to the proper species.

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²The investigation reported in this paper (No. 81-7-181) is in connection with a project of the Kentucky Agricultural Experiment Station and is published with approval of the Director.

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We also designate a neotype for *P. serricollis* (Say) at this time to stabilize this name. There has been some confusion in the past as to which species this name refers and there may be additional species found which may be closely related to it.

KEY TO THE MALES OF *PTILODACTYLA* OF NORTH AMERICA

1. Genitalia less than four times as long as wide (*angustata* group) 2
 Genitalia more than four times as long as wide (*serricollis* group) 4
2. Lateral lobes truncate at apex *equilobata* Chapin
 Lateral lobes pointed at apex 3
3. Lateral lobes closely appressed to median lobe *exotica* Chapin
 Lateral lobes capable of being deflexed near base *angustata* Horn
4. Median lobe with dorsal, subapical, fleshy inner flaps (Fig. 7) 5
 Median lobe without dorsal, subapical fleshy inner flaps (*nanoderma* has very small
 inner flaps, usually not visible) (Fig. 9) 6
5. Median lobe with apex asymmetrical (Fig. 7) *serricollis* (Say)
 Median lobe with apex symmetrical (Fig. 8) *isoloba* n. sp.
6. Median lobe with apex asymmetrical (Fig. 10) *nanoderma* n. sp.
 Median lobe with apex symmetrical (Fig. 9) 7
7. Median lobe with apex rounded, with a subapical dorsal process (Fig. 12) *hyperglotta* n. sp.
 Median lobe with apex narrow, without a subapical dorsal process 8
8. Median lobe with apex boat-shaped (Fig. 9) *carinata* Johnson & Freytag
 Median lobe with apex not boat-shaped (Fig. 11) *acuta* Johnson & Freytag

Angustata Group

This group of three species is well characterized in Chapin's paper (1927) and he gives good illustrations of the male genitalia of each.

Ptilodactyla angustata Horn

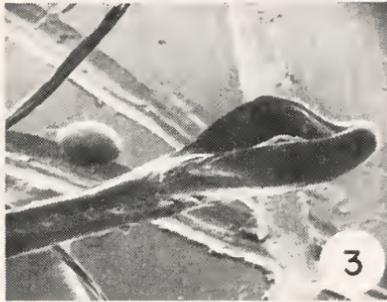
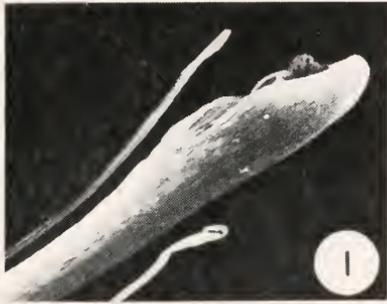
Ptilodactyla angustata Horn 1880, p. 90; Chapin 1927, p. 243.

This species is now known from the following states: Florida, Georgia, Kentucky, Louisiana, Maryland, Missouri, North Carolina, Pennsylvania, Tennessee, Texas, Virginia, and West Virginia.

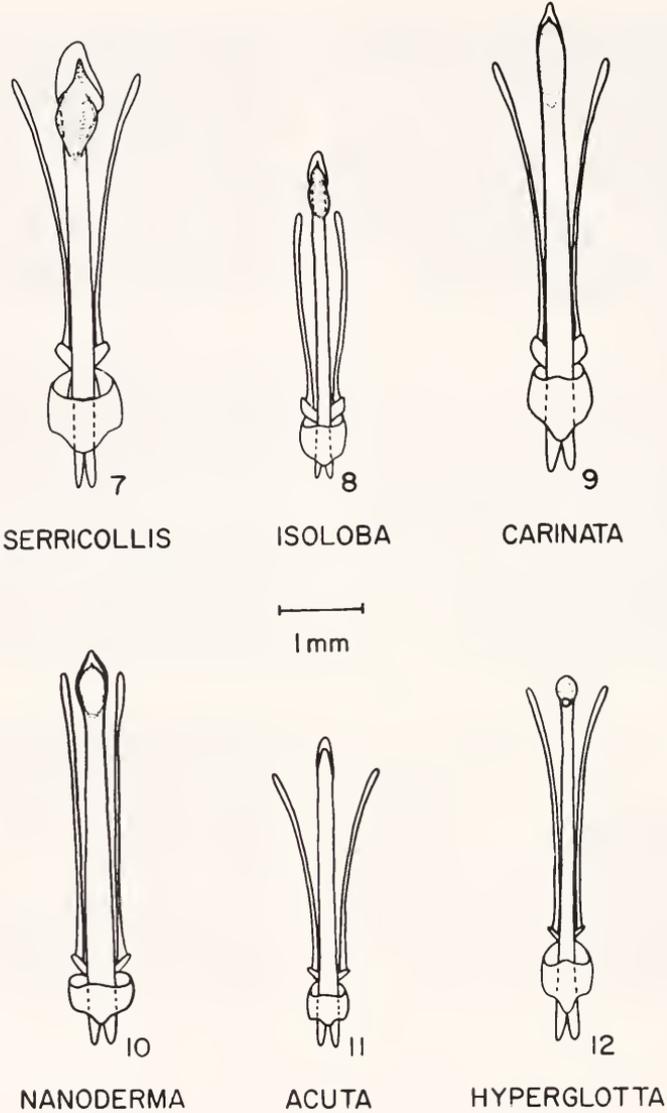
Ptilodactyla equilobata Chapin

Ptilodactyla equilobata Chapin 1927, p. 245.

This species is known only from Texas.



Figs. 1-6, *Ptilodactyla* spp., apex of male genitalia. Fig. 1: *P. isoloba* n. sp., lateral view. Fig. 2: *P. isoloba* n. sp., dorsal view. Fig. 3: *P. nanoderma* n. sp., lateral view. Fig. 4: *P. nanoderma* n. sp., dorsal view. Fig. 5: *P. hyperglotta* n. sp., lateral view. Fig. 6: *P. hyperglotta* n. sp., dorsal view. Figs. 1-5, 120x Fig. 6, 240x.



Figs. 7-12, Dorsal view of male genitalia of *Ptilodactyla* spp., Fig. 7, *P. serricollis* (Say); Fig. 8, *P. isoloba* n. sp.; Fig. 9, *P. carinata* Johnson and Freytag; Fig. 10, *P. nanoderma* n. sp.; Fig. 11, *P. acuta* Johnson and Freytag; Fig. 12, *P. hyperglotta* n. sp. All drawn to the same scale.

Ptilodactyla exotica Chapin

Ptilodactyla exotica Chapin 1927, p. 246.

This species is known only from the northeastern states from Illinois to Washington, D.C.

Serricollis Group*Ptilodactyla serricollis* (Say)

(Figure 7)

Ptilinus serricollis Say 1823, p. 186.

Ptilodactyla serricollis Horn 1880, p. 90; Chapin 1927 (in part), p. 242; Spilman 1961: p. 105; Johnson and Freytag 1978, p. 125.

This species was discussed by Chapin (1927), who accompanied his description with a line drawing of the male genitalia. This drawing indicated a median lobe of the penis that was symmetrical. Johnson and Freytag (1978) further discussed this species and included scanning electron micrographs of the male genitalia. These micrographs showed a median lobe that was strongly expanded and distinctly asymmetrical. After further study of several hundred specimens, we have concluded that the species with the larger and more asymmetrical median lobe of the penis is *serricollis*. This species is quite common and its distribution includes the type locality (Missouri) as indicated by Say (1823) in his original description. For clarification of *serricollis* we are hereby specifying a male specimen labeled "Advance, Missouri, corn field, June 9, 1919, J.R. Painter" (Type No. 100316, USNM) as the neotype of *Ptilinus serricollis* Say. The other species with the symmetrical median lobe of the penis is uncommon and appears to be distributed in the northeast. We describe it as a new species (*isoloba* n. sp.) in this paper.

We have seen many specimens of *serricollis* from the following states: Arkansas, D.C., Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maryland, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, Virginia, and West Virginia. Also one male was seen from Ontario, Canada.

Ptilodactyla isoloba, new species

(Figures 1, 2 & 8)

Ptilodactyla serricollis Chapin 1927 (in part), p. 242.

Similar to *serricollis* in all aspects, except male with median lobe of penis symmetrical.

Tarsal claws of male forelegs with inner portions of unguis about one-half length of claws.

Male genitalia with median lobe of penis expanded symmetrically at apex, with two smaller inner flaps proximal to lateral expansions. Lateral lobes of penis sub-equal in length of median lobe, setiform.

Holotype male: Erlanger, Kentucky, at light, June 8, 1980, Victor Johnson. (Type No. 100315, USNM). Paratypes: Same data as type, except one male, June 11, 1980; one male,

August 9, 1981; one male. August 15, 1981; one male, Rockhaven, Kentucky. July 22, (no year), J. Soltau; one male, Cincinnati, Ohio, August 19, (no year), H. Soltau; one male, Wayne, Co., New York. August 10, 1950, Shoemaker; one male, Breton Bay, Maryland, July 13, 1923, H.S. Barber; and one male, Plummers Island, Maryland, July 30, 1919, H. Barber. The first three paratypes in the University of Kentucky Collection and the remainder in the U.S. National Museum.

Note: This species was illustrated (as *serricollis*) by Chapin from specimens from Pennsylvania. No Pennsylvania specimens have been seen by us, but this state is within the distribution of this species. It does not occur in Missouri (no specimens collected there) so could not be *serricollis* as described by Say.

We have also seen one questionable male specimen of this species in the U.S. National Museum. It is labeled "Albuq. N.M., Wickman, Wickman Coll. 1933". This appears to be a mislabeled specimen.

Ptilodactyla nanoderma, new species

(Figures 3, 4, & 10)

Similar to *isoloba* in all aspects, except male having median lobe of penis without the pair of inner flaps.

Tarsal claws of male forelegs with inner portions of unguis about one-half length of claws.

Male genitalia with median lobe of penis nearly symmetrically expanded at apex, and usually lacking the pair of inner flaps proximal to the expanded apex. Lateral lobes of penis sub-equal to median lobes, setiform.

Holotype male: Osborne, Indiana, June 4, 1911, E. Lilijebad, (Type No. 100313, USNM). Paratypes: Two males, same data as holotype; one male, LaBelle, Florida, July 16, 1939; Oman; one male, Missouri, July, collection of C.V. Riley; one male, N. Illinois, collection of J.B. Smith. The first paratype in the University of Kentucky collection and the remainder in the U.S. National Museum.

Note: This species differs from *serricollis* by the absence of the inner flaps on the median lobe of the male penis. It is also close to *carinata* but differs by having the median lobe more abruptly expanded near the apex.

Ptilodactyla carinata Johnson and Freytag

(Figure 9)

Ptilodactyla carinata Johnson and Freytag, 1978, p. 126.

This is a common species in the eastern states and has a wide distribution. It is now known from the following states: Alabama, Arkansas, D.C., Florida, Georgia, Kansas, Kentucky, Louisiana, Maryland, New Jersey, New York, Pennsylvania, Texas, and West Virginia.

Ptilodactyla hyperglotta, new species

(Figures 5, 6, & 12)

Similar to *serricollis* in overall characteristics, but with the median lobe of male penis having a dorsal subapical tongue-like process.

Tarsal claws of male forelegs with inner portion of unguis about one-half length of claws.

Male genitalia with median lobe of penis symmetrically expanded at apex into a rounded spoon-shaped tip. At the proximal end of spoon-shaped expansion a tongue-like process extends dorsad.

Holotype male: Near Brownsville, Texas, November 22, 1967, A & M.E. Blanchard (Type No. 100314, USNM). Paratypes: all Brownsville, Texas, three males, same data as holotype; three males, at light, April 4, 1908, D.K. McMillan; one male, May 15, 1934, J.N. Knull; and one male, May 15, 1935, J.N. Knull. The first paratype in the University of Kentucky Collection, the last two paratypes in the Ohio State University Collection, and the remainder in the U.S. National Museum.

ACKNOWLEDGMENTS

We thank the following persons: C.A. Triplehorn, Ohio State University Collection (OSUC); T.R. Yonke, University of Missouri Collection (UMRM); and J.M. Kingsolver, U.S. National Museum (USNM), for the loan of material examined, and P. Southgate for assistance with the SEM photographs.

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A NEW SPECIES OF *GONIOZUS* (HYMENOPTERA: BETHYLIDAE) IMPORTED INTO CALIFORNIA FOR THE BIOLOGICAL CONTROL OF THE NAVEL ORANGEWORM (LEPIDOPTERA: PYRALIDAE)¹

Gordon Gordh²

ABSTRACT: *Goniozus legneri* NEW SPECIES is described. This primary parasite was imported into California from Uruguay for the biological control of the Navel Orangeworm (NOW), *Amyelois transitella* (Walker). The parasite has become established and shows exceptional promise for the control of NOW on almonds in California.

In conjunction with biological control work on the navel orangeworm (NOW), *Amyelois transitella* (Walker), E.F. Legner conducted foreign exploration for natural enemies in Uruguay. During November 1977 Legner collected parasites of this moth with Professor Silvera-Guido near Payanu, Uruguay on *Erythrina cristagalli* Linnaeus. Among the parasites recovered was an undescribed species of bethylid. This material was propagated in Professor Silvera-Guido's laboratory on NOW and shipments of parasites on NOW were sent to the Division of Biological Control, University of California, Riverside, during the spring of 1978. The parasite was cultured in the laboratory, subsequently released against NOW in the Central Valley of California, and has become established on NOW attacking almonds. This paper provides a name for the parasite. A comprehensive biological study is currently being conducted and will be published elsewhere. Terminology follows Evans (1964, 1978).

Goniozus legneri n. sp.

Female: 3.86 mm long (Holotype). Body jet black; wings hyaline, 2.50 mm long. Coxae black; fore femur black with apex dusky; middle femur dark brown with apex somewhat more pale; fore tibia and tarsomeres tan; middle and hind tibiae dusky with apices more pale; middle and hind tarsomeres tan; antenna predominantly tan with apical segments dusky.

Head in dorsal aspect 1.05 times longer than wide, minutely and finely reticulate, with numerous shallow, setigerous punctures forming a conspicuous vestiture of long white setae such that the length of each seta extends to the socket of an adjacent seta. Median longitudinal keel of clypeus short, not conspicuous but acute; scrobal impressions not acute. Ocelli forming a slight, but definite, acute triangle; lateral ocellus less than its diameter from occipital margin; WOT:OOL 6:16. Head in lateral aspect with compound eye rather small, very sparsely setose; HE:LH 19:42. Mandible with three teeth and a truncation. Antenna as illustrated (Figure 3).

¹Received January 11, 1982

²Division of Biological Control, Department of Entomology, University of California, Riverside, CA 92521

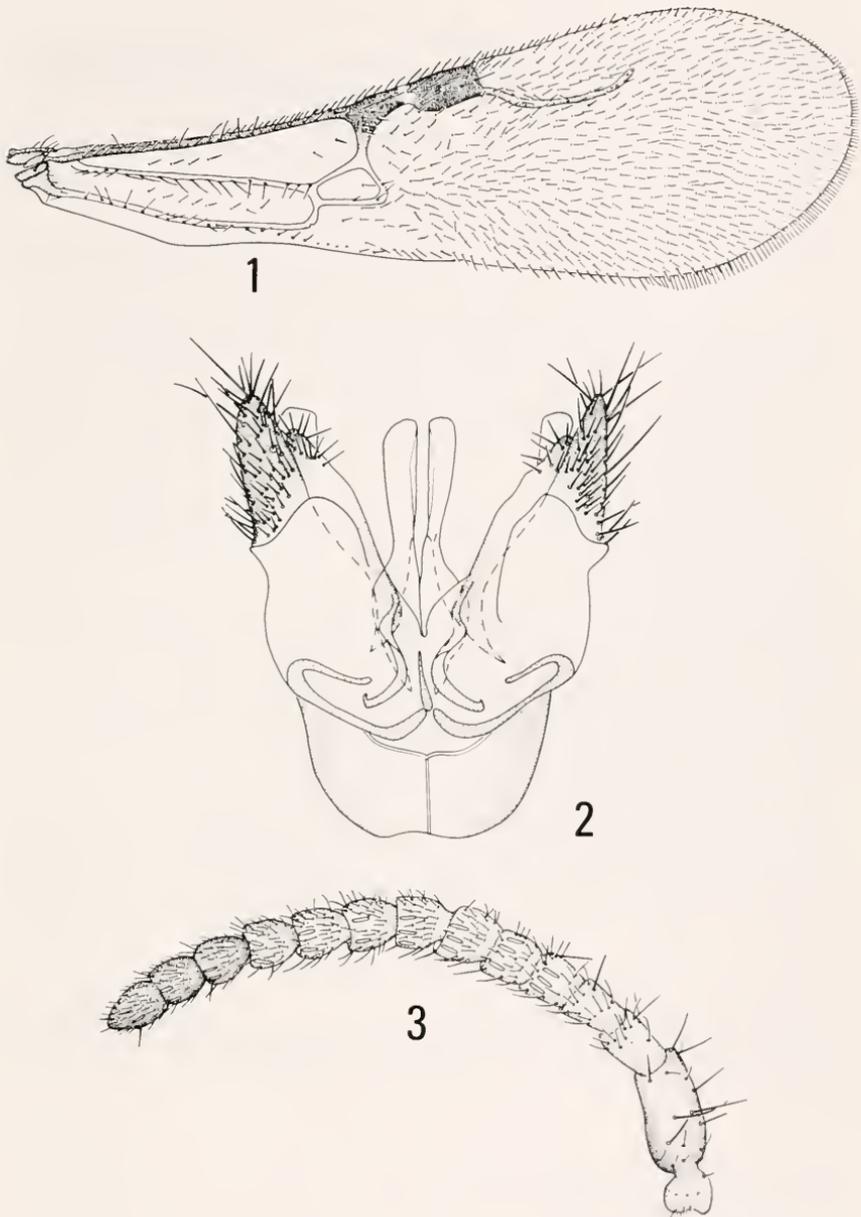


Fig. 1. Right forewing of ♀ *Goniozus legneri*, new species. Fig. 2. ♂ genitalia of *G. legneri*, new species. Fig. 3. Right antenna of ♀ *G. legneri*, new species (inner aspect).

Ratio of pronotum: mesoscutum: scutellum: propodeum 17:15:11:25 in dorsal aspect. Pronotum with same sculpture and chaetotaxy as dorsum of head. Mesoscutum sculpture less pronounced, with two parallel, longitudinal, lateral, shallow sulci (evident only in certain plays of light); anterior 0.20 - 0.25 asetose, remainder with same chaetotaxy as pronotum. Antero-lateral scutellar pits exceptionally small, obsolete; scutellum with same sculpture and chaetotaxy as mesoscutum; anteromedial portion of propodeum with a few minute pits, otherwise polished; remainder of propodeum minutely, finely, obliquely reticulate; lateral carina not strongly developed. Forewing as illustrated (Figure 1).

Male: Virtually identical to female except slightly smaller in size. Genitalia as illustrated (Figure 2).

Described from 105♀, 87♂♂ lab reared in the UCR insectary during September 1981 on *Amyelois transitella* (Walker) from material originally collected near Payanu, Uruguay. Holotype ♀, 5♀♀, 5♂♂ paratypes deposited in the U.S.N.M. Paratypes deposited in the following institutions: California Academy of Sciences (4♀♀, 4♂♂); Canadian National Collection (4♀♀, 4♂♂); Australian National Insect Collection (4♀♀, 4♂♂); Zoological Institute, Leningrad, USSR (4♀♀, 4♂♂); Plant Protection Institute, Pretoria, South Africa (4♀♀, 4♂♂); Entomology Department, Colorado State University, Fort Collins (4♀♀, 4♂♂), Ehime University, Shikoku, Japan (4♀♀, 4♂♂); remainder of paratypical series deposited in Division of Biological control, UCR.

This species is named in honor of Dr. E.F. Legner is recognition of his work with the biological control of the Navel Orangeworm and other agricultural pests.

Goniozus legneri is a member of the PUNCTATICEPS species group, characterized by short antennae, sharp median clypeal keel, complete areolet of the forewing, and scrobes not carinate. Within the PUNCTATICEPS species group *G. legneri* appears most closely related morphologically to *G. emigratus* (Rohwer) of the species in the PUNCTATICEPS species group found in the United States. The new species may be distinguished from *emigratus* based on antennal segment size and shape, shape of the ocellar triangle, relative closeness of the lateral ocellus to the crest of the vertex, and the ratio of the length of the compound eye to the length of the space behind the compound eye to the lateral margin of the vertex (HE:LH). *Goniozus emigratus* is found in Texas, Hawaii, and California; *G. legneri* is found in Uruguay and the Central Valley of California.

ACKNOWLEDGMENTS

I thank Dr. John Pinto and Mr. Jack Hall for critically reading the manuscript. Mr. Robert Medved cultured the host and parasite in the laboratory and provided the material which constituted the type-series. The illustrations were prepared by Ms. Patti Mote.

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OCCURRENCE OF *ANTHRENUS FUSCUS* OLIVIER (COLEOPTERA: DERMESTIDAE) IN IOWA^{1,2}

James W. Mertins³

ABSTRACT: There is evidence that *Anthrenus fuscus* Olivier, an Old World dermestid beetle, is permanently established in Ames, Iowa. The first collected specimen dates from 1970. This is the best documented and westernmost infestation of *A. fuscus* in North America and is a new state record. Morphological and biological means are presented for differentiating larval *A. fuscus* from the similar larvae of *A. verbasci* (L.).

Life history studies (Mertins 1980) of the bethylid wasp parasitoid, *Laelius pedatus* (Say), depleted the supply of hosts in culture. The wasps and hosts, larvae of *Anthrenus verbasci* (L.), originated in Madison, WI. I attempted to replenish the host supply from local infestations of dermestid larvae in my office and other areas in the Insectary Building on the Iowa State University campus, Ames, Iowa.

I was surprised when these collected insects proved largely refractory to the venom of *L. pedatus*, a situation theretofore not observed with *A. verbasci*. The local larvae appeared to be *A. verbasci*; they were acceptable hosts to female *L. pedatus* for stinging and oviposition, but the ephemeral efficacy of the wasp venom made them unsuitable for subsequent development of progeny. Paralysis rarely lasted more than 48 hours and, usually, half that. Oviposition usually occurred in the interim, but the fully mobile host larvae always dislodged the parasitoid eggs on revival. These larvae ran to *A. verbasci/A. fuscus* Olivier in the key of Hinton (1945), which noted the difficulty of satisfactorily distinguishing between the two. I therefore collected associated adult *Anthrenus* from windows in the Insectary and reared some of the collected larvae to the adult stage. These adults were easily identifiable as *A. fuscus* by the unusual five-segmented structure of the antennae (Hinton 1945).

A. fuscus is indigenous to Europe (Mroczkowski 1968, 1975) and Great Britain, where it is considered one of the three common species of *Anthrenus* (Munro 1966). Palearctic populations persist in nature, primarily in bird nests (Kunike 1939, Hinton 1943, Woodroffe and Southgate 1951, Woodroffe 1953), nests of aculeate Hymenoptera (Maréchal 1932, Hinton 1943, Linsley 1944), and especially in and around spider webs (Hinton

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²Journal Paper No. J-10591 of the Iowa Agriculture and Home Economics Experiment Station, Ames, IA 50011. Project No. 2259.

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1943, 1945). The latter sites seem to be the primary source of infestation by *A. fuscus* in houses and other buildings, although the beetle is seldom a pest except occasionally in insect collections (Hinton 1943, Mroczkowski 1975). The adults also occur on flowers (Olivier 1789, Hinton 1943, Linssen 1959, Mroczkowski 1975).

Initial permanent establishment of *A. fuscus* in the United States is open to question (R.S. Beal, Jr., Northern Arizona University, pers. commun.) The first published New World distribution is in the Leng (1920) catalog from "Pennsylvania (North America)" and probably is based on a misidentification. Hinton (1945), perhaps paraphrasing Leng, states "North America (Holarctic)", and Mroczkowski (1975) likewise mentions "North America (introduced)." Arnett (1968) records *Helocerus*, the subgenus of *A. fuscus*, from the United States. The existence of specimens to support these reports is undocumented. However, Bayer et al. (1972) record one specimen from Kenosha, Wisconsin, and housed in the Purdue University collection; W.E. Burkholder (University of Wisconsin-Madison, pers. commun.) confirms establishment in Madison, Wisconsin. Becker (1977) reports specimens from three sites in southern Ontario, the earliest in 1962 from a flour mill in St. Jacobs and, the latest, in 1974 from Dunn Township. Finally, although the specific records are heretofore unpublished, Beal (pers. commun.) reports seeing 21 specimens from Durham, NH (1907), two specimens from Ithaca, NY (1966), and one specimen from Syracuse, NY (1966).

The population in Ames seems to be well established. I found only one preserved specimen in the Iowa State Insect Collection, but it was taken from a "human habitation" in Ames in 1970. Larvae are found with little difficulty throughout the ISU Insectary Building, usually associated with dead insects and often in or near spider webs. Adult beetles begin to appear in windows of the building by the middle of March. I collected 29 *Anthrenus* adults on May 26, 1981, from flowers of *Spiraea x vanhouttei* Zab. growing on campus; 15 proved to be *A. fuscus*. I also have collected adults and larvae in several area homes; indeed, I observed and captured a female as it squeezed in through the mesh of a patio screen door in my own home.

Because of the frequent difficulty in separating larvae of *A. fuscus* from those of *A. verbasci*, I have summarized the differences I have observed between the two in Table 1. Hinton (1945) also noted that *A. verbasci* larvae are paler and more active than *A. fuscus* larvae.

These observations establish a new state distribution record for *A. fuscus* and provide the most complete published evidence for permanent establishment in the United States, if not North America inclusive. This is also the westernmost locality of collection for *A. fuscus*. Voucher specimens are deposited in the Iowa State Insect Collection, Ames, and with R.S. Beal, Jr., at Northern Arizona University.

Table 1. Morphological, behavioral, and biological characters useful in differentiating mature larvae of *Anthrenus fuscus* and *A. verbasci*.

<i>A. fuscus</i>	<i>A. verbasci</i>
1. Smaller species; maximum larval length ca. 4.1 mm x maximum width ca. 1.7 mm	1. Larger species; maximum larval length ca. 4.5 mm x maximum width ca. 2.0 mm
2. Not especially active or agile; forward movements smooth; not good climbers	2. Very active and agile; forward movements irregular and jerky; good climbers
3. Abdominal terga 1-5 evenly pigmented dark brown side-to-side	3. Abdominal terga 1-4 medium to dark brown laterally but lightly pigmented medially; tergum 5 evenly very dark brown side-to-side
4. Short, transversely porrect hastisetae on posterior of each thoracic and abdominal tergum through number 4 robust, darkly pigmented, and densely arranged	4. Short hastisetae on posterior of each thoracic and first 4 abdominal terga more delicate, less pigmented, and often more sparsely distributed
5. Because of points 3 and 4 (above), larvae appear uniformly dark dorsally from anterior to posterior	5. Because of points 3 and 4 (above), larvae usually appear somewhat pale dorsomedially, especially on the abdomen
6. Reaction to attack by <i>Laelius</i> spp. rarely involves more than erection of posterior hastisetae and elevation of the cephalic and caudal ends of the body	6. Reaction to attack by <i>Laelius</i> spp. similar, but also usually involves violent somatic twists, turns, and tumbles aimed at dislodging the parasitoid
7. Refractory to venom of <i>Laelius pedatus</i> , usually recovering in 24 to 48 hours	7. Completely susceptible to venom of <i>L. pedatus</i>

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PHORESIS BETWEEN THE SNAIL *OXYTREMA* (=ELIMA) *CARINIFERA* AND AQUATIC INSECTS, ESPECIALLY *RHEOTANYTARSUS* (DIPTERA: CHIRONOMIDAE)¹

William S. Vinikour²

ABSTRACT: Insects, especially the midge *Rheotanytarsus*, were found to be phoretically associated with the snail *Oxytremma* (=Elimia) *carinifera*. Maximum incidence (82.5%) and density (\bar{x} = 2.4 midges/snail) occurred at a shaded headwater site. This association provided the midge with food resources through its filtration of organic matter suspended by the snail. The midge optimized filtration by orientating its tube opening toward the aperture of the snail. This association also provided the midge with a measure of protection from sedimentation, dislodgement, and predation. Rarely, the midge *Thienemanniella*, the blackfly *Simulium tuberosum*, and the hydroptilid *Ochrotrichia* were observed as phoronts of *Oxytremma*. Their low incidence (< 0.5% per species) indicates a nonselective colonization of the snail over other available substrates. *Rheotanytarsus* may be unique among the midges in its preferential phoretic association with snails, especially in less suitable habitats.

Symbiotic relationships between aquatic insects and gastropods were first noted by Barnard (1911). Other authors have reported similar associations (see Steffan, 1967) These relationships involve parasitism of the snail by dipterans of the families Chironomidae and Sciomyzidae. Only recently have phoretic associations (nonparasitic relationships in which one species lives on another to obtain transportation) between snails and insects been reported. These associations have invariably involved the midge *Rheotanytarsus* Bause (Diptera: Chironomidae) occurring on pleurocerid snails (Mancini, 1979; White et al., 1980). This study also reports on the occurrence of *Rheotanytarsus* as a phoront of snails and provides an interpretation of the nature of this association. Additionally, other insect species are reported as phoronts of snails for the first time.

Study Site and Methods

I collected snails of the species *Oxytremma* (=Elimia) *carinifera* (Lamarck) (Gastropoda: Pleuroceridae) from three sites in the upper reach of Davis Creek, Tuscaloosa County, Alabama. Pertinent physicochemical parameters associated with each site have been presented by Vinikour (1982). Sampling was conducted on 14 March and 17 June 1981. Snails

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were hand-collected, and attempts were made to obtain a random sampling of a full range of snail sizes. In the laboratory the number of *Rheotanytarsus* (as indicated by numbers of tubes) and other insects associated with each snail was determined under a dissecting microscope. All midges encountered within the tubes were mounted for identification, and predominant gut contents were noted. The length of each snail was measured to the nearest 0.05 mm with dial calipers. A total of 679 snails were examined.

Results and Discussion

The percent infestation³ and mean number of *Rheotanytarsus* occurring on snails for each sample site and date are given in Fig. 1. Midge infestations were highest at the headwater site (DV-01). Combining the data for the two sampling dates, I found that 75.2% of the snails at DV-01 harbored *Rheotanytarsus*, while infestation rates at the other sites were much lower (7.2% at DV-02 and 6.0% at DV-03). White et al. (1980) observed that 80% (36 of 45) of the pleurocerid *Elimia acutocarinata* harbored *Rheotanytarsus*; Mancini (1979) routinely observed 35% infestation of the pleurocerid *Goniobasis semicarinata* at two of the three sites he studied, with the highest infestation rate being 56%.

In my study, the mean number of midges per snail for the combined dates was highest at DV-01 (1.9), compared to only 0.07 at DV-02 and 0.06 at DV-03. If only infested snails were considered, the mean number of midges per snail was 2.5 at DV-01 and 1.0 at both DV-02 and DV-03. Multiple infestations were common at DV-01, with 69% (161 of 233) of the infested snails harboring two or more midges. Most infested snails harbored from one to four midges, but one snail had ten midges (see Fig. 1). In instances of heavy infestations, some of the individual midge tubes were constructed on top of each other (see Fig. 2). White et al. (1980) observed 89% (32 of 36) of infested snails to have multiple infestations of two to four midges; Mancini (1979) only found \cong 10% of infestations to be multiple, although he did collect one snail with seven midges.

Mancini (1979) found that mature specimens of *Goniobasis semicarinata* tended to harbor more midges than did immature specimens. To determine whether the size of *Oxytrema* governed infestation by *Rheotanytarsus*, I conducted t-tests comparing the length of infested and uninfested snails from DV-01 for each sampling date. For the March collection, the mean length of the infested snails (13.55 mm) was significantly greater than that for uninfested snails (11.40 mm). This is mainly attributable to the fact that

³The term "infestation" is used in this paper to denote the nonparasitic occurrence of *Rheotanytarsus* on snails.

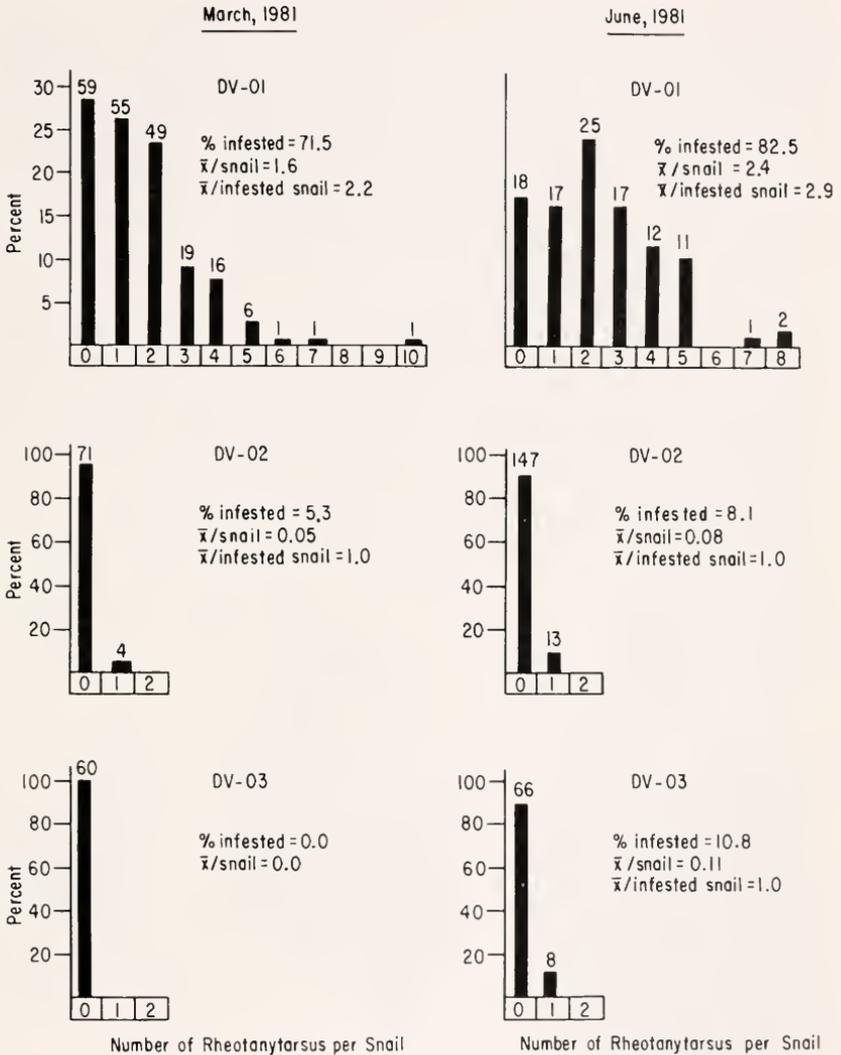


Figure 1. Percent infestation and density of *Rheotanytarsus* on *Oxytrema carinifera*. The number above each bar is the number of snails. Sites DV-01, DV-02, and DV-03 are 0.6, 4.7, and 12.8 km downstream of the headwater of Davis Creek, respectively.

most (13 of 17) snails less than 8 mm long harbored no midges. For the June collection, no significant difference in mean shell length was found between infested (\bar{x} length = 13.65 mm) and uninfested (\bar{x} length = 13.50 mm) snails. In part this was because the mean snail length in June (13.61 mm) was significantly larger than the mean length in March (12.87 mm). Only four snails <8.0 mm long were collected in June. A larger shell length provides greater surface area for colonization by midges. This partly accounts for the percent infestation, the mean number of midges per snail, and the mean number of midges per infested snail at DV-01 being greater in June than in March (see Fig. 1).

Also, recruitment of midges that occurred prior to the June collection would account for the insignificant difference in mean size between infested and noninfested snails in June, and for the higher incidence and density of infestation in June compared with March. Many of the midges encountered in the June collection were early instars. Smaller midge size accompanying early instar recruitment would readily allow habitation upon smaller snail shells. In contrast, most midges in the March collection were later instars, and therefore the size of their tubes either precluded their occurrence on smaller snails or, less often, resulted in there being room for only one midge on a snail (see Fig. 2). However, significant differences between mean snail length and the number of midges per snail were not observed, as midges would also construct tubes on top of each other (see Fig. 2). Therefore, multiple infestations were not constrained solely by the amount of snail-shell surface area available for colonization.

Both Mancini (1979) and White et al. (1980) concluded that the occurrence of *Rheotanytarsus* on snails is phoretic and not parasitic. The distinct filter-feeding habits of *Rheotanytarsus* (see Walshe, 1950) lends support to their conclusions. The gut contents of 180 midges I examined consisted predominantly of sand and diatoms, with no indication of animal tissue. White et al. (1980) believed that the phoretic association between *Rheotanytarsus* and snails in their study area may have resulted from the snail shell being an easier attachment site for the midge than rough rock surfaces. However, the site at which I found the highest incidence and density of midges on snails contained a smooth bedrock substrate. Therefore, adequate substrate attachment sites would not be limited as in the study area of White et al. (1980).

Several factors have been implicated as reasons for phoretic associations between the dipteran families Chironomidae and Simuliidae and other aquatic invertebrates. Corbet (1961, 1962) believed the *Simulium* species associate with freshwater crabs, mayflies, and dragonflies primarily for a pupation site. This was inferred from the occurrence of large larvae and pupae on the host. *Rheotanytarsus* does pupate upon *Oxytremata*, as

evidenced by the fact that 13% of the midges I observed were pupae. However, I observed all larval instars on the snails, with earlier instars predominating in June due to recruitment. Furthermore, an abundance of natural attachment sites was available for midge development. Also, rather than seeking an area for pupation, *Rheotanytarsus* only adds to its tube as it develops, closing it off for pupation (Walshe, 1950).

Researchers investigating the association between *Simulium* and invertebrates (crabs and mayflies) prior to Corbet's studies (see Steffan, 1967) concluded that the blackfly derived a number of advantages, including shelter from the current, a more stable substrate in areas of erodible habitat, and/or increased access to food resources. The midge *Nanocladius* obtains increased mobility, habitat security, and protection through its phoretic association with alderflies (Gotceitas and Mackay, 1980) and stoneflies (Doddall and Mason, 1981). Gotceitas and Mackay (1980) felt that *Nanocladius* derived a greater degree of protection from predators once it was established on the alderfly. This was due to the alterfly's position as top carnivore in the trophic structure of the community studied. Although *Oxytrema* is low in the trophic structure of Davis Creek, it



Figure 2. *Rheotanytarsus* and *Simulium tuberosum* on *Oxytrema carinifera*. Note orientation of the anterior portion of the midge tubes toward the aperture or body whorl of the snail. Also evident are how early instar *Rheotantarsus* (based on the posterior portion of the tube) orient along suture lines and that some midges construct their tubes atop other midges.

is among the largest and most abundant of the invertebrates in the stream, and the shell protects the snail from many predators. Through its association with the snail, *Rheotanytarsus* would be protected from most invertebrate predators and would be subject to predation mainly by fish and other organisms large enough to consume the snails.

Dosdall and Mason (1981) believed that the midge *Nanocladius* obtained security by associating with the stonefly *Acroneuria*, in that the stonefly, being larger and stronger than the midge, could better relocate in instances of habitat disturbance. This could be pertinent in Davis Creek, because soils in Tuscaloosa County are highly erosive and the smaller streams are subject to chronic flood scouring (Harkins, 1980). Also, the high density of snails at the study site could be a potential threat to *Rheotanytarsus* in that midges colonizing bedrock surfaces could be readily disrupted by the wanderings of the snail. Thus, a major benefit that the midge would obtain from the association would be security from the snail itself.

The phoretic association can provide a measure of protection to the midge from dislodgement and sedimentation, but such protection may be secondary to the increased availability of food to the midge (especially in less than optimal habits).

Diatoms were abundant in the gut contents of midges found on the snail at all sites. However, because of (1) dense riparian shading at location DV-01 and (2) the short stream length upstream of this headwater site, it is doubtful that diatoms would be abundant within the water column for filtration by midges. The sparsity of diatoms and other fine particulate organic matter (FPOM) in the water column at DV-01 can be inferred from the fact that while large populations of Asiatic clams (*Corbicula fluminea*) were present at DV-02 and DV-03, the species was totally absent from DV-01.

It therefore can be concluded that at DV-01, the midges obtained their food by filtration of diatom-laden sediments suspended near the aperture of the snail during the snails' movement and feeding activities. This conclusion is supported by the fact that only eight midges were located on the dorsal side of the snail shell and that overall, 98% of the midges had their anterior tube openings oriented toward the aperture of the snail or toward the body whorl adjacent to the aperture (see Fig. 2). Such orientation is probably a behavioral modification to facilitate feeding, because material sloughed into suspension by the snail would flow directly into the capture net of the midge.

Tubes of early instar larvae were usually found along suture lines, with the anterior end directed toward the body whorl. Although such orientation would generally direct the capture net perpendicular to the line of snail

movement (that is, perpendicular to snail length), the midges' filtration capabilities would not be minimized. Early instar *Rheotanytarsus* tend to have only one arm from which silk is attached (Walshe, 1950), and thus a slightly perpendicular orientation to the flow of suspended matter would actually maximize filtration potential (i.e., expose more silk strands directly to incoming flow). With a full compliment of arms (five) on late instar midges, filtration would be maximized by the anterior of the tube facing the incoming source of organic matter. This was apparent in that the body position of many late instar larvae were oriented along suture lines, but the anterior ends (especially the raised position containing the net) were turned toward the aperture. At DV-01, where instream primary production and inflow of FPOM is probably limited, the midge could obtain more food by filtering relatively concentrated quantities of sediments being continuously suspended by the snail. That *Rheotanytarsus* was attaching to the snails primarily for this feeding advantage may also be inferred from the position of the midges on the underside of the snail. This position essentially precludes direct contact of the net with the inflowing mainstream current, thereby reducing acquisition of the mainstream drifting food resources.

It should be noted that no other invertebrates were found harboring *Rheotanytarsus* at any of the sample sites. The fact that *Oxytrema* was the only large invertebrate commonly encountered on bedrock substrates may account for this. Thus, although the association between *Rheotanytarsus* and *Oxytrema* may have been initiated through chance encounter, the midge was able to take full advantage of the association by orienting itself on the snail in such a way as to optimize its collection of food, as described in the preceding discussion.

Two factors may account for the high incidence of *Rheotanytarsus* on snails at DV-01 and the low incidence at DV-02 and DV-03. The first is that *Rheotanytarsus* densities were low at DV-02 and DV-03. Samples taken at DV-02 indicate that *Rheotanytarsus* densities were less than 10 per square meter, compared to potential densities at DV-01 of $\geq 4,000$ per square meter (based on estimated snail densities and mean number of midges per snail). Low *Rheotanytarsus* densities, coupled with high densities of *Oxytrema*, at DV-02 and DV-03 would result in both the low observed incidence and low density of midges on snails.

The other factor accounting for the low incidence of *Rheotanytarsus* on snails at DV-02 and DV-03 is that both the quantity of FPOM and instream primary productivity are likely higher at those two sites than at DV-01. These increases result from the amplification of upstream input sources associated with extended stream reach distance and from enhanced sunlight penetration from an open canopy associated with broader stream widths. Thus, food resources available to the midge are increased at downstream reaches to the extent that the feeding advantage gained by associating with

the snail at DV-01 is diminished at DV-02 and DV-03.

Other aquatic insects phoretically associated with *Oxytrema* were the midge *Thienemanniella*, the blackfly *Simulium tuberosum*, and the hydroptilid caddisfly *Ochrotrichia*. The single specimen of *Thienemanniella* encountered was found to be inhabiting a vacated *Rheotanytarsus* tube. Mancini (1979) observed a similar situation with an unidentified beetle larva inhabiting an empty midge tube. Only two pupae and one vacated pupal cocoon of *Simulium* were observed. As concluded by Corbet (1961, 1962), such an association between blackflies and other invertebrates is probably formed as a means for the blackfly to obtain an adequate pupation site. The two *Ochrotrichia* larvae encountered probably associated with *Oxytrema* for a similar reason. White and Fox (1979) found pupae of the hydroptilid *Oxyethira azteca* phoretically associated with the dragonfly *Macromia georgina* due to lack of adequate pupation sites (e.g., vegetation and rocks) normally utilized. The low incidence of *Thienemanniella*, *Simulium*, and *Ochrotrichia* on *Oxytrema* (mean per species <0.5%) indicates a nonselective colonization of snails over the other available substrates.

Most authors have concluded that phoretic associations involving aquatic insects are relatively common (Roback, 1977; Mancini, 1979; White et al., 1980). The specific relationship involving *Rheotanytarsus* and snails appears to be geographically widespread — such associations have been reported from Indiana (Mancini, 1979), South Carolina (White et al., 1980), and Alabama (this study). Although *Rheotanytarsus* is widespread, it may develop a high incidence of association with snails only within restricted areas of a given locality where substrate and/or food resources are inadequate. Due to its use of capture nets to filter food, *Rheotanytarsus* may be unique among the Chironomidae in its preferential phoretic association with snails, especially in less suitable habitats.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

c/o BRITISH MUSEUM (NATURAL HISTORY), CROMWELL ROAD, LONDON, SW7 5BD

ITZN 11/4
(A.N.(S.) 122)

16 June 1982

The Commission hereby gives six months notice of the possible use of its plenary powers in the following cases, published in the *Bulletin of Zoological Nomenclature*, volume 39, part 2, on 15 June 1982, and would welcome comments and advice on them from interested zoologists. Correspondence should be addressed to the Secretary of the above address, if possible within six months of the date of publication of this notice.

Case No.

- 327 Revived proposal for the suppression of the Aphid names of Rafinesque under the plenary powers (Insecta, Hemiptera, Aphididae).

Continued on page 179

***GERRIS REMIGIS* SAY IN A UNIQUE WINTER ENVIRONMENT (HEMIPTERA-HETEROPTERA: GERRIDAE)¹**

Diane M. Calabrese², Peter Tallericó³

ABSTRACT: Adult *Gerris remigis* Say (Hemiptera: Heteroptera) may accumulate day degrees within rock crevices along edges of limestone hot spring beds.

Gerris remigis Say, widely distributed throughout North America, ranges south to Mexico and Guatemala (Drake and Harris 1934). It is commonly found in lentic habitats having water temperatures below 10°C (Calabrese 1977). Spence et al. (1980) proposed that waterstriders belonging to the genus *Gerris* Fabricius exhibit submergence behavior to accumulate day degrees in the spring. In this way the waterstriders reach the threshold for reproductive maturation (gametogenesis) more quickly than they would if they accumulated day degrees only in the colder air environment (Spence et al. 1980).

Limestone hot spring beds (Fig. 1) in Huntsdale, Pennsylvania, visited on 19 February 1982, contained large populations of *Gerris remigis* (aggregations of 20-40 individuals per 20 sq. m bed). The air temperature was 4°C; the water temperature was 15°C.

Water temperature varies only between 12°C and 15°C throughout the year⁴ in the limestone beds, and the waterstriders remain active throughout the year (pers. comm., Paul Biebel, phycologist who conducts research in the area).

Further observation of the populations on 26 February 1982 revealed that adults were moving in and out of crevices in the limestone beds (Fig. 2). We suggest that the *G. remigis* adults were accumulating day degrees within the rock crevices, another means of increasing reproductive rate. (No submergence behavior was observed.)

Some reproduction must have gone on while the air temperature was very low because a second instar was collected on 19 February 1982.

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⁴Huntsdale Fish Cultural Station, brochure. The Pennsylvania Fish Commission

Adults taken into the laboratory and dissected were found to be reproductively mature. It has been shown that although the optimum temperature for growth in *G. remigis* is 22°C., the threshold temperature is only 12.6°C. (Jamieson 1973).

Tipulids and chironomids emerging in large numbers at the site probably serve as a food source for the gerrids.



Fig. 1. Limestone Bed at Huntsdale, Pa.



Fig. 2. Crevices in limestone at Huntsdale, Pa.

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AN ANNOTATED CHECKLIST OF THE FLEAS OF SOUTH DAKOTA (SIPHONAPTERA)^{1,2}

Emmett R. Easton³

ABSTRACT: Collecting data are reported for 35 species of Siphonaptera from South Dakota. New state records and ecological data are presented for the flea species *Ctenophthalmus pseudagyrtis pseudagyrtis* Baker. *Ceratophyllus celsus celsus* Jordan. *Cer. niger* C. Fox. *Cer. styx riparius* (Jordan and Rothschild), and *Cer. petrocheliodoni* Wagner.

Distribution studies of many Nearctic insect species are impeded by a scarcity of information. Except for the mosquitoes, there is no complete list of potential vectors of disease in South Dakota. Fleas are known vectors of sylvatic plague in nature, and even though human cases of plague have not been reported in the state, cases have been reported from most of the states west and south of South Dakota. Results of periodic collecting of fleas from 1977 to 1982 are presented in addition to references to known published accounts. Small mammals in most cases were live-trapped followed by light etherization in a plastic bag enabling the fleas to leave their hosts. Following preservation in 80% alcohol, parasites were cleared in 10% KOH, washed, and subjected to ascending concentration of alcohol. They were then transferred to xylene before mounting in Canada balsam. Specimens are in the author's personal collection unless indicated otherwise.

FAMILY HYSTRICHOPSYLLIDAE

Genus *Catallagia* Rothschild

Catallagia decipiens Rothschild. Ex. *Peromyscus maniculatus*, Black Hills; ex. *Microtus pennsylvanicus*, 18 July 1977, Spearfish Canyon, Lawrence County. First reported in South Dakota by Turner (1974).

Genus *Ctenophthalmus* Kolenati

Ctenophthalmus pseudagyrtis pseudagyrtis Baker NEW STATE RECORDS Ex. *Tamias striatus*, 20 May 1979, Hartford Beach State Park, Roberts County.

Genus *Eptedia* Jordan

Eptedia wenmanni (Rothschild). Ex. *P. maniculatus*, Clay County; Ex. *Microtus longicaudus*, *P. maniculatus*, 30 Sept. 1978, Spearfish Canyon, Lawrence County. First reported from central South Dakota by Benton (1955).

Genus *Hystrichopsylla* Taschenberg

Hystrichopsylla dippiei Rothschild. Ex. *P. maniculatus*, 18 Sept. 1977, Spearfish Canyon, Lawrence County. First reported in Custer County by Holland (1957) as *H. d. dippiei*.

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FAMILY ISCHNOPSYLLIDAE

Genus *Myodopsylla* Jordan and Rothschild

Myodopsylla gentilis Jordan and Rothschild. ex. *Myotis lucifigus*, 21 August 1978, Ralph, Harding County. Reported earlier from South Dakota by Anderson and Jones, Jr. (1971) Ex. *Myotis volans* and *M. lucifigus* in Harding County. *Myodopsylla insignis* (Rothschild). Ex. *M. lucifigus*, 21 Aug. 1978, Ralph, Harding County. Reported from South Dakota earlier by Anderson and Jones (1971) Ex. *M. lucifigus*.

FAMILY LEPTOPSYLLIDAE

Genus *Peromyscopsylla* I. Fox

Peromyscopsylla catatina (Jordan). Ex. *M. pennsylvanicus*, 18 July 1977 and 18 Sept. 1978. Spearfish Canyon, Lawrence County. Reported in South Dakota by Easton (1981). *Peromyscopsylla hesperomys* (Baker). Ex. *P. maniculatus*, 20 Aug. 1977, 18 Sept. 1977, 1 Oct. 1978; Spearfish Canyon, Lawrence County; Ex. *P. maniculatus*, 26 March 1978, Badlands Nat. Park, Jackson County. Johnson and Traub (1954) reported subspecific intergrades of this flea from *Clethrionomys gapperi* and *P. maniculatus* in Custer County and from *P. maniculatus* in Pennington and Meade Counties.

FAMILY CERATOPHYLLIDAE

Genus *Ceratophyllus* Curtis

Ceratophyllus celsus celsus Jordan. NEW STATE RECORD. Nest of *Petrochelidon pyrrhonota*, 4 May 1980, nr. Redig. Harding County.

Ceratophyllus niger C. Fox. NEW STATE RECORD. Nest of *Phalacrocorax auritus*, 4 July 1926. Lake Poinsett, Hamlin County; 16 Aug. 1977. Waubay Nat. Wildlife Ref., Day County.

Ceratophyllus styx riparius Jordan and Rothschild. NEW STATE RECORD. Nest of *Riparia riparia*, Aug. 1977, 1 mi. N. Miller, Hand County.

Ceratophyllus petrochelidoni Wagner. NEW STATE RECORD. Nest of *P. pyrrhonota*, 10 Oct. 1977, Badlands Nat. Park, Jackson County.

Genus *Foxella* Wagner

Foxella ignota (Baker). Ex. *Thomomys talpoides*, Harding County, Ex. *Mustela* sp. 29 Oct. 1921, Brookings County; First reported from Harding County by Anderson and Jones (1971).

Genus *Monopsyllus* Kolenati

Monopsyllus eumolpi eumolpi (Rothschild). Ex. *Eutamias minimus*, 1 Oct. 1978, Spearfish Canyon, Lawrence County. Earlier reported in Custer County by Johnson (1961), and from *E. minimus* in Harding County. (Anderson and Jones, Jr. 1971).

Monopsyllus exilis (Jordan). Ex. *Onychomys* sp. from Jones County first reported by Johnson (1961).

Monopsyllus wagneri (Baker). Ex. *Zapus hudsonicus*, 29 May 1978, Spearfish Canyon, Lawrence County. Ex. *P. maniculatus*, 8 Oct. 1977; Ex. *M. pennsylvanicus*, 30 July 1978, Spearfish Canyon, Lawrence County. First reported in South Dakota by Johnson (1961).

Genus *Opisocrostis* Jordan

Opisocrostis bruneri (Baker). Ex. *Spermophilus franklinii*, 30 April 1977, Astoria, Brookings County; Ex. *S. tridecemlineatus*, April 1915 and Sept. 1935, Brookings County in the State University Collection. First reported by Prince (1943) from Potter, Brown and Spink Counties.

Opisocrostis hirsutus (Baker) Ex. *Cynomys ludovicianus*, April-June 1977, Wind Cave National Park, Custer County, J. Hoogland; Ex. *C. ludovicianus* 26 May 1979, 2 miles west of New Underwood, Pennington County. King (1955) was first to report this species from prairie dogs in the Black Hills. Boddicker (1968) also reported it from *Mustela nigripes* in Bennett and Mellette Counties.

Opisocrostitis tuberculatus cynomuris Jellison. Ex. *Cynomys ludovicianus*, April-June 1977, Wind Cave National Park, Custer County. J. Hoogland; Ex. *C. ludovicianus* 26 May 1979, 2 miles west of New Underwood, Pennington County.

Genus *Megabothris* Jordan

Megabothris quirini (Rothschild). Ex. *Zapus hudsonicus*, 29 May 1978, Spearfish Canyon, Lawrence County. First reported in South Dakota by Easton (1981).

Genus *Malareus* Jordan

Malareus telchinum (Rothschild). Ex. *Zapus hudsonicus* 26 May 1977, 12 mi. S. Spearfish, Lawrence County; Ex. *P. maniculatus*, 6 May 1978. First reported by Turner (1974) in the Black Hills from *Reithrodontomys megalotis*.

Genus *Nosopsyllus* Jordan

Nosopsyllus fasciatus (Bosc.) Ex. *Rattus norvegicus*, (no date), Brookings Brookings County. South Dakota State University Insect Collection.

Genus *Orchopeas* Jordan

Orchopeas caedens (Jordan). Ex. *Tamiasciurus hudsonicus*, 17 May 1955, Sylvan Lake, Custer County, Jellison and Kohls. Unpublished record of the Rocky Mountain Laboratory, Hamilton, Montana. Ex. *T. hudsonicus*, 5 May 1979, 10 mi. S. Pluma, Lawrence County; Ex. *T. striatus*, 20 May 1979, Hartford Beach State Park, Roberts County. First reported by Coffman and Balsbaugh Jr. (1971) in Brookings County from the nest of *Sciurus niger*.

Orchopeas howardi (Baker) Ex. *Sciurus niger* 16 December 1978, 9 miles south, 2 miles west of Brookings, Brookings County. W. Soeffing. First published record in South Dakota by Wilson (1978) from the same host in McCook County.

Orchopeas leucopus (Baker). Ex. *Microtus ochrogaster*, and *P. maniculatus* from the Black Hills was reported by Turner (1974). *Orchopeas sexdentatus* (Rothschild). Ex. *P. maniculatus*, Black Hills, Lead. Ex. *N. cinerea*, 14 Aug. 1979, Spearfish Canyon, Lawrence County. First published records by Turner (1974) from *N. cinerea* southwest of Lead.

Genus *Thrassis* Jordan

Thrassis stanfordi Wagner. Ex. *Marmota flaviventris*, 5 May 1979, 1 mi. N. Deadwood, Lawrence County. First reported in Custer County by Stark in 1970.

Thrassis bacchi (Rothschild). Ex. *M. pennsylvanicus*, 10 May 1977 2 mi. NE Watertown, Codington County. First reported by Prince (1943) from Potter, Brown and Spink Counties from *S. richardsonii*, *S. franklini* and *S. tridecemlineatus*.

Thrassis fotus (Jordan). Ex. *S. tridecemlineatus*, Wind Cave National Park, Custer County (Turner, 1974). First reported by Stark (1970) at two locations near the center of the state.

FAMILY PULICIDAE

Genus *Ctenocephalides* Stiles and Collins

Ctenocephalides canis (Curtis). Ex. Dog, 15 July 1935, Huron, Beadle County. Ex. Dog, 14 July 1914, Brookings County, O. Larson.

Ctenocephalides felis (Bouche). Ex. Cat, 15 July 1935, Brookings, Brookings County, 26 June 1941, Aberdeen, Brown County; 15 July 1935, Huron, Beadle County. Ex. House, Sioux Falls, Minnehaha County, South Dakota State University Insect Collection.

Genus *Cediopsylla* Jordan

Cediopsylla inequalis (Baker). Ex. *Sylvilagus audubonii*. First reported by Anderson and Jones, Jr. (1971) in Harding County.

Cediopsylla simplex (Baker). First reported by Kohls (1940) Ex. *Sylvilagus floridanus*, in Brookings County, South Dakota.

Genus *Euhoplopsyllus* Ewing

Euhoplopsyllus affinis (Baker). Ex. *Lepus townsendi*, Brookings, Brookings County; Ex. *S. floridanus*, 15 April 1936, Brookings County, D.E.H. First published record was reported as *Hoplopsyllus affinis* by Kohls (1940).

Genus *Pulex* Linnaeus

Pulex irritans (Linnaeus). Home, no date, Brookings, Brookings County; Ex. *Canis latrans* pup. 16 May 1955; Edgemont, South Dakota, Fall River County, Kohls and Jellison. Unpublished record of the Rocky Mountain Laboratory, Hamilton, Montana. Ex. *C. latrans*, 12 Oct. 1976, Harding County. E. Schitoskey; Ex. *Vulpes velox*, Aug. 1978, Shannon County. J. Sharp.

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The author wishes to thank Dr. William L. Jellison (USPHS, retired, Hamilton, Montana) and Dr. Omer R. Larson (University of North Dakota, Grand Forks) for the identity of fleas in this study.

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THOUGHTS ON THE ORIGIN OF INSECT FLIGHT¹

Frank Louis Carle²

ABSTRACT: It is suggested that early Paleozoic landscapes were characterized by extensive seepage areas which provided relatively stable environmental conditions for early apterygotes. Increased dependence on the aquatic environment is envisioned as directing the development of pleural respiratory folds which could be ventilated by subcoxo-coxal muscles; pleural folds are not considered to be derived from preexisting insect structures such as paranota or coxal styli. It is also suggested that wing development may have been influenced by a thermoregulatory or swimming function of wings, or both. Flight is considered to have evolved in the reproductive adult stage in response to a continuous downstream displacement during the juvenile stage; flight eventually augmenting other forms of locomotion during the migration to upstream oviposition and nursery areas. The polyphyletic origin of wings is considered improbable, although the Protodonata and Odonata are considered to be the sister group of remaining Pterygota. Further, it is suggested that if the small stream theory is similar to the actual course of events then it is probable that pertinent fossil evidence will be scarce due to the high energy nature of the small stream environment.

Speculation concerning past evolutionary events is perhaps the most intriguing aspect of evolutionary study, although inherently the most problematic. Evolutionary scenarios are based on the determination of character state polarity as are cladograms and phylogenies, but the impetus for their conception lies beyond morphology, being primarily to achieve an understanding of the evolution of function. This is a noteworthy virtue as adaptive radiations are often triggered by functional adaptations of preexisting structures. A well-known example concerning preadaptation of flight involves the fossil "bird" *Archaeopteryx* which displays feathered wings and tail but lacks a well-developed breastbone for flight muscle attachment. The most ancient pterygote or winged insects are the Palaeoptera (a paraphyletic group with living representatives being the Ephemeroptera and Odonata) characterized by the inability to withdraw the wings into a folded arrangement flat over the abdomen. The abdominal gill plates of palaeopteran nymphs are obvious candidates for preadapted wings and have been suggested as such by several authors.

The origin of insect flight has been the subject of considerable speculation, the most favored scenario currently being the paranotal theory of Muller (1873-75). However, the paranotal theory did not receive general acceptance until Crampton (1916) considered, apparently incorrectly, insect wings to be of tergal origin. Crampton's version of the paranotal theory proposes that protective thoracic paranota first acted as parachutes,

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then as gliding and steering wings, and finally as flapping wings. The considerable discontinuity between gliding and flapping paranota is also an objectionable supposition of the theory and has led to the proposal of several alternative theories incorporating the idea of the preadapted "flapping" wing. The majority of these alternatives have involved an aquatic-related origin of insect wings: Woodworth (1906) proposed the origin of wings from gill opercula (gill-plates), Bradley (1942) and Grant (1945) from swimming gills, and Wigglesworth (1973, 1976) from gill plates derived from coxal styli. Rasnitsyn (1981) has proposed the origin of wings from movable structures which supposedly fused with the tergum and then again became movable coincident with the development of flight. In the present paper it is suggested that the environment of Paleozoic spring seeps provided suitable conditions for the evolution of insect flight, that wings originated from pleural respiratory folds ventilated by what are now the flight muscles, and that wing development may have been influenced by a swimming or thermoregulatory function, or both.

DISCUSSION

Mid-Paleozoic Terrestrial Environments

Silurian spring seeps may have been widespread, offering hospitable habitats to the early apterygote insects. Possible soil bacteria discovered in the Gowganda formation of Ontario suggest the presence of soils by the Mid-Prepaleozoic, and the textural and compositional maturity of Cambrian terrigenous sediments compared to those of the Ordovician suggest the development of soils and terrestrial plants by the Mid-Paleozoic (Dott and Batten 1971). Land plants appeared at least by the Silurian and by the late Devonian diverse lowland forests existed in eastern North America, Greenland, and Britain (cf. Andrews 1961). Fossil winged insects show considerable diversity in carboniferous rocks, indicating, as in the case of land plants, an earlier origin than documented by known fossils. Silurian terrestrial plants included the psilophytes (Dott and Batten 1971) and probably also lichens, liverworts, mosses, and primitive ferns. This low and shallow-rooted vegetation would reduce runoff and evaporation, and although evapotranspiration would occur it would be much less than that associated with later more deeply rooted plants (cf. Hibbert 1967). These conditions would favor the accumulation of vast ground water reserves and the widespread formation of seepage areas. Therefore, seepage areas and spring-fed streams may have characterized large portions of the Paleozoic landscape at a time coinciding with the origin of insect wings and flight.

Seepage areas, springs, and spring-fed streams would afford a somewhat discontinuous but stable environment to the early apterygotes. Emerging

groundwater generally remains at about the average annual air temperature, has stable chemical characteristics, and is relatively abundant in nutrients although oxygen concentrations near the source are typically lower than that of the atmosphere. Mid-Paleozoic seeps were probably only partially shaded by plants and therefore supported the growth of green algae which in addition to the inflow of allochthonous material formed the basis of innumerable productive seepage communities. It is clear that ancient apterygotes would be attracted to seepage areas, even though it is likely they originally inhabited the terrestrial environment.

Life History and Morphology of Protopterygota

The life history of protopterygotans is likely best approximated among living forms by that of the Archaeognatha (Machilidae). A semiaquatic way of life for the Protopterygota is supported by the habitat requirements of archaeognathan genera such as *Allomachilis* and *Petrobius* which live in the damp crevices of coastal cliffs. Heeg (1967) found archaeognathans much more susceptible to dehydration than thysanurans, and Smith (1970) found that if mienertelids, the most primitive archaeognathans, were deprived of water in droplet form they would die in two or three days. In addition, the aquatic nymgal stage of extant Palaeoptera and primitive Neoptera (i.e. Plecoptera) also suggests that protopterygotes were semiaquatic. It is likely that the protopterygotes were characterized by an ametabolous development which included several instars after the attainment of sexual maturity, indirect sperm transfer which was accomplished in the terrestrial environment via the substrate, and exophytic oviposition probably in moist detrital material. The diet probably combined items consumed by archaeognathans and ephemeropterans such as algae, diatoms, lichens, microscopic organisms, and detritus, all of which are generally relatively abundant in or near spring seeps. Smith (1970) reported that the archaeognathan *Machilinus* is attracted to warm surfaces, which indicates that protopterygotes were likely attracted by the stenothermal environment of spring seeps.

Protopterygotan morphology was evidently characterized by a pronounced serial homology of body parts (Fig. 1), although the specialization of body segments had already led to the formation of insectan tagmata, as evidenced by the morphology of Archaeognatha and fossil Monura. The mandibular, maxillary, labial, thoracic, and abdominal segments bore paired coxae, with each coxite in turn apparently bearing a lateral telopodite (leg), a sensory stylus, and an absorptive organ or vesicle. Snodgrass (1954) considered apterygote abdominal styli to be homologous with the lateral abdominal gills of Ephemeroptera and Zygoptera; and Wigglesworth

(1973) considered archaeognathan coxal and abdominal styli, and ephemeropteran gill-plates homologous with wings. However, Smith, (1969, 1970) considered abdominal styli telopodites, and archaeognathan thoracic styli homologous with apterygote vesicles and gonapophyses. Smith's interpretation is supported by the presence of segmented abdominal styli in some fossil Palaeoptera (Kukalova-Peck 1978). Several workers have considered gill plates to be serially homologous with wings, and venational patterns of gill-plates noted by Woodworth (1906) have also been demonstrated in the abdominal "wings" of Palaeozoic nymphs (Kukalova-Peck 1978). Wings are always found above the spiracle and telopodites below the spiracle (Snodgrass 1935). Landa (1948) has shown the intermediate position of the spiracle between the dorsal gill-plate (wing) trachea and telopodite tracheae of ephemeropteran nymphs. The position of vestigial "abdominal wings" above the spiracles of certain adult Ephemeroptera (Birket-Smith 1971) and the position of leg-derived male forceps below the spiracles also support this arrangement. It is also noted that the lateral abdominal gills of certain zygopteran nymphs may be homologous with those of the Ephemeroptera as indicated by their position with respect to the developing female gonocoxae. According to Kukalova-Peck (1978), Durken (1907, 1923) reported that gill-plates arise from

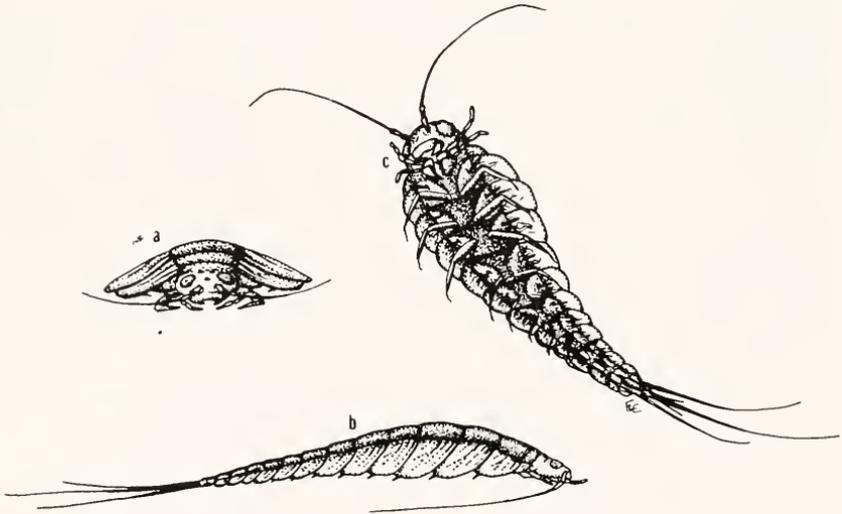


Figure 1. Hypothetical protopterygota: (a) anterior view of subadult, (b) lateral view of subadult, and (c) lateroventral view of adult in gliding posture; length of body 10-15 mm.

pleural evaginations above the spiracles which migrate with consecutively older instars toward the terga, as do the thoracic wings (Tower 1903; Bocharova-Messner 1959, 1965, 1968). However, Matsuda (1981) claims that Durken's work on *Ephemerella ignita* supports the tergal origin of ephemeropteran gills. Unfortunately, the gills of *Ephemerella* are highly specialized in their dorsal position, indicating that study of forms such as *Ameletus*, *Siphloplectron*, or *Isonychia* may clearly support a pleural origin of ephemeropteran gills. Dorsal migration of stylus-derived wings proposed by Wigglesworth (1973, 1976) would be blocked by the subcoxal annulus which E.L. Smith (Kuklova-Peck 1978) believes was developed in primitive apterygotes since it occurs in both recent Archaeognatha and fossil Monura. Paleozoic nymphs have been found with articulating "wings" on three thoracic and nine or ten abdominal segments (Carpenter 1935, Kukalova 1968). As shown by Kukalova-Peck (1978) the immobile nature of recent nymphal thoracic wings is secondary and does not support the origin of wings from paranota. Therefore, the apparent desirability of proposing the origin of wings from old structures such as paranota or coxal styli is vacuous, wings being likely derived from new structures arising from the pleural region above the spiracles.

Origin of Preflight Wings

The possibility that wings are entirely new insect structures greatly increases the array of scenarios which may explain their origin. Bocharova-Messner (1971) suggested the origin of wings from spiracular flaps which served sensory and protective functions related to respiration. In addition, Kukalova-Peck (1978) suggested that spiracular flaps may have served as opercula to close spiracles while under water, or to prevent water loss while on land; and Woodworth (1906) considered wings to be derived from gill plates which were used to ventilate and protect filamentous gill-clusters. Indeed, the abundance of plesiomorphic character states attributable to aquatic juveniles indicate that terrestrial apterygotes invaded the aquatic environment and that the origin of wings was somehow related to a change in respiratory function. In addition, an original respiratory function of the wings is somewhat supported by the wing pad spreading behavior of various Zygoptera in response to low oxygen levels.

A transition to aquatic respiration would be favored by the unique environment of the seepage area. Protopterygotes attracted by an abundant food supply and stable temperatures would encounter high oxygen concentrations during daylight due to photosynthetic activity. Low oxygen levels may have occurred after nightfall due to both the low oxygen content of emerging ground water and a substantial biological oxygen demand. The lowest oxygen concentrations would then coincide with the time of maximum

possible benefit from the stenothermal nature of spring seeps. The wide range in oxygen concentrations possibly allowed a gradual increase in the efficiency of aquatic respiration. Plastrons (air cells) and the absorption of oxygen through the membranous pleural region were likely the initial mechanisms of aquatic respiration, and it is possible that setae present on the developing wing buds of recent insects may be vestiges originally used in the retention of plastrons. Increased dependence on the aquatic environment would select for a dendritic-like development of small tracheal branches above and lateral to the spiracles to aid in the distribution of oxygen through the original tracheal system. This could be augmented by the development of pleural folds on the thoracic, abdominal, and possibly the maxillary and labial segments to increase pleural surface area. Such folds apparently occur in the Archaeognatha. Pleural folds would be preadapted for ventilation by the subcoxo-coxal muscles which would distort a membranous pleural region during walking, and it is perhaps significant that tergal-sternal muscles could also aid in ventilation by compressing the pleural region. These muscles would represent the primitive direct and indirect flight muscles, respectively. It is likely that the uppermost gill folds would become operculate both for ventilation and protection of the more delicate inner gills. A review of the literature reveals that elements of this sequence were first proposed by Oken (1811), Lang (1888), and Woodworth (1906). Efficiency could be improved by increasing the surface area to volume ratio through a flattening and expansion of the protowings. However, maintenance of sufficient blood flow through the protowings would require internal modifications.

Preflight Wing Venation

Kukalova-Peck (1978) suggested that the haemocoel was restricted to channels which later became cuticularized and sclerotized to form a stiffening venational framework. Fluting was supposedly achieved by a differential excretion of cuticular material on the veinal tubes, and blood circulation achieved by a refluxing of blood into and out of six basal vein openings. If convex veins were primitively formed on the dorsal wing surface and concave veins formed on the ventral surface, then an alternate scenario is suggested. It is noted that this condition apparently persists as a plesiomorphic character state in at least ephemeropteran wings (Spieth 1932), wing pads, fossil wing pads (Carpenter 1979), and possibly gill-plates; and in nymphal odonate wings (Calvert 1911), and wing pads. Nonalignment of blood channels and venation in the nymphal wings of recent insects is here considered an adaptation of the lacunae to subsequent changes in wing function. It is possible that as the protowings became flattened, a septum was formed between the dorsal and ventral surfaces to

maintain a sufficient blood flow (Fig. 2). Accessory dorsal pulsatile organs were eventually utilized, although gravity probably maintained the circulatory gradient in the earliest wings. The dorsal convex chasm was the efferent route and the ventral concave chasm afferent. In addition to the obvious functions of blood circulation in the wing such as the transfer of nutrients and hormones, the blood transfers heat which may have been its most important function in the wings of early insects.

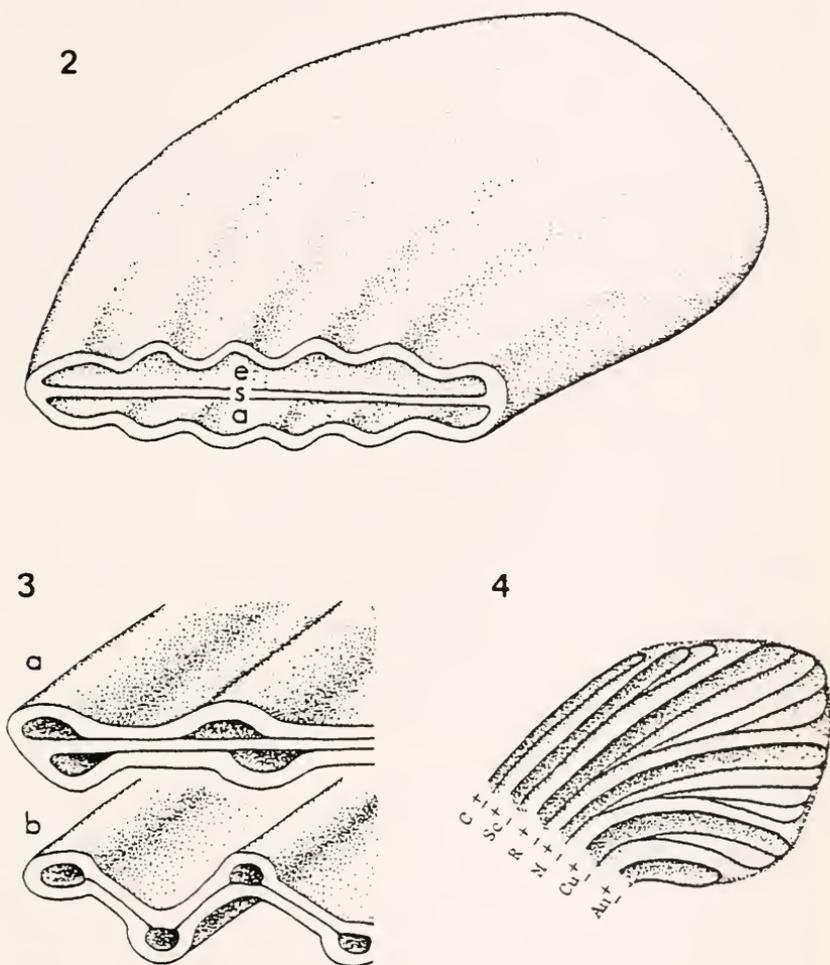
Preadaptation of Protowings

Prothoracic winglets of adult Palaeodictyoptera and wings of Paleozoic nymphs are characterized by a tubular cuticularized venation, a slight corrugation, and a hinge comprised of tergal sclerites and enlarged vein bases suggesting that preflight wings were significantly preadapted for flight (Kukalova-Peck 1978). The possibility of a preadapted hinge indicates that preflight wings were utilized in a flapping manner, either as gill opercula (Woodworth 1906) or possibly as spiracular flaps (Bocharova-Messner 1971). However, since corrugation and copious venation are not needed in the gill-plates of recent insects, it is possible that additional selective pressures acted in their development, notably the need to control body temperature. A semiaquatic insect adapted to the stable temperatures of emerging ground water would certainly benefit from a system which regulated body temperature while entering the terrestrial environment for reproductive purposes. Such a system is apparently utilized by the Odonata for either "heating up" in the morning or "cooling down" at midday; the system involves the wing, its circulatory system, and its variable orientation with respect to the sun. Certain fossil Palaeoptera have the dorsal veins hyperdeveloped suggesting a thermoregulatory function in early wings. The transition of gill opercula to structures useful in thermoregulation could occur in the humid microenvironment of the spring seep, and it is noted that the caudal gills of certain Zygoptera such as *Megalagrion* are surprisingly resistant to damage while the nymph scampers about in the terrestrial environment. A thermoregulatory function in early wings would be enhanced by the increase of wing size which would require an associated venational framework for support and heat transfer. In addition, corrugation would aid support, allow for a greater surface area, and provide for zones of shading and air pockets. It is evident that the dorsal and ventral blood chasms of the wing were reduced to five or six rib-like veins which contained tracheae and nerves as well as blood. Possibly, convex veins were originally located directly above concave veins so that the dorsal-ventral dimension of wing corrugation developed before the anterior-posterior dimension (Fig. 3). As the dorsal veins have apparently slipped forward, a suitable wing vein notation slightly modified from that of Kukalova-Peck (1978) would be:

costa anterior (CA+), costa posterior (CP-), subcosta anterior (ScA+) subcosta posterior (ScP-), radius anterior (RA+), radius posterior (RP-), media anterior (MA+), media posterior (MP-), cubitus anterior (CuA+), cubitus posterior (CuP-), anal anterior (A+), and anal posterior (AP-). However, evidence for recognizing CP- and Sc+ is weak because the anterior wing margin questionably represents a vein, and Sc+ is vestigial when apparent. Improvements of the hinge involving a thickening of wing vein bases and a thinning of the wing in general coupled with changes in venation to improve a thermoregulatory function of wings would lead to the modification of the original blood flow pattern. The concave (ventral) veins may have become multilooped in order to increase shading efficiency by increasing the width of troughs (Fig. 4). This process of looping was apparently carried to some dorsal veins, but vein pairs in the anterior wing region were probably not involved at all in order to maintain strength along the leading edge of the wing. Major vein pairs became fused basally and cross veins allowed the eventual anterior-posterior blood flow of existing Pterygota.

A thermoregulatory function of the wings not only offers a possible explanation for the increase in wing size and the development of venation and corrugation in the preflight wing, but may explain the muscular and articular changes necessary for pronation and supination. It is apparent that early insects could regulate their temperature while in the terrestrial environment by varying body orientation with respect to the sun, but considering only the wings it is obvious that at low angles of inclination only slight reorientations of the wings are necessary to regulate body temperature. This effect is particularly enhanced when the corrugations are characterized by wide troughs and oriented perpendicular to incoming light. Therefore, rotation and the associated modifications of the wing base can be considered an adaptation to thermoregulation and a preadaptation to flight.

Bradley (1942) and Grant (1945) have suggested that preflight wings became adapted for flight by serving as fins and propulsion devices in water. However, the original use of gill plates in swimming would probably not be similar to the gill-plate method employed by nymphal mayflies such as *Chloeon*, or the method used by certain adult Chalcid wasps which swim under water with their wings. The original hinge was apparently straight, wide, and parallel to the body axis. Swimming, if achieved, was likely accomplished by undulating the body in an up and down fashion while altering the pitch of the gill-plates. The gill-plates could be tilted with the subcoxal-coxal muscles (precursors of the direct flight muscles), which is a possible explanation for the muscular and articular changes necessary for pronation and supination. However, the development of pronation and



Figures 2-4. Hypothetical insectan protowings illustrating a possible scenario leading to the formation of corrugation and venation.

Figure 2. Section through protowing distal to hinge, note formation of septum; (s) septum, (a) afferent chasm, (e) efferent chasm.

Figure 3. Formation of corrugation and venation: (a) primary dorsal-ventral corrugation, (b) secondary anterior-posterior corrugation.

Figure 4. Branching or looping of the posterior (ventral) veins.

supination of gill-plates to improve the ventilation of inner gills may have been a preadaptation for both swimming and flying.

Development of Flight

The development of flight, like the origin of wings, was quite possibly brought about by conditions in the small stream environment. Life history was likely segregated into a semiaquatic juvenile stage and a terrestrial adult stage. However, it is noted that Kukalova-Peck (1978) believes that metamorphosis did not evolve until much later and occurred several times in the Pterygota. The nymphal stage would be primarily a period of feeding characterized by a substantial increase in body size; in contrast the adult stage would be primarily concerned with reproduction. A continuous downstream displacement, or drift (cf. Waters 1972), characterized the nymphal stage which was compensated for by an upstream migration during the adult stage. Wigglesworth (1963, 1973, 1976) proposed that semiaquatic pterygotes "learned to fly" after being swept up by the thermal upcurrents of semiarid regions to be deposited with the next rainfall. However, advantages accrued to adults while migrating to upstream reproductive areas also seem a plausible explanation for the origin of flight. Upstream migration was probably achieved through a combination of walking, swimming, jumping, and eventually gliding and flapping flight. The author has observed primitive archaeognathans jumping from the surface of water, and primitive ephemeropterans (*Isonychia*) jumping back into water when disturbed while out of water to emerge. The author has also observed *Isonychia* to "swim" out of water into the air when startled; it is perhaps significant that this ability is developed in forms inhabiting rapid streams. Although these primitive forms do exercise some attitude control in flight, presumably with the cerci, legs, and antennae, Flower (1964) has calculated that attitude control and gliding distance would be improved in small insects with even rudimentary wings. This suggests that even small articulating lateral gill opercula might be advantageous in flight. Evening updrafts through stream valleys could have helped carry the early pterygotes to the upstream mating and nursery areas, and downstream drift of nymphs to areas containing unexploited food resources would gradually lengthen migratory routes and necessitate the gradual improvement of gliding and flapping flight. The specialization of the ovipositor for laying eggs in the protective environment of living and dead plant material surrounding seepage areas could lead to a further consolidation of reproductive sites and also to intense sexual selection between males which would probably involve flight capabilities. Increased vagility coupled with the isolated nature of reproductive areas would then set the stage for a dramatic adaptive radiation.

Monophyletic Origin of Wings

Matsuda (1981) has revived the polyphyletic origin of insect wings originally proposed by Lemche (1940). Matsuda suggests the origin of the Eupalaeoptera (Protodonata and Odonata) from the Archaeognatha, and the origin of the Neopalaeoptera (Protephemrida, Ephemeroptera, Palaeodictyoptera, and Megasecoptera) and Neoptera (remaining Pterygota), from the Thysanura. Although an original dichotomy between the Eupalaeoptera and remaining Pterygota seems well-founded, a polyphyletic origin of wings seems doubtful. Matsuda's conclusion was reached by considering certain similarities of the Archaeognatha and Odonata synapomorphic (derived characteristics held in common), when they are as reasonably considered symplesiomorphic (primitive characteristics held in common) or a result of convergence. Primary justification for the character state polarities determined by Matsuda is his belief that the considerable autapomorphy (unique derived characteristics) of the Eupalaeoptera cannot be explained by ecological divergence. However, all eupalaeopteran autapomorphy may be explained by what appears to be a basic ecologic dichotomy of the Pterygota, that is between "predator and nonpredator", a dichotomy which is repeated within later orders such as the Plecoptera and Coleoptera. Of the several eupalaeopteran autapomorphic thoracic characteristics listed by Matsuda (1981), all can be explained by the need to increase flight agility. Furthermore, the unique wing venation of the Eupalaeoptera (supposed absence of MP and CuA) can be explained by the basal fusion of longitudinal veins (Carle 1982a), again in response to the need for increased flight agility and not due to a unique origin of eupalaeopteran wings.

Matsuda considered the large compound eyes "which almost meet dorsally in Anisoptera and Machilidae" symplesiomorphic. However, annectants reveal this similarity to have developed through convergence. Symplesiomorphic characteristics of the Archaeognatha and Eupalaeoptera probably include: presence of four intratergal apophyses, presence of the pseudoprescutum, absence of the indirect flight mechanism, and the absence of contact between the primary genitalia during sperm transfer. The latter characteristic is again likely related to the predatory nature of the Eupalaeoptera (Carle 1982b). It is probable that ancient eupalaeopteran males used the cerci to guide females to their spermatophores (as in at least some archaeognathans), and eventually developed the tandem hold to prevent being eaten by the female. The eupalaeopteran copulatory process then developed with its unique secondary copulatory apparatus, sperm removal, and male above copulatory position. In contrast, in the Ephemeroptera and Neoptera the primitive copulatory position of the female is above the

male, and the presence of ephemeropteran-like forceps on the ninth sternum of male Palaeodictyoptera (Kukalova 1970) supports the female above copulatory position in all noneupalaeopteran Pterygota. Other synapomorphic character states of the Neopalaeoptera and Neoptera are related to the development of the indirect flight mechanism in which the downstroke is achieved by contraction of longitudinal dorsal muscles which restore curvature to momentarily flattened pterothoracic terga, these include: partial fusion of the thoracic terga and pleura, specialization of several muscles (cf. Matsuda 1981), differentiation of the nodal wing processes, and apparent differentiation of the proximal portion of the axillary plate into the second and third axillary sclerites. The Neoptera are further specialized in the integration of the third axillary sclerite into a unique wing folding mechanism. Similarities of the Thysanura and noneupalaeopteran Pterygota which have been suggested as synapomorphic by Matsuda (1981) may of course be due to convergence. It is also possible that the Thysanura represent an early Neopalaeopteran group which became secondarily wingless.

Fossil Protopterygota

The small stream theory concerning the origin of insect wings and flight has many implications if it does indeed depict the true course of events. Foremost are implications concerning the abundance and distribution of early pterygote fossils. If the assumption concerning the thermoregulatory function of preflight wings is correct; then regions of the Devonian geography characterized by seasonal climates may yield enlightening fossil evidence; these areas include Siberia, Greenland, and the southern continents as evidenced by the occurrence of Paleozoic "tree" rings (cf. Dott and Batten 1971). The high energy environment of the small stream is certainly not a suitable environment for insect fossilization, leaving a bias in the fossil record toward relatively advanced forms which lived near swamps and lakes. However, Rasnitsyn (1981) states that the "chances of fossilization were much higher for aquatic and amphibious insects than for terrestrial ones." Rasnitsyn's belief seems doubtful in light of the author's experience in carefully processing benthic lake and stream samples (cf. Carle 1980). Insect remains were primarily of hard-bodied terrestrials, typically Coleoptera. This is apparently related to both the higher population levels and higher durability of terrestrial insects. Therefore, bias in the insect fossil record is probably toward a disproportionate representation of coleopteroids and orthopteroids. However, the importance of fossil evidence in determining the correct phylogenetic classification of insects must not be underrated in light of the considerable degree of parallel evolution likely after the origin of insect flight.

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A BIOSYSTEMATIC STUDY OF THE EUROPEAN STRATIOMYIDAE (DIPTERA). VOL. 1. Rudolf Rozkosny. 1982. Dr. W. Junk, Pub. 401 pp. \$79.50.

A biosystematic revision of the European Stratiomyidae, summarizing basic information on morphology, biology, ecology, distribution, economics, and taxonomy. Vol. 1 contains introductory sections and the systematics of the Beridinae, Sarginae and Stratiomyinae subfamilies.

NOTES ON THE BIOLOGY AND DISTRIBUTION OF *HYLOTRUPES BAJULUS* (L) (COLEOPTERA: CERAMBYCIDAE) IN VIRGINIA¹

Kevin F. Cannon, William H. Robinson²

ABSTRACT: The old house borer, *Hylotrupes bajulus* (L.), was found equally distributed in the three geographic regions of Virginia. A survey of pest control operators and homeowners showed a majority of infestations were in buildings less than 7 years old. Old house borer adults and larvae were collected in a sawmill, associated with processed and unprocessed wood.

The old house borer (OHB), *Hylotrupes bajulus* (L.), is an important structural insect pest in eastern and southern United States (St. George et al. 1957). It was introduced into the U.S. over 200 years ago and now occurs in states along the Atlantic seaboard and Gulf Coast. It is ranked second to subterranean termites in its damage to buildings and structures (St. George et al. 1957). In the U.S., the OHB is a pest of man-made structures with no known evidence of naturally occurring populations in unprocessed wood (Snyder 1955).

Larvae of this cerambycid beetle tunnel in the sapwood portion of seasoned softwoods used in the construction of houses and other wooden structures. Larvae are known to feed in wood for several years. Larval feeding often results in loss of structural integrity of infested wood, and financial losses incurred in the treatment and replacement of damaged wood.

The OHB is native to the Atlas Mountains of northern Africa and is found feeding, under natural conditions, in pine stumps and logs. Becker (1979) noted that the OHB has been introduced onto all major continents, and gave its distribution in the U.S., including 38 counties in Virginia. On most continents the OHB is considered an established pest, capable of surviving under natural conditions in unprocessed wood, as well as in seasoned softwoods.

The purpose of this study was to record the distribution of the OHB in Virginia. Midway in the distribution of the OHB along the east coast, and with 3 distinct geographic regions, (coastal, piedmont, mountain) Virginia offers representative temperatures for the entire Atlantic seaboard.

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Materials and Methods

Distribution records were compiled from 1977 to 1982 from specimens located in the U.S. National Museum of Natural History, VPI&SU insect collection, and VA Cooperative Extension records. Professional pest control operators and homeowners in Virginia were surveyed (1979-1981) to determine occurrence and location (within structure) of OHB infestations. A 10-point questionnaire was sent to pest control operators and homeowners submitting specimens of OHB to VPU&SU for identification. Two lumber yards and one sawmill in Montgomery Co., VA were sampled for OHB adults and larvae. Sampling involved a 2 hr. walk 3 times weekly around the premises over a 3 week period (June 17 to July 5, 1981). Adult OHB were captured with sweep nets. Wood containing OHB larvae was returned to the laboratory and the larvae removed.

Results and Discussion

Distribution records and survey data show the OHB is equally distributed throughout Virginia's 3 geographic regions (Fig. 1). The OHB was reported to occur in 86 of Virginia's 99 counties.

Five OHB adults (3 males, 2 females) and 3 medium-to large-sized (100-150 mg) larvae were collected at the sawmill. Adults were found, in mid-day, flying about the lumber yard. Larvae were found in pine lumber stacked around the periphery of the mill. The adult females were returned to the laboratory where they laid viable eggs. The larvae were transferred to fortified wood blocks (southern yellow pine) in the VPI&SU OHB colony.

These findings strongly suggest that the OHB is surviving and reproducing in areas where wood is processed and stored. Wood for local use as well as rough-cut pine logs for modern log homes are processed at the sawmill where the OHB specimens were collected. Moore (1978) reported that the majority of OHB infestations were found in structures built with infested wood. Data from the pest control operator and homeowner survey further supported this premise.

The survey data showed that of the homeowners and pest control operators reporting infestations, 81.3% were in houses ≤ 7 years old, with 56.3% in houses ≤ 4 years old. This data indicates that OHB larvae were probably in the wood when the houses were constructed.

Cannon (1979) reported that first-instar larvae were able to live and feed for 6 months outdoors in pine blocks placed in the geographic regions of Virginia. The data indicated that the wood moisture content in the test blocks and not temperature was the limiting factor in larval survival outdoors. The data presented here confirms that OHB can survive outside structures. The presence of OHB adults and larvae in a lumber yard helps to explain active infestations in buildings less than 10 years old.

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SYSTEMATICS OF BEES OF THE GENUS *EUFRIESEA* (HYMENOPTERA: APIDAE). Lynn S. Kimsey. 1982. Univ. of Calif. Press. 125 pp. \$12.50. pbk.

The purpose of this paper is to provide a general overview of the Euglossini, with a key to the genera, and to present a revision of the genus *Eufriesea*, including taxonomic and biological information and a key to the species.

BIOLOGY OF SPIDERS. Rainer F. Foelix. 1982. Harvard Univ. Press. 306 pp. \$30.00.

Comprehensive treatment of spider biology, emphasizing their physiology, sensory physiology and behavior. Anatomy, web spinning, locomotion, predation, reproduction, development and ecology are all covered. Translated and updated from the original (1979) German edition.

SOCIAL INSECTS. VOLS. III & IV. H.R. Hermann, ed. 1982. Academic Press. Vol. III 459 pp. \$58.00. Vol. IV 385 pp. \$52.00

Vol. 3 treats the eusocial insects, the Apidae, with chapters on the bumble bees, the honey bees and the stingless bees. Vol. 4 completes the series with chapters on wasps and ants.

NEW NORTH AMERICAN RECORDS FOR THE PALEARCTIC SOLDIER FLY, *CHLOROMYIA* *FORMOSA* (SCOPOLI) (DIPTERA: STRATIOMYIDAE)¹

E. Richard Hoebeke, L.L. Pechuman²

ABSTRACT: The Palearctic soldier fly, *Chloromyia formosa* (Scopoli), was found at Ithaca (Tompkins County), New York, in May-June 1978 and 1979; at Letchworth State Park (Livingston County) in June 1981 and 1982; and in Genesee County in July 1981. These collections represent new North American records and an extension of the known range of this Old World species.

The Palearctic species, *Chloromyia formosa* (Scopoli) was first reported in North America by James (1941) based on a collection of two males at Rochester (Monroe County), New York on July 16, 1939.

In 1970, James reported two additional specimens, a male and female, taken in Monroe County, on June 23, 1967, probably in the town of Hamlin (about 18 miles NW of Rochester).

Pechuman (1974) collected a single male from vegetation along the edge of a swamp on the Cole Road, Mendon (Monroe County) on June 15, 1972, and he collected an additional male and female at the same locality on June 22, 1973, and two males from vegetation along a pond at Mendon Ponds Park, about 3 miles west of the Cole Road site a few hours later.

In late June 1981 and 1982, collecting trips to Letchworth State Park (Livingston County), approximately 30 miles SW of Mendon, turned up a large series of males and females: all were swept from tall, uncut grasses and weeds growing adjacent to a roadside in a campground at the north end of the park. The collection data are as follows: NY: Livingston County, Letchworth State Park, Highbanks Campground, ca. 5 miles E. of Perry, June 18-21, 1981 and 1982, E.R. Hoebeke and M.E. Carter, collectors. From July 10-12, 1981, likely habitats for *C. formosa* were sampled by L.L. Pechuman in portions of Orleans and Genesee Counties adjoining Monroe County. Pechuman collected a single female in Bergen (Genesee County) on July 12, by sweeping tall grasses. In addition, a collection of four specimens (all males) was made in the Finger Lakes Region of New York in May-June 1978 and 1979. These specimens were collected by D.J. Bickel (Cornell University) at Ithaca (Cayuga Heights) (Tompkins County) on June 12, 1978, and May 30 and June 15, 1979.

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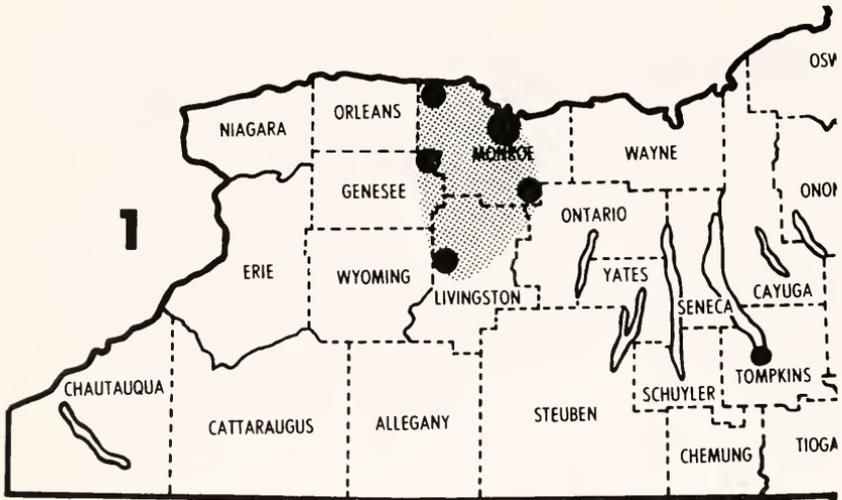
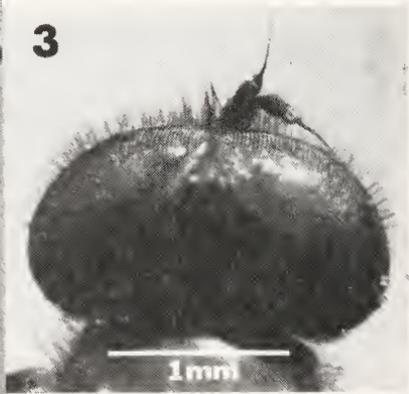


Fig. 1. Map of western New York showing North American distribution of *Chloromyia formosa* (Scopoli).



Figs. 2, 3. *Chloromyia formosa* (Scopoli). 2, dorsal habitus, male. 3, closeup of head (male) showing pilose eyes.

The specimens referred to above are deposited in the Cornell University Insect Collection (CUIC). All known collections of *C. formosa* in North America are mapped in Fig. 1.

Adults of *Chloromyia formosa* (Fig. 2) may be distinguished from other geosargine stratiomyids by the following combination of characters: a moderate-sized species, 7.5-9.0 mm in length; brilliantly colored, with the thorax bright metallic blue-green and the abdomen dull metallic gold-green (these hues are subject to some variation among individuals in a population); scutellum unspined; second antennal segment sometimes convex and not produced into a finger-like process; and the eyes densely and conspicuously pilose (Fig. 3). Male eyes are holoptic while those of females are dichoptic.

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Continued from page 151

ITZN 59

16 June, 1982

The following Opinions have been published by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature*, volume 39, part 2, on 15 June 1982:

<i>Opinion No.</i>	
1203 (p. 95)	ERIOCOCCIDAE Cockerell, 1899 conserved; type species designated for <i>Eriococcus</i> Targioni-Tozzetti, 1868 (Insecta, Homoptera).
1204 (p. 99)	<i>Acrydium undulatum</i> J. Sowerby, 1806 (Insecta, Orthoptera): placed on the Official List.
1208 (p. 109)	<i>Goniurellia</i> Hendel, 1927 (Insecta, Diptera): designation of type species.
1212 (p. 119)	<i>Siphonophora</i> Brandt, 1837 (Diplopoda): conserved.
1213 (p. 122)	<i>Toxorhynchites brevipalpis</i> Theobald, 1901 (Insecta, Diptera): conserved.

The Commission regrets that it cannot supply separates of Opinions.

R.V. MELVILLE
 Secretary

COLLEMBOLA FROM VERMONT¹

Peter F. Bellinger²

ABSTRACT: 57 collembolan species are recorded, mainly from the University of Vermont collection; 52 of these are new state records.

The only published records of Collembola from Vermont prior to Christiansen & Bellinger, 1980-81, are of three species of *Entomobrya* (Folsom, 1924; Christiansen, 1958). Since 200 species were recorded from New York by Maynard (1951), it is evident that the Vermont fauna of this order has been neglected.

I have recently had the opportunity to study the collection of the University of Vermont, accumulated mainly through the efforts of Dr. Ross T. Bell and his students. Much of the material comes from the mountains east of Burlington, but there are scattered collections from many parts of the state. Most records are of specimens collected by hand or in pitfall traps, and large, active surface species predominate. However, some Berlese extracts from Camel's Hump, Chittenden County, contain representatives of the smaller hemiedaphic and euedaphic species.

The following list includes all species of Collembola known to occur in Vermont. Unless a reference is given, records are from the University of Vermont collection. Localities are in Chittenden Co. unless another county is named. Records without locality are from Camel's Hump, Chittenden Co.

Podura aquatica L. Gleason Brook, 1400'.

Hypogastrura (H.) harveyi (Folsom). Mt. Dewey, Underhill.

H. (H.) lima Christiansen & Bellinger. 16 collections, 3000'-4000'.

H. (H.) nivicola (Fitch). 2800', 22 July; Lewis Creek Mouth, N. Ferrisburg, Addison Co., 25 May. The species is usually found on snow in winter.

H. (H.) packardi (Folsom). Owl's Head, Richmond.

H. (Ceratophysella) denticulata (Bagnall). 4050', bilberry meadow; Jonesville; Milton, Mt. Dewey; South Starksboro, Addison Co.; Fairfax, sand pit, Franklin Co.

H. (Mitchellania) hiawatha (Yosii). 3900'.

H. (M.) loricata Yosii. 5 collections, 3300'-3900', in mushroom, in sphagnum, etc.

Freisea sublimis Menamara. 2800'.

Pseudachorutes aureofasciatus (Harvey). 5 collections, 3800'-3950'; Bristol-Middlebury line, Addison Co.

P. simplex Maynard. 2800'.

Anurida (A.) cf. *granaria* (Nicolet). 3300', in sphagnum.

A. (Micranurida) pygmaea (Borner). 2800', 3900'.

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Neanura muscorum (Templeton). 7 collections, 3300'-4000'; Jonesville; South Starksboro, Addison Co.

Onychiurus (Archaphorura) affinis Agren. 4050', bilberry meadow. First record south of Canada.

O. (Protaphorura) armatus (Tullberg). Rutland Co. (Christiansen & Bellinger, 1980).

O. (P.) parvicornis Mills. 2800', 3700'.

O. (P.) subtenuis Folsom. 9 collections, 2800'-4000', balsam fir litter etc.: Mt. Dewey, Underhill.

O. (Onychiurus) folsomi (Schaffer). 3 collections, 3300'-3900'.

Proisotoma (Ballistura) alpa Christiansen & Bellinger. 7 collections, 3900'-4050', including bilberry meadow; Owl's Head, Richmond. Previously known only from the type locality, Mt. Washington, New Hampshire.

Cryptopygus thermophilus (Axelson). Fairfax, sand pit, Franklin Co.

Folsomia penicula Bagnall. 12 collections, 2800'-4500', in sphagnum, balsam fir litter, bilberry meadow, etc.

Metisotoma grandiceps (Reuter). 5 collections, 2800'-4000'. Windsor Co. (Christiansen & Bellinger, 1980).

Isotomiella minor (Schaffer). 5 collections, 2800'-3900'.

Isotomurus palustris (Müller). Duxbury, 3900', Washington Co.

I. tricolor (Packard). Winooski R., Winooski.

Isotoma (Desoria) nigrifrons Folsom. South Starksboro, Addison Co.

I. (D.) notabilis Schaffer. 4 collections, 2800'-3900'; South Starksboro, Addison Co.

I. (D.) cf. *propinqua* Axelson. 2800', 8 July; 3300', 2 August; most are "Spinisotoma" ecomorphic forms which may be seasonal. This is probably a new species which is being described by J. Najt.

I. (D.) tariva Wray. 3900', balsam fir litter. Not previously recorded north of Pennsylvania.

I. (Isotoma) veridis Bourlet. 6 collections, 3900' 4050'; Mt. Philo Rd., Shelburne; Fairfax, sand pit, Franklin Co.

I. (Pseudisotoma) sensibilis Tullberg. 3000', 3900'.

Orchesella cincta (Linnaeus). Springfield, Windsor Co.

O. hexfasciata (Harvey). 37 collections, 1180'-3900'; Lewis Creek, Milton, Mt. Dewey, and Owl's Head; Bristol-Middlebury Line, and South Starksboro, Addison Co.; South Cambridge, Lamoille Co.

O. villosa (Linnaeus). 4 collections, Mt. Philo Rd., Shelburne; South Burlington; Winooski; Fairfax, sand pit, Franklin Co.

Entomobrya (Entomobrya) assuta Folsom. 3800'. Rutland Co. (Folsom, 1924).

E. (E.) multifasciata (Tullberg). 3500'; Fairfax, sand pit, Franklin Co.; South Cambridge, Lamoille Co.; Springfield, Windsor Co.

E. (E.) nivalis (Linnaeus). Milton town line, Mayo Rd. off Rt. 2, Burlington (Christiansen, 1958).

E. (Entomobryoides) purpurascens (Packard). Milton town line, Mayo Rd. off Rt. 2; South Starksboro, Addison Co. Brattleboro, Windham Co. (Christiansen, 1958).

Willowsia nigromaculata (Lubbock). South Burlington, in bathtub.

Lepidocyrtus helenae Snider. South Starksboro, Addison Co.

L. pallidus Reuter. Milton, net sweeping; Fairfax, sand pit, Franklin Co.

L. paradoxus Uzel. Milton, sweeping and pit traps; Shelburne, Lewis Creek Mouth, and New Haven, Addison Co.; Fairfax, sand pit, Franklin Co.

L. violaceus (Fourcroy). 3 collections, 1850'-4000'.

Pseudosinella rolfsi Mills. Johnson, Lamoille Co.

Tomocerus (Pogonognathellus) elongatus Maynard. Milton town line, Mayo Rd. off

Rt. 2: Bristol-Middlebury line, Addison Co.

T. (P.) flavescens (Tullberg). 65 collections, 1180'-4000': Burlington, Essex, Essex Park, Fort Ethan Allen, Milton, Mt. Dewey, Owl's Head, Shelburne Bay, South Burlington, and Winooski; Starksboro, South Starksboro, and 1 mile south of Lincoln Gap, Addison Co.; Fairfax, sand pit, Franklin Co.; South Cambridge, and Stowe, Lamoille Co.; Duxbury, and Montpelier, Washington Co.; Springfield, Windsor Co.

Neelus (Megalothorax) minimus (Willem), 3900'.

N. (Neelides) minutus Folsom, 3300'.

Sminthurides (S.) lepus Mills, 7 collections, 1180'-3900'.

Sminthurinus (Katiannina) macgillivrayi (Banks), 6 collections, 1180'-4000'.

S. (Sminthurinus) henshawi (Folsom), 1180'.

S. (S.) quadrimaculatus (Ryder), 3500'; Jonesville.

Bourletiella (B.) hortensis (Fitch), Fairfax, sand pit, Franklin Co.

Sminthurus (S.) butcheri Snider, 9 collections, 3400'-4100': Fort Ethan Allen; Fairfax, sand pit, Franklin Co.

Dicytoma (Ptenothris) atra (Linnaeus), 5 collections, 2800'-3900'; Milton; South Starksboro, Addison Co.

D. (P.) marmorata (Packard), 9 records, 1180'-3900'; South Starksboro, Addison Co.; Fairfax, sand pit, Franklin Co.

This list omits several species which could not be determined because specimens were immature or damaged; among these is a new species of *Arrhopalites*.

There are no records of Collembola from six of the fourteen counties of Vermont, and I suspect that the 50 species recorded from Chittenden Co. are less than half the number which actually occur there. Vermont is not really unusual in this respect; systematic collecting in almost any locality in the United States would add new records and, very likely, new species.

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INSECT LIFE HISTORY PATTERNS: HABITAT & GEOGRAPHIC VARIATION. Robert F. Denno & Hugh Dingle, eds. 1981. Springer-Verlag. 225 pp. \$29.80.

Twelve papers from a symposium held during ESA meeting in Denver, CO in November 1979. The theme centers on controversies in ecology and evolutionary biology associated with plant-herbivore interactions, life history theory and equilibrium status of communities. Study organisms are all either herbivorous insects or those intimately associated with plants.

SOCIAL INSECTS. Vol. II. Henry R. Hermann, ed. 1981. Academic Press. 491 pp. \$55.00.

Vol. I reviewed known concepts related to insect sociality. Vol. II enters a period of intensive research in the study of insect sociality in an attempt to fill the gaps in our knowledge of these arthropods. Book consists of five chapters contributed by seven authors.

EVOLUTIONARY BIOLOGY. Vol. 14. M. Hecht, B. Wallace, & G. Prance, eds. 1982. Plenum Press. 445 pp. \$39.50.

Six chapters contributed by eleven authors present subjects as relationship of genetics to human evolution, classifications of selection-migration, regulatory mutations, and yeast flora associated with decaying cacti and *Drosophila* in No. America.

THE ECOLOGY OF PESTS: SOME AUSTRALIAN CASE HISTORIES. R.L. Kitching & R.E. Jones, eds. 1981. CSIRO (thru ISBS, Box 1632, Beaverton, OR 97075). 254 pp. \$12.00 pbk.

The biology, ecology and control of eleven Australian pests are studied in detail by fourteen authors. Pests studied include: skeleton weed, kangaroos, crown of thorns starfish, aphids, codling moth, light-brown apple moth, mosquitoes, Australian bushfly, sheep blowfly, cabbage butterfly, and the *Sirex* woodwasp.

BIOGRAPHICAL DICTIONARY OF ROCKY MT. NATURALISTS, 1682-1932. J. and N.D. Ewan, 1981. Bohn, Scheltema & Holkema, Utrecht. 253 pp. \$37.50.

A guide to the writings and collections, as well as brief biographical sketches, of botanists, zoologists, geologists, artists, and photographers, arranged alphabetically, in encyclopedic style.

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FOR SALE: Bee Flies of the World, 1973, 687 pp., \$20.00 and Robber Flies of the World, 1962, 907 pp., \$20.00; both by F.M. Hull. Order from C.S. Hull, Box 1883, University, Miss. 38677.

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FOR SALE: Proceedings Hawaiian Entomological Society, Vols. I (1905) through XV complete. Best offer. Ellery W. French, 337 Callowhill Road, Chalfont, PA 18914.

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