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(Continued on inside of back cover)

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A NEW SPECIES OF PSEUDOPHYLLINE KATYDID FROM COCOS ISLAND, COSTA RICA (ORTHOPTERA: TETTIGONIIDAE)[1]

David A. Nickle[2]

ABSTACT: A pseudophylline katydid, *Parascopioricus binoditergus* Nickle new species, is described and figured for the first time. It occurs only on Cocos Island, off the coast of Costa Rica, and displays characters that are intermediate between species of *Parascopioricus* and *Scopioricus*.

In his revision of the Pseudophyllinae, Beier (1961: 283) segregated two species of *Scopioricus* and placed them with an additional new species within a new genus, *Parascopioricus* Beier 1961. These species, *P. lancifolius* (Brunner von Wattenwyl), 1895 [type species], *P. carinulatus* (Saussure and Pictet), 1897, and *P. cordillericus* Beier, 1961, differed from *Scopioricus* in the spination of the ventral carinae of the fore and mid femora and in the shape of the apex of the tegmen. In *Scopioricus* both ventral carinae of the fore and mid femora have spines, and the apex of the tegmen is rounded. in *Parascopioricus* only one ventral carina of the fore and mid femora has spines, and the apex of the tegmen is lanceolate or nearly so.

In a faunal survey of the insects of Cocas Island, Costa Rica, Hogue and Miller (1981) collected five specimens of an undescribed species of pseudophylline katydid with characters that most closely align it with *Parascopioricus*. The pronotum is rugose, crenulated, with lateral lobes that are about as wide as deep; the fore and mid femora are each armed with spines on only one ventral carina; the male subgenital plate bears two styles; the male cerus is not branched; and the ovipositor is smooth, lacking rows of oblique or transverse nodes. However, it differs from members of that genus in several respects: the apex of the tegmen is acutely rounded and more similar in shape to those of *Scopioricus* species; the male cercus, though not branched, is acutely upcurved and lanceolate, similar to the cerci of *Scopioricus* species; and all genicular lobes are unarmed, again more characteristic of *Scopioricus* species.

It is likely that the separation of species into *Scopioricus* and *Parascopioricus* as distinct genera is unjustified, based as it is on the spination of the ventral carinae of the fore and mid femora and shape of the apex of the tegmen. Within other genera of tettigoniids one can find both

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extremes of characters (Hebard 1925; Ragge 1980), and it is possible that they will be synonymized when more information is acquired for these species. However, for the present, it seems expedient to follow a conservative approach and describe this as a new species of *Parascopioricus*, the genus to which it keys in Beier (1961: 283).

The description will serve to make a name available for a paper on the insect fauna of Cocos Island (Hogue *et al.*, in preparation). Specimens have been deposited in the Los Angeles County Museum, Los Angeles [LACM], California Academy of Sciences, San Francisco [CAS], U.S. National Museum of Natural History, Washington, D.C. [NMNH], and American Museum of Natural History, New York [AMNH].

Key to the Species of ***Parascopioricus***

1 Tegmina no more than 4 times as long as wide, anal margin moderately to strongly convex; margins of pronotum well-developed only in the lateral metazona 2

1' Tegmina 5 times as long as wide, anal margin weakly convex; margins of pronotum well-developed along entire lateral margin (Costa Rica) .... *carinulatus* (Saussure and Pictet)

2(1) Male cerci short, thickened basally; male subgenital plate weakly emarginate apically; female subgenital plate bifid 3

2' Male cerci long and slender, straight; male subgenital plate deeply excised apically; female subgenital plate broadly rounded (Panama, Colombia) .... *lancifolius* (Brunner von Wattenwyl)

3(2) Male tenth tergite apically elongate, rounded; female subgenital plate terminally emarginate, with triangulate, pointed, tapering lobes; smaller species (♂, 17-19 mm; ♀, 20-23 mm) (Colombia). .... *cordillericus* Beier

3' Male tenth tergite apicolaterally expanded into two clawlike projections, each terminating in a sharp, ventrally-curved tooth; female subgenital plate emarginate, with rounded lobes; larger species (♂, 35-37 mm; ♀, 38-42 mm) (Cocos Island)....... .... *binoditergus* Nickle, new species

Parascopioricus binoditergus Nickle, new species

Diagnosis. Male. This species differs from other species of *Parascopioricus* in the shapes of the tenth tergite and the cercus. The tenth tergite is produced well beyond the apices of the cerci, concealing them from above, and is belaterally extended into two broad, tapering lobes, each terminating apically in a deflexed tooth. The cercus is basally thick and cylindrical, abruptly narrowed and recurved acutely upward, and is apically sharp and lanceolate.

Female. The shape of the tegmen, which is similar to that of the male, is apically acutely rounded (as in Fig. 1), and the subgenital plate is broad with a wide U-shaped emargination, producing a rounded bifid apex (Fig. 9).

Holotype. ♂. COSTA RICA: Cocos Island, Wafer Bay, on beach at Wafer Bay Station III-26-1978 (C. Hogue and S. Miller, Steele Exped.) #1 [LACM].

Description of holotype. Head. Eyes small, prominent, globose; diameter of eye equal to about 1/2 length of subocular genal length; lower margin of eye confluent with ventral margin of antennal insertion. Frons and vertex narrow, 0.3-0.4 mm wide: vertex apically rounded, extending horizontally slightly beyond frons and separated from it by a distance equal to apical diameter of vertex.

Thorax. Pronotum saddle-shaped, with a weakly-expressed median ridge interrupted twice by an anterior shallow and posterior deep lateral sulcus. Posterior lateral sulcus entire, extending along midline of pronotum and lateral lobes to their ventral margins. Anterior lateral sulcus also extending to ventral margin of lateral lobe but more weakly expressed, becoming obscure along its course. Pronotum rugose, crenulate. Lateral lobe of pronotum quadrate, about as deep as wide; ventral margin of lateral lobe with a blunt, ventrally-directed tooth just below termination an anterior lateral sulcus. Prosternal spines slightly shorter and narrower than mesosternal spines, separated by a distance equal to length of spine. Metasternal spines shorter still, separated from mesosternal spines by a distance equal to three times as great as distance between pro- and mesosternal spines.

Wings. Tegmina oval, extending just beyond tip of abdomen; acutely rounded apically; costal margin subtruncate; anal margin convex. Stridulatory field as in Fig. 2; mirrors of fields on both tegmina depressed by recurvature of anal margins of tegmina, producing a sharp ridge along median vein; accessory veins surrounding trapezoidal, translucent mirrors, inflating edges of anal margins of tegmina at region of stridulatory field. Stridulatory file with 78 teeth, 26 teeth/mm (Fig. 3). Hind wing translucent, light green, in repose concealed completely beneath tegmina.

Legs. Procoxal spine present. Ventral margins of left and right fore femora with 4-0 and 3-0 spines, respectively; ventral margins of left and right mid femora with 0-1 and 0-2 spines, respectively; ventral margins of left and right hind femora with 0-9 and 0-6 spines, respectively. Tympana concealed on both sides; tympanal shields closely appressed to tibial surface, barely inflated; shield openings slit-like. Genicular lobes of all legs unarmed.

External Genitalia. Tenth tergite inflated, medio-apically depressed; apical margin produced beyond apices of cerci, concealing them in dorsal view. Posterior margin of tenth tergite lobes on either side of medial depression, with each lobe terminating in a well-developed deflexed tooth (Fig. 4). Basal half of cercus inflated, round in cross-section; distal half abruptly narrowing and recurving vertically, distally lanceolate and terminally pointed (Fig. 5). Subgenital plate elongate, upcurved, extended distally beyond apex of tenth tergite; mediobasally keeled, apically depressed, and terminating with two short, stout, articulating styles (Fig. 6).

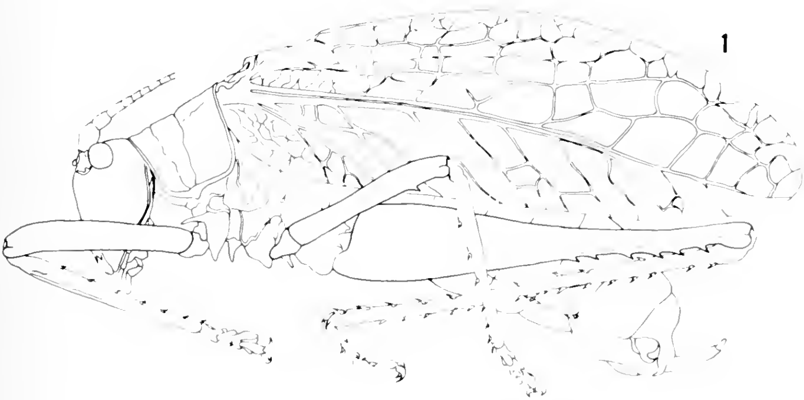
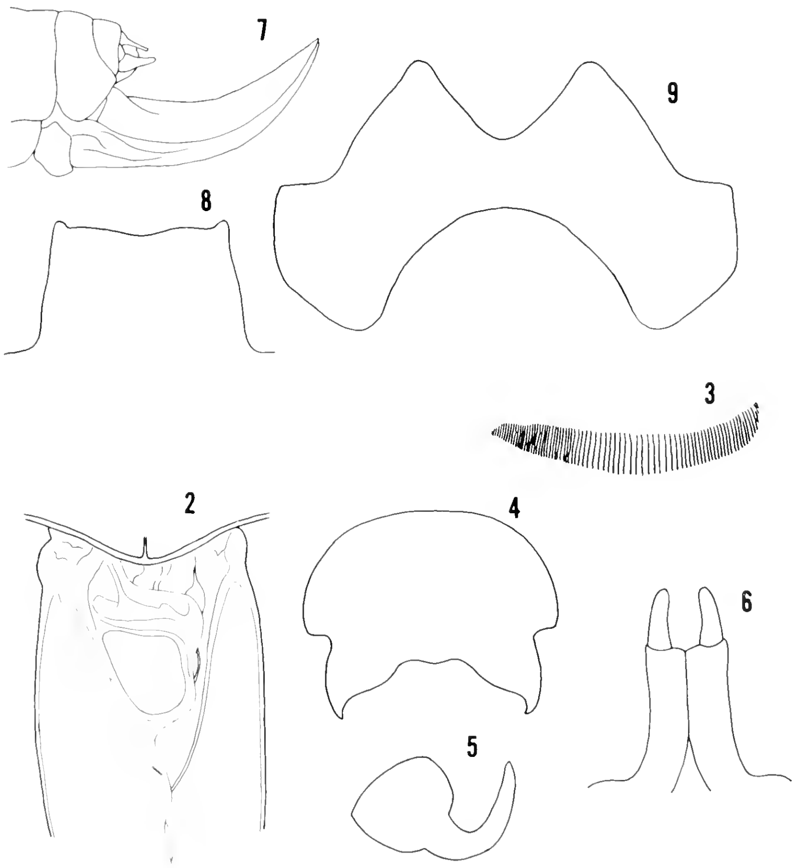


Figure 1. *Parascopioricus binoditergus,* new species. Holotype. Left lateral habitus.

Internal Genitalia. Not examined in holotype, but apparently lacking sclerotized or pigmented structures.

Color. Uniform leaf green. Fuscous areas limited to Cu_2 vein on stridulatory field. Basal third of antennae annulate, with dark brown rings.

Allotype. ♀. COSTA RICA: Cocos Island, Rio Genio III-25-1978 (C. Hogue and S. Miller, Steel Exped. 1978) [LACM].



Figures 2-9, *Parascopioricus binoditergus*, new species: Figs. 2-6, holotype. Figs. 7-9, allotype. 2, stridulatory field; 3, stridulatory file, left tegmen; 4, tenth tergite; 5, left cercus; 6, subgenital plate; 7, left lateral abdomen; 8, supra-anal plate; 9, subgenital plate. Figs. 5 and 7 are lateral views; 2, 4, and 8 are dorsal views; and 3, 6 and 9 are ventral views.

Description of allotype. Similar to holotype in nonsexually related characters. Differs from holotype in number of spines on ventral margins of femora: both fore femora with 5-0 spines: mid femora with 0-3 spines: hind femora with 0-5 (right) and 0-6 (left) spines.

External Genitalia. Abdominal tergites gradually becoming narrower successively from VII to X. Terminal tergite unmodified: in lateral view, lateral edge concealing base of cercus. Supra-anal plate flat, quadrate; distal edge directed posteriorly: lateral corners extending beyond distal edge as small papillae (Fig. 8). Cercus short, slightly longer than supra-anal plate, simple, cylindrical, curving medially along its length, slightly more constricted at distal third and curving more abruptly to the apex. Ovipositor about twice as long as pronotum, gradually upcurved across its length, sickle shaped, apically pointed, and minutely serrated along distal third of both dorsal and ventral valves; surface of ovipositor smooth, lacking oblique or transverse ridges (Fig. 7). Basal lobe of ovipositor oval, partially concealed dorsally by ventral margin of terminal tergite and ventrally by an expanded ridge of ventral valve of ovipositor. Subgenital plate spatulate, apically bifid, with a broad U-shaped emargination separating rounded furcae (Fig. 9).

Paratypes. 2♂♂, 1♀. COSTA RICA: Isla del Coca [Cocos Island], Bahia Chatham III-8-1964 (R.O. Schuster) 1 ♂, 1♀ [CAS. NMNH]; Cocos Island, Wafer Bay III-1963 (P. Slud) 1 ♂ [AMNH].

Variation. The number of spines on the ventral margins of the femora varies among individuals and on either side of the same individual. Previous studies (Hebard 1925: Ragge 1980) conclude that the number of spines are irrelevant as a taxonomic character, although their presence or absence may carry some relevant information at the generic level. The Cu_2 veins of the male paratypes are not nearly as fuscous as in the holotype, but portions of other adjoining veins are fuscous.

Measurements. (means, range, mm). Total length, ♂ 36.0 (35.3-36.8), ♀ 40.3 (38.0-42.6). Pronotum length, ♂5.6 (5.4-5.7), ♀ 5.8 (5.6-6.0). Pronotum width, ♂ 5.6 (5.4-5.8), ♀ 5.9 (5.8-6.1). Tegmen length, ♂ 30.2 (29.2-30.9), ♀ 32.3 (31.5-33.1). Tegmen width, ♂ 9.9 (9.3-10.2), ♀ 10.0 (9.8-10.1). Fore femur length, ♂9.3 (8.9-9.6), ♀ 10.2 (9.8-10.6). Hind femur length, ♂ 21.0 (20.4-21.3), ♀ 22.4 (20.4-23.1). Length subgenital plate, ♂ 7.4 (7.2-7.6). Length ovipositor, ♀ 12.8 (12.6-12.9). Mean number of spines on ventral margins of femora: ♂ (4-0, 0-2, 0-6), ♀ (4-0, 0-2, 0-5), medial and lateral margins of fore, mid, and hind femora, respectively.

Etymology. (Lt.) *bi-* two; *node-* node, projection; *tergus-* tergite; referring to the apical modification of the male tenth tergite into two projections, a feature lacking in other species of *Parascopioricus*.

Discussion. *Parascopioricus binoditergus* is the second species of pseudophylline katydid considered to be endemic to Cocos Island. The other species, *Cocconotus bellicosus* Rehn, described in 1902 from a single female, has been collected more recently by Hogue and Miller. The two species are not related, *Parascopioricus* belonging to the tribe Pterophyllini and *Cocconotus* to the Cocconotini. The nearest relatives to both species occur on the South American mainland in Columbia. Since Cocos Island is nearly midway between South America and the Galapagos Archipelago, one might expect the fauna to be related. Such is not the case, however, for the pseudophylline fauna on the Galapagos chain is limited to yet another unrelated species, *Nesocoecia cooksoni* (Butler) (Hebard 1920), which may be a complex of several species. Beier (1961) synonymized three described species into one, but he apparently made the synonymy in part on the circumstantial evidence that no males are known for one species (McNeill 1901). This species is a brachypterous member of the Cocconotini, and its origins are more obscure, since its only known relatives occur in the Yucatan Peninsula in Mexico and in Bahia, Brazil.

Based on the shape of the male cercus, the elongate male tenth tergite, and the bifid subgenital plate of the female, *P. binoditerugs* appears to be most closely related to the Colombian species *P. cordillericus.*

ACKNOWLEDGMENTS

The author expresses his appreciation to Mr. Scott Miller, Harvard University, Cambridge, Mass., for securing the specimens and supplying information about this species. The author appreciates the comments and criticism of the manuscript that were provided by Drs. A.S. Menke and D.D. Wilder of the Systematic Entomology Laboratory, IIBIII, USDA, and Dr. J.J. Whitesell, Valdosta State College, Valdosta, Ga.

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NOTICE OF SURVEY RESULTS

In the March - April, 1982 issue of ENT. NEWS a card insert asked members to express their opinion concerning the possible inclusion of brief news reports, possibly as "fillers", about society meetings, proceedings, and other activities, as well as doings of society members. We wish to thank those members who responded, sixty percent of whom indicated they would very much like to have this material included in future issues. The first of these reports appears in this issue.

— Ed.

LIFE HISTORY OF THE RED OAK BORER, *ENAPHALODES RUFULUS* (HALDEMAN), IN WHITE OAK (COLEOPTERA: CERAMBYCIDAE)[1]

Jimmy R. Galford[2]

ABSTRACT: Young red oak borer larvae feed horizontally in white oak but mostly vertically in red, black, and scarlet oak. Overgrowths of successful attacks in white oak appear as "L" or reverse "L" marks on the trees. In a study in central and southern Ohio between 1977 and 1981, 27 of 457 trees examined in the basal 6 feet had borer injuries. Only small, suppressed trees were injured.

The life history of the red oak borer, *Enaphalodes rufulus* (Haldeman), in red, *Quercus rubra* L., black, *Quercus velutina* Lam., and scarlet oak, *Quercus coccinea* Muenchh., was reported by Hay (1969). Donley and co-workers (1969) reported red oak borer damage in white oak, *Quercus alba* L. However, the behavior of the red oak borer in white oak was not reported.

Methods

The basal 6 feet of 457 living white oak trees, ranging from 5 to 45 cm dbh, were examined in central and southern Ohio between 1977 and 1981. Twenty-seven trees had evidence of red oak borer attacks. Diameter breast height (dbh) measurements of the attacked trees were taken; the trees were cut and average annual diameter growth for the last 10 years was recorded. The trees were sectioned and debarked, and the number of attacks that damaged the xylem were recorded. Sections with attacks that went deep into the xylem were split open to see if long slivers (10 to 25 mm) of wood remained in the larval galleries indicating successful adult emergence. In addition, 27 other randomly chosen trees without attacks were cut, and their average annual diameter growth during the last 10 years was recorded.

The life history of the red oak borer in white oak was determined as follows: 10 mated females were caged individually in hardware cloth sleeve cages on 10 white oaks, 10 to 15 cm dbh, in July of 1979. The beetles had been reared artificially using techniques reported by Galford (1974). The beetles were F_1 and F_2 offspring of parents that had emerged from a white oak tree. In November of 1979, and June and November 1980, 10 of the attack sites on the trees were exposed and measurements of larval damage were made. In August of 1981 the remaining attack sites were examined to see if adult emergence had occurred.

[1]Received August 12, 1982

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Results

The mean dbh of the 27 naturally attacked trees was 9.9 cm and ranged from 7.1 to 18 cm. Mean number of attacks per tree that damaged the xylem was 7, ranging from 2 to 14. Mean number of adult emergents per tree was 1.4 and ranged from 0 to 4. Average annual diameter growth of the attacked trees during the last 10 years was 2 mm, ranging from less than 1 mm to 4 mm.

Average annual diameter growth for the 27 trees without attacks was 6 mm, ranging from 2 mm to 9 mm. The mean dbh of these trees was 13 cm and ranged from 7 to 28 cm.

As a result of caging the 10 females on 10 different trees, 46 attacks were detected on 4 of the trees. Thirty of the attacks were exposed to make measurements, and the larvae were killed in the process. Only 2 of the remaining 16 larvae survived to become adults.

Observations and measurements of attacks that occurred as a result of caging females on trees led to the following conclusions: the newly hatched larvae mine in the cambium area horizontally around the tree from late July and early August until cold weather arrives, and then overwinter. Damage in the phloem-cambium region ranges from roughly circular areas about 5 mm in diameter to horizontal lines 2 to 3 mm wide and 6 to 15 mm long.

During the spring of the next year, the larvae continue to feed horizontally around the tree until late June or early July. Horizontal feeding now extends 40 to 75 mm around the tree. The larvae then feed upward widening the gallery and begin to score the xylem more heavily. After feeding upward for 75 to 125 mm, the larvae bore obliquely into the xylem about 30 to 50 mm, then vertically for 100 to 150 mm. In the fall, the larvae plug the holes with wood slivers and overwinter behind the plugs. The following spring the plugs are removed and replaced with other plugs behind which the larvae pupate. Sometimes the overwintering plugs are not removed, and pupation occurs without new plugs being made.

When emerging, the adults gnaw and rip the plugs out, pushing some of the wood slivers behind them. Long slivers of wood often extrude from the emergence hole indicating adult emergence. Figure 1 illustrates borer damage in white oak.

When white oak trees are vigorous enough to overgrow borer injuries, the overgowths resemble an "L" or reverse "L" (Figure 2). One attack was found that did not have a horizontal feeding scar, but this was exceptional.

Discussion

In southern and central Ohio, 27 of 457 white oak trees examined had external evidence of red oak borer damage. These were suppressed, very slow-growing trees. In Ohio, either the red oak borer does not readily attack white oak, or the larvae can survive only in very suppressed trees.

The red oak borer has a 2-year life cycle in white oak, the same development period as Hay (1969) observed in red, black, and scarlet oak.

The difference in feeding habits of young larvae in white oak versus red, black, and scarlet could be due to the very thin layer of phloem in slow-growing white oaks, or there could be a strain of red oak borers that prefers or attacks only white oak.

Fig. 1. Horizontal feeding scar caused by red oak borer larva during first year of development.

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Fig. 2. Red oak borer attacks on white oak almost overgrown with callus tissue.

A NEW MILLIPED OF THE GENUS *DELOPHON* FROM MISSISSIPPI (CALLIPODIDA: CASPIOPETALIDAE)[1]

Rowland M. Shelley[2]

ABSTRACT: A fourth species of *Delophon*, *D. mississippianum*, is described and illustrated. It is closely related to *D. georgianum* Chamberlin and *D. serrulatum* Causey, and features a smooth margin on the coxal process, a tibiotarsal process that is homologous to the postfemoral process on the other species, and a parasolenomerite that is longer than the tibiotarsus.

In 1979 I revised the callipodid genus *Delophon* and reported that it was comprised of three species — *georgianum* Chamberlin, *serrulatum* Causey, and *holti* Shelley — in Tennessee, North Carolina, Georgia, and Alabama. Recently, while sorting through the diplopod collection of the Missisippi Entomological Museum, Mississippi State University, I discovered a single male of a fourth species from the northern part of that state. I present herein a description of the new species along with a new generic distribution map and phylogeny, to supplement information in the revision. I thank Dr. Richard L. Brown, Director of the Mississippi Entomological Museum, for the opportunity to describe this species and permission to deposit the holotype in the invertebrate primary type collection of the North Carolina State Museum of Natural History (NCSM).

Delophon mississippianum, new species
Figs. 1-3

Type specimen: Male holotype (NCSM A3983) collected by W.H. Cross, 9 May 1980, form a pitfall trap in deciduous woods, 1.6 km SE Ecru, Pontotoc Co., Mississippi.

Diagnosis: A small species of *Delophon* distinguished by following features of male gonopods: distal elements forming approximately 90 degree angle with femur; coxal process with apical lobes on medial and lateral sides of femur, distal margins smooth; with tibiotarsal process representing postfemoral process of *georgianum;* parasolenomerite comparatively large, longer than tibiotarsus, bent slightly dorsad distal to midlength, subparallel to tibiotarsus; solenomerite short, blunt, arising from parasolenomerite at midlength, located between latter and tibiotarsus, without subterminal spur.

Holotype: Length about 18 mm, greatest width about 1.1 mm, ca. 43 segments. Dorsum light mottled brown in color, with wide, light yellow middorsal stripe extending from 2nd segment to epiproct; pore crests faintly yellow anteriad and brown caudad, thus forming two less distinct stripes equidistant of median one. Epicranium dark mottled brown, interantennal

[1]Received August 23, 1982

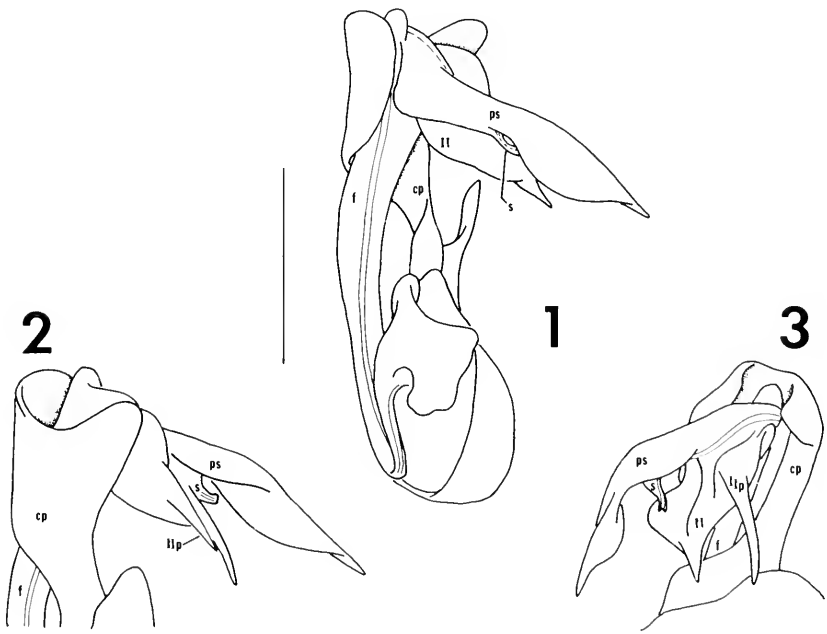
[2]North Carolina State Museum of Natural History, P.O. Box 27647, Raleigh, North Carolina 27611

region lighter, color fading out in clypeal region. Antennae long and slender, extending beyond caudal margin of segment 5; relative lengths of antennomeres 3 > 2 > 5 > 4 > 6 > 7 > 1, 2-6 clavate. About 34 ocelli in subtriangular patches.

Collum with 22 crests beginning near midlength, medial crests slightly shorter than lateral ones, anterior half of collum smooth. Secondary crests subequal in length to, but noticeably smaller than, primary crests on all segments, fading out around segment 27. Setal formula normal for genus.

Gonopods (Figs. 1-3) small, femur extending caudad only to metazonite of segment 8; parasolenomerite extending laterad to edge of body. Coxal process very broad, sheathing femur, expanded apically into two lobes on medial and lateral sides of distal extremity of femur, apical margins smooth. Postfemur nearly perpendicular to femur, of normal length relative to distal elements. Tibiotarsus shorter than parasolenomerite, angling abruptly caudad apically and narrowing into spiniform projection, inner margin with broad lobe at level of solenomerite, with spiniform process proximad, homologous to postfemoral process of *georgianum*. Parasolenomerite relatively long, longer than tibiotarsus, bent dorsad just beyond midlength (level of solenomerite), with broad rounded lobe distad on dorsal margin, narrowing abruptly apically into spiniform projection. Solenomerite a short, blunt, bisinuately curved structure arising near midlength of parasolenomerite, located between latter and tibiotarsus, expanded slightly apically, without subterminal spur.

Distribution: Known only from the type locality.



Figs. 1-3. *Delophon misissippianum*. 1, left gonopod, caudal view. 2, right gonopod, ventral view. 3, left gonopod, lateral view. cp, coxal process; f, femur; ps, parasolenomerite; s, solenomerite; tt, tibiotarsus, ttp, tibiotarsal process; Scale line = 0.50 mm for all figs.

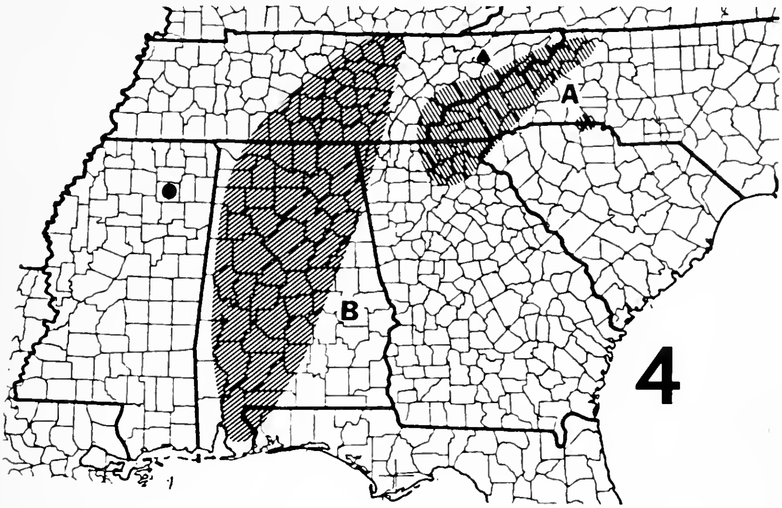


Fig. 4. Distribution of *Delophon*. A smooth curve has been drawn around the range extremes of *georgianum* and *serrulatum*. A, *georgianum*; B, *serrulatum*; dot, *mississippianum*; triangle, *holti*.

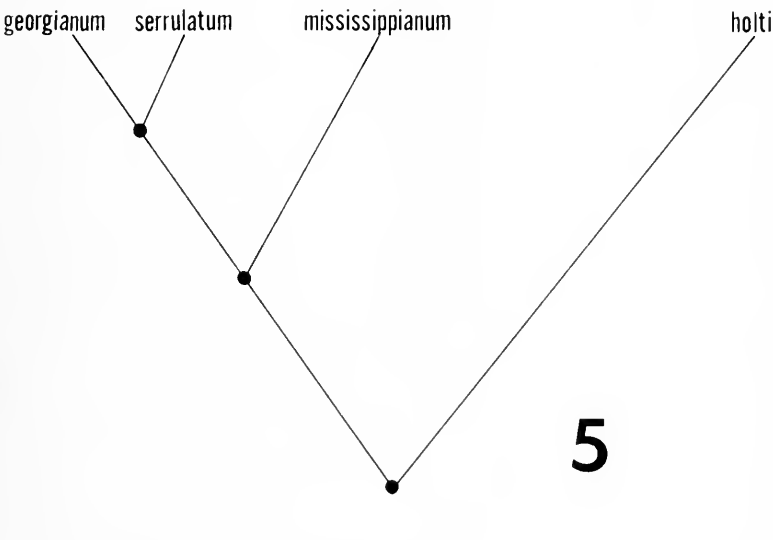


Fig. 5. Relationships in the genus *Delophon*.

Remarks: One of the main diagnostic traits of *mississippianum* is the location of a process on the proximal part of the tibiotarsus, which is similar in form to, and undoubtedly homologous to, the postfemoral process of *georgianum.*

At first glance the parasolenomerite and tibiotarsus appear to be reversed in *mississippianum,* in comparison to *georgianum* and *serrulatum.* The longer parasolenomerite is similar to the tibiotarsi of the other species, and the tibiotarsus of *mississippianum* is likewise similar in length to their parasolenomerites. The origin of the solenomerite, however, is the key factor in identifying the projections, and as in *georgianum* and *serrulatum,* it arises from the more caudal of the two in *mississippianum.* Thus in this species, the parasolenmerite is longer than the tibiotarsus.

Figure 4 shows the type locality of *mississippianum* along with known ranges of its congeners. It is the westernmost species, occurring some 60 miles west of the nearest known record of *serrulatum,* in Franklin County, Alabama. The distribution of *mississippianum* in Mississippi is a subject for future investigation, and the species may also be found in western Tennessee.

Although similar in size to *holti, mississippianum* is a product of the *georgianum-serrulatum* branch of evolution (Fig. 5). It has the general gonopodal form of these two species, so *holti* still stands by itself as representing a second line of descent. However, the unexpected discovery of *mississippianum* suggests that more species of *Delophon* may occur in the southeast and that a sister species for *holti* may eventually be discovered. The most probable area for such a form is northeastern Tennessee, western Virginia, and eastern Kentucky.

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SOCIETY MEMBER HONORED

Dr. Hal C. Reed, a member of the American Entomological Society, and a contributing author to ENTOMOLOGICAL NEWS, is the 1982 recipient of the Entomological Society of America Pacific Branch Graduate Student Award. This award is given annually to promote interest in the science of entomology at the graduate level.

Dr. Reed is associate Professor, Dep't. of Natural Sciences, Oral Roberts University. He received his B.S. in biology in 1975 from Oral Roberts and his M.S. in entomology in 1978 from Texas A&M University. His doctoral degree in entomology was awarded from Washington State Univeristy in 1982. Dr. Reed's research was in the nesting biology and social behavior of a forest dwelling yellowjacket, *Vespula acadica.* Usurpation and colony behavior of the obligate social parasite, *V. austriaca,* were also investigated.

NOTHOCHAULIODES PENAI, A NEW GENUS AND SPECIES OF MEGALOPTERA FROM CHILE (NEUROPTERA: CORYDALIDAE)[1]

Oliver S. Flint, Jr.[2]

ABSTRACT: *Nothochauliodes penai*, new genus, new species, is described and figured. It is found on the coastal mountains of Maule Province in Chile. A key is provided to separate the genus from the related genera *Neohermes, Protochauliodes*, and *Taeniochauliodes*.

In 1973 I reviewed the Megaloptera known to occur in Chile. In the nearly ten intervening years, numerous additional collections from this country have been examined, but all material has proven to be known species. Early in 1982 a collection from the coastal ranges was received from the noted Chilean naturalist and collector, Sr. Luis E. Peña G. In the lot were two male specimens of a species that differed strikingly from all known Chilean Megaloptera. Study shows these to represent an undescribed genus and species related to the chauliodine genera *Neohermes* (North America), *Protochauliodes* (North America, Chile, Australia), and *Taeniochauliodes* (South Africa).

Family Corydalidae

Subfamily Chauliodinae

Genus *Nothochauliodes*, new genus

Antenna filiform, with short hair; of 45-50 segments. Head lacking postocular ridge and spine; with raised, non-setose, muscle attachment scars. Pronotum roughly quadrate. Forewing with Rs branching pectinately, R_4 not forked; M_{1+2} forked; Cu_1 forked; anterior branch of 2A fused to 1A for a short distance. Hindwing with Rs branching pectinately. R_4 not forked; M_{1+2} forked; CU_1 forked; both branches of 2A arising close together, adjacent to 3A.

Type-species: *Nothochauliodes penai*, new species

The genus belongs to the cluster of genera held together by the apotypy of the fusion for a short distance of the anterior branch of 2A with 1A in the forewing. In two of the genera in this series (*Neohermes* and *Protochauliodes*), R_4 in both the fore-and hindwings is forked. In *Nothochauliodes* and *Taeniochauliodes* the vein is simple, resulting in the appearance of pectinate branching of the Rs system. The vein M_{1+2} in the fore- and hindwings is branched in *Nothochauliodes*. In *Taeniochauliodes* this vein is not branched in either wing, and in *Protochauliodes* and *Neohermes* is

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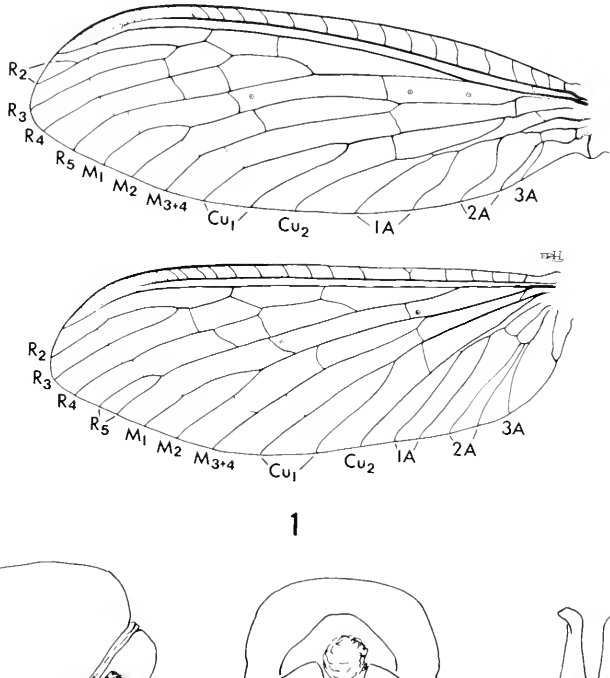
branched only in the hindwing (in *P. bullocki* Flint, the largest species of the genus, M_{1+2} is usually branched in both wings but R_4 is forked). Thus the combination of the venational characteristics of an unbranched R_4 in both wings and a branched M_{1+2} in both wings will distinguish *Nothochauliodes* from all other described genera showing the fusion of the anterior branch of 2A with 1A in the forewing. In addition to these characters, the male genitalia differ strongly from those of the other related genera. The vertical orientation of the tenth tergites appears to be unique within the subfamily.



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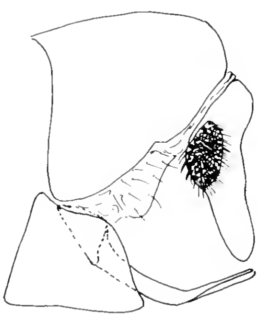

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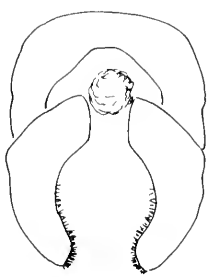

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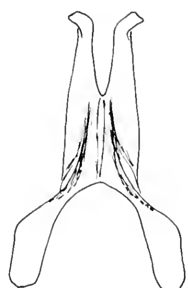

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Figs. 1-4. *Nothochauliodes penai*: 1, fore- and hindwings (drawn by Elaine R. Hodges); 2, male genitalia, lateral; 3, male ninth and tenth terga, posterior; 4, aedeagus, dorsal.

The very long, slender, and deeply divided aedeagus is also very unusual, if not unique.

The genus will run in Kimmins (1954) key to the Chauliodinae to couplet 4, genus *Protochauliodes.* Couplets 3 and 4 may be modified as below to allow easy separation of the four related genera.

3. Anterior branch of M in hindwing forked 3A
   Anterior branch of M in hindwing simple .... *Taeniochauliodes*

3A. R_4 of fore- and hindwings simple .... *Nothochauliodes*
   R_4 of fore- and hindwings forked 4

4. Male antenna with a whorl of erect hairs on each segment, no crossvein in apical fork of R_4 in forewing (rarely present in large specimens) .... *Protochauliodes*
   Male antenna with whorls of erect hairs on each segment; a crossvein in apical fork of R_4 in forewing (rarely absent) .... *Neohermes*

Nothochauliodes penai, new species

Because the genus is monotypic, the species at this time is recognizable by the generic characters. If other species are discovered, specific characteristics ought to be evident in the male genitalia, as they are in related genera. Coloration often, but not invariably, differs between species.

Adult. — Length of forewing, 27-30 mm. Color pale brown, head brown, muscle scars virtually concolorous; pronotum with distinctly darker lateral bands; forewing mostly pale brown with short, darker, transverse maculae, generally darkest on veins giving them a distinct dotted appearance; hindwing, except for anal area, similarly marked, but dotting on veins less pronounced. Male genitalia: Ninth tergum large, with ventral margin oblique. Ninth sternum roughly triangular in lateral aspect; in ventral aspect with posterior margin almost semicircular. Tenth tergite elongate, almost vertical in lateral aspect, with a large basolateral cercal area; in posterior aspect with tergite slightly arcuate with apicomesal face bearing many, small, black setae. Posterior region of genitalia partially membranous, but with a large area between and below tenth tergites lightly sclerotized and sparsely setate. Aedeagus in lateral aspect long, slender, and slightly curved; in dorsal aspect with anterior margin deeply and broadly divided, lateral arms expanded anteriorly, produced into a long, slender lobe posteriad which is deeply and narrowly divided mesally, tips hooked slightly laterad.

Variation. — In the two specimens available, there are a number of venational differences. The type, the larger specimen, has in the forewing a small apical fork to the anteriormost branch of Rs in both sides, R_5 (on the side not figured) has an apical fork, and one of the hindwings (figured) has an apical fork in R_5. The smaller specimen lacks all these, that I believe to be, extra forks of the radial system.

Material. — Holotype, male: Chile, Provincia Maule, Cayurranquil, west of Cauquenes, 400m, 23-31 Jan 1981, L.E. Peña G. USNM Type 100591. Paratype: Same data 1♂.

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LARVAL *HYDROPSYCHE* AND *SMYPHITOPSYCHE* RECORDS FROM WEST VIRGINIA (TRICHOPTERA: HYDROPSYCHIDAE)[1]

Charlene K. Nugen, Donald C. Tarter[2]

ABSTRACT: Over 4,000 larvae of the genera *Hydropsyche* and *Symphitopsyche* were collected from 225 sites in West Virginia. A total of 15 species, including 13 state records, and two species groups were identified from the collections. Important extensions included *S. macleodi* (Flint), *S. ventura* (Ross), *H. leonardi* Ross and *H. hoffmani* Ross.

Until this investigation, only three *Hydropsyche* species have been recorded from West Virginia: *H. morosa* Hagen, *H. sparna* Ross and *H. opthalmica* Flint (Ross, 1944 and Flint, 1965). Tarter and Hill (1979) noted the *H. scalaris* group from the Cranberry Glades.

From 225 sites in West Virginia, approximately 4,000 larvae of the genera *Hydropsyche* and *Symphitopsyche* were collected and identified. Fifteen species, including 13 state records, and two species groups were recorded from these collections. The classification system employed in this study follows that of Schuster and Etnier (1978), and species are arranged alphabetically with drainage basins and rivers (Janssen, 1973). State records are indicated by an asterisk (*). All specimens are stored in the West Virginia Benthological Survey at Marshall University, and detailed records are found in Nugen (1981).

Four important range extensions are noted: *S. macleodi* (Flint) (GA, NC, TN, VA); *S. ventura* (Ross) (ME, MA, NY, PA, TN, VA, NEWFOUNDLAND); *H. leonardi* Ross (MI, VA); and *H. hoffmani* Ross (MD, VA).

Symphitopsyche

S. bifida group: *S. cheilonis* (Ross); *S. bronta* (Ross), Central Form, *S. bifida* (Banks): Drainages I, II (1, 2, 4), III (5, 7a, 7b) V (10, 13, 14, 15, 16) and VI.

**S. bronta* (Ross): Drainages I, II (1,3), III (5, 6, 7a, 7b, 8), V (12, 13, 14, 16), VI and VII.

**S. macleodi* (Flint): Drainages II (1, 3), III (7b), V (13) and VII.

S. morosa (Hagen): Drainages II (1, 3), III (5, 6, 7b), V (10, 12, 13, 14) and VI.

**S. slossonae* (Banks): Drainages I, II (1, 2, 3), III (6, 7a, 7b), IV, V (13, 14, 15, 16), and VI.

S. sparna (Ross): Drainages I, II (1, 2, 3), III (5, 6, 7a, 7b), V (10, 11, 12, 13, 14, 15, 16), VI and VII.

**S. ventura* (Ross): Drainages II (3), III (7a, 7b), V (12, 13, 14, 15, 16), VI and VII.

**S. walkeri* (Betten and Mosely): Drainage II (1).

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Hydropsyche

H. depravata group: *H. betteni* Ross; *H. depravata* Hagen: Drainages I, II (1, 2, 3, 4), III (5, 7a, 7b, 8), IV, V (10, 11, 12, 14, 15, 16), VI and VII.

**H. dicantha* Ross: Drainages I, II (1, 3), III (5, 7a, 7b, 8), IV, V (11, 12, 13) and VI.

**H. hageni* Banks: Drainages III (8), V (10, 14, 16) and VI.

**H. hoffmani* Ross: Drainages III (8), IV, V (14, 15) and VII.

**H. leonardi* Ross: Drainage V (16).

**H. orris* Ross: Drainages I, VI.

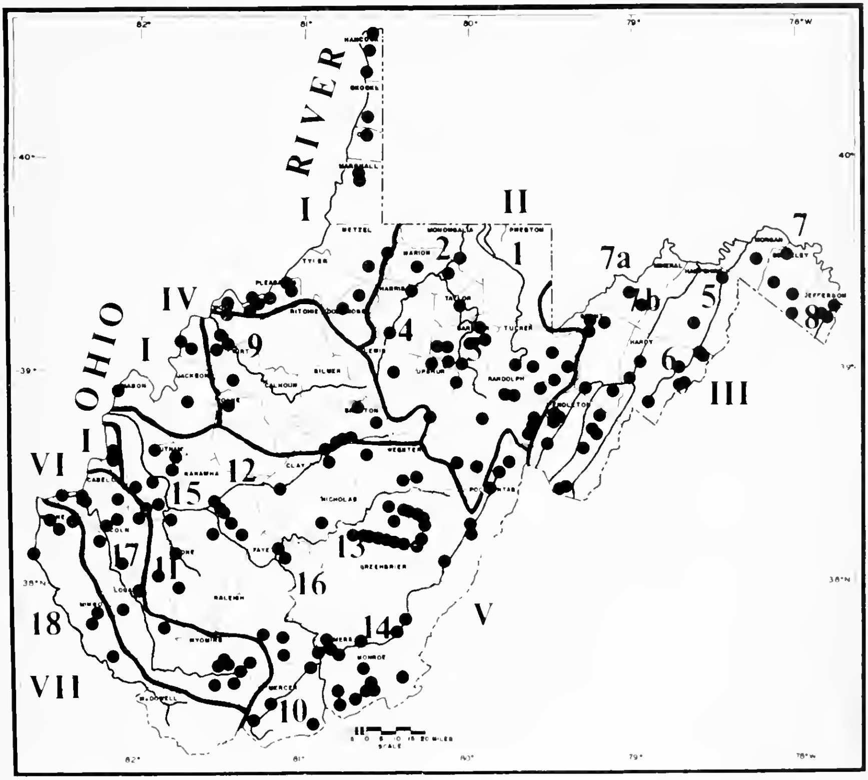

Figure 1. Drainage Basins and Major Rivers in West Virginia. Black dots represent collecting sites.

I. Ohio River. II. Monongahela River: 1. Cheat River 2. Monongahela River 3. Tygart River 4. West Fork River. III. Potomac River: 5. Cacapon River 6. Lost River 7. Potomac River a. North Branch b. South Branch 8. Shenandoah River. IV. Little Kanawha River: 9. Little Kanawha River. V. 10. Bluestone River: 11. Coal River, 12. Elk River, 13. Gauley River 14. Greenbrier River 15. Kanawah River 16. New River. VI. Guyandot River. VII. Big Sandy River.

H. phalerata Hagen: Drainage III.
H. scalaris Hagen: Drainages III (5, 7a, 7b, 8), V (12, 13, 14).
H. simulans Ross: Drainages I, IV, VI, and VII.

ACKNOWLEDGMENTS

We are indebted to Dr. Guenter A. Schuster, Eastern Kentucky University, for identification and confirmation of many specimens. We acknowledge the loan of specimens from the West Virginia Department of Natural Resources, Water Resources Division. A special thanks to Ms. Vickie Crager for typing the manuscript.

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SOCIETY MEETING — OCTOBER 7, 1982

The first fall meeting of the American Entomological Society was held October 7, 1982 at the University of Delaware. Nine members and four guests attended. Dr. Judith Hough, Assistant Professor of Entomology and Applied Ecology at the University of Delaware, presented an illustrated lecture on "Oviposition Behavior of Root Maggots." She described how maggots of the fly *Hylemya antiqua* can do considerable damage to commerical onion crops in the Northern United States. Females appear to be attracted to volatile, sulfur-containing compounds produced by onions after physical damage or by rot-inducing microorganisms. In Southern Delaware the related seed corn maggot, *H. platura*, is an agricultural pest on melon and bean seeds planted in April. The factors which stimulate ovipositon in this species are being studied in Dr. Hough's laboratory.

In notes of local entomological interest, Howard Boyd reported the appearance of a substantial population of the tiger beetle, *Cicindela lepida*, on a tract of disturbed New Jersey Pine Barrens about 30 miles from the coast. Aside from some very early records (Clementon and Lahaway (Smith, 1909)), this is the first New Jersey record of this species so far from coastal sand dunes and the first on recently disturbed soil. Hal White displayed specimens of *Aeshna tuberculifera* and *A. verticalis* collected October 3 at Lums Pond State Park. This is the first time either of the dragonflies has been found in Delaware. He also reported that the damselfly, *Argia bipunctulata*, was collected in the state for the first time this summer.

Harold B. White — Corresponding Secretary

A NEW SPECIES OF *PENAPHLEBIA* (EPHEMEROPTERA: LEPTOPHLEBIIDAE) FROM ARGENTINA[1]

Eduardo Dominguez[2], Manuel L. Pescador[3]

ABSTRACT: A new species of *Penaphlebia, P. exigua,* is described from southerr Argentina. Diagnostic morphological characters of both nymph and imagos are illustrated

Included in the mayfly collections of the senior author from Argentina are unusually small specimens of the genus *Penaphlebia* which represent a new species, *Penaphlebia exigua,* described herein. In the revision of the generic classification of certain Leptophlebiidae from southern South America, Peters and Edmunds (1972) listed four recognized species of *Penaphlebia: P. chilensis* (Eaton), *P. fulvipes* (Needham and Murphy), *P. sepia* (Thew), and *P. vinosa* (Demoulin). Pescador is presently revising the genus and additional species will be included in the genus.

Penaphlebia exigua, new species
(Fig. 1-9, 11)

Male imago (in alcohol). Length: body 6.4-6.9 mm, fore wings 6.5-7.0 mm. Head pale brown; a black stripe extends from compound eyes to base of antennae. Scape and pedicel of antennae pale yellow, flagellum paler. Ocelli grayish-white, black at base. Upper portion of eyes beige, lower portion grayish-black. Thorax: nota brown, pronotum paler, except margins black with 2 pairs of longitudinal submedian black stripes. Pleura and sterna brown. Wings (Fig. 1-3): membrane of fore wings hyaline, yellowish at extreme base; pterostigma translucent white; longitudinal and cross veins yellowish-brown, vein C, Sc, and R_1 darker; vein MP_2 of at least one of fore wings attached to vein CUA (Fig. 1); prepterostigmatic cross veins weakly developed; number of costal cross veins 17-20. Hind wings elliptic; membrane hyaline; longitudinal and cross veins yellowish-brown; number of costal cross veins 7-8. Legs: coxae, trochanters, tibio-femoral joints, and tarsal joints brownish-yellow, remaining segments yellow, progressively paler toward apex; femora with faint transverse black median band; segment 3 of protarsi longer than segment 4. Abdomen: terga translucent yellow with pronounced black maculae (Fig. 7) and black posterolateral markings thinly extended to posterior margins of segment. Sterna yellow; lateral margins on sternum 9 yellowish-brown. Genitalia (Fig. 4-6); forceps pale yellow, segment 1 faintly washed with brown, pronounced on inner lateral margin; basal 3/4 of inner margin of segment 1 moderately serrated, segments 2 and 3 subequal length. Styliger plate yellow with shallow U-shaped posteromedian emargination. Penes pale yellow; subapical spine on penis lobe stubby and pointed posterolaterally (Fig. 5, 6); subapical lobe weakly developed (Fig. 5, 6). Caudal filaments: pale yellow with apical 1/3 of basal segments brown, brown portion progressively becoming

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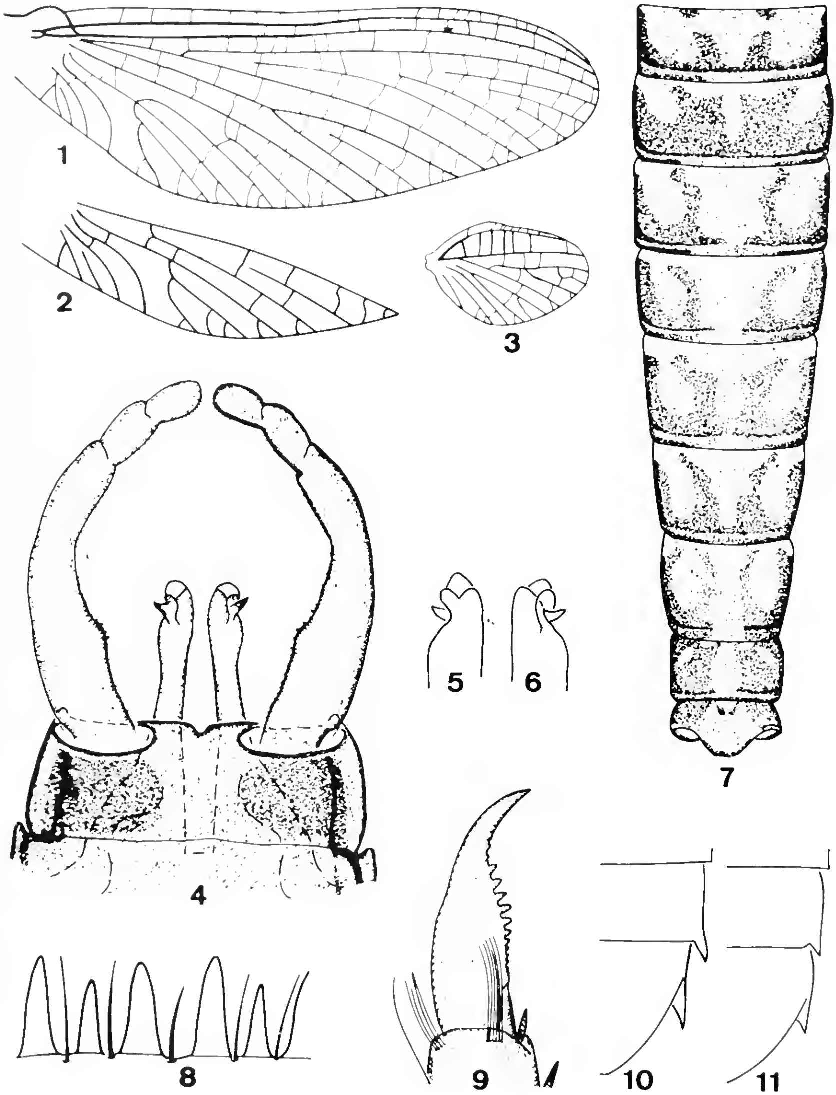

Fig. 1-9. *Penaphlebia exigua*. Fig. 1-7. ♂imago: 1, fore wing, 2, variation in vein MP of fore wing; 4, genitalia, ventral; 5-6, dorsal (5) and ventral (6) detail of apex of penis lobe; 7, abdominal terga 2-10. Fig. 8-9, nymph: 8, posterior margin of abdominal terga; 9, fore claw. Fig. 10-11, posterolateral projections of abdominal segments 8-9 of nymph; ventral view: 10, *P. chilensis;* 11, *P. exigua*.

broader towards apex until filaments consist of alternating pale yellow and brown segments with brown segments gradually faded distally.

Female imago (in alcohol). Length: body 7.7 mm, fore wing 8.0 mm. Color and marking of head, antennae and ocelli as in male. Eyes black. Thorax: color and markings as in male. Wings: color of fore and hind wings as in male except veins darker, and costal and subcostal cross veins well developed. Abdomen: color slightly darker than male, markings similar (Fig. 7).

Mature nymph (in alcohol). Body length 6.9-7.2 mm. Dorsum of head pale brown, venter paler; small triangular pale yellow spot anterior to median ocellus and lateral to lateral ocelli. Scape and pedicel of antennae light brown, flagellum paler. Ocelli black. Eyes of female black. Upper portion of male eyes orange brown, lower portion black. Mouthparts: labrum with a transverse row of closely set hair near dorsoapical margin. Outer margin of mandibles smoothly curved, middorsal depression shallow to absent. Maxillary palpi uniformly yellow. Thorax: nota light brown, sterna paler; color markings on pronotum as in imagos. Legs: light brown; femora with broad transverse median and apical dark brown bands. Middenticles on claws larger than apical denticles (Fig. 9). Abdomen: terga yellowish-brown with black maculae as in imagos; terga 2-7 with midsublateral pale yellow spot: tergal posterior spines subequal length with hair-like setae (Fig. 8); posterolateral projections on abdominal segments 8 and 9 weakly developed (Fig. 11). Sterna pale yellow, anterior margin brownish. Gills: membrane grayish-white; tracheae black; lamellae terminated in a filamentous process. Caudal filaments; pale brown, with pronounced dark shiny brown annulation on every other articulations.

Geographical Distribution. Holotype ♂ imago, ARGENTINA: Rio Negro Prov., Rincon de Asconape, 70 km S Valcheta, 27-II-80, Willink, *et. al.* Allotype ♀ imago, same data as holotype. Paratypes: ARGENTINA: 19 ♂ imagos, 14 nymphs, same data as holotype.

Association of nymph and imagos is by color markings of nymphs and adults collected in same locality. Holotype, allotype, 9 ♂imaginal and 7 nymphal paratypes are deposited in the collections of Fundacion Miguel Lillo, Miguel Lillo, Tucaman, Argentina. Ten ♂ imaginal and 7 nymphal paratypes are deposited in the collections of Florida A&M University.

Etymology. exiguus, L., meaning little.

Discussion. The nymphs of *P. exigua* exhibit minor variations on markings on the abdominal sterna, and the development of posterolateral projections on abdominal segments 8-9. Young nymphs have uniformly pale yellow abdominal sterna while mature ones have the anterior margin of each segment brownish, and anterior brown maculae on sternum 9. Additionally, mature nymphs have pronounced midsublateral pale yellow spots on terga 2-8, less pronounced or absent among the immature ones. Male nymphs have posterolateral projections of abdominal segments 8-9 more developed (Fig. 11) than the females.

Black maculae on abdominal terga 4 and 5 of most imagos are medially separated (Fig. 7) while a few have such maculae medially fused. Except for three ♂ imagos which have the base of vein MP_2 of one of the fore wings attached by a cross vein to vein MP_1 (Fig. 2), the rest have vein MP_2 basally fused or attached with vein CUA (Fig. 1).

Penaphlebia exigua can be distinguished from the other species of the genus by any of the following characters. In the imagos: (1) small body size having a length of 6.4-6.9 mm (male), 7.7 mm (female); (2) pattern of black maculae on abdominal terga is similar to Fig. 7; (3) vein MP_2 of at least one of the fore wings is basally attached to vein CUA (Fig. 1); and (4) apex of penes is as in Fig. 5, 6. In the nymph: (1) body length ranges from 6.9-7.2 mm; (2) middle denticles on claws are larger than the apical denticles (Fig. 9); and (3) posterolateral projections on male abdominal segments 8-9 are weakly developed (Fig. 11) compared to the other species (Fig. 10).

Biology. The nymphs of *P. exigua* were collected in a small stream in Somuncura Plateau which supports a thick growth of *Nostoc* and moss. Along the edge of the stream are thick growths of *Cortaderia speciosa* Nees, *Samoulus valerandi* (L.), *Cynodon dactylum, Agrostis,* and ferns (Cei, 1969).

ACKNOWLEDGMENTS

This research was supported in part by a grant (FLAX 79009) from SEA/CR, USDA. Collection of specimens by one of us (ED) was supported by a grant from the National Geographic Society, Dr. A. Willink, Principal Investigator, Fundacion Miguel Lillo. We thank M.D. Hubbard, W.L. & J.G., Peters, and H.M. Savage for reading the manuscript. The nymphal figures were drawn by J.G. Peters.

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AWARDS FOR STUDY

at The Academy of Natural Sciences of Philadelphia

OBSERVATIONS ON TERRITORALITY OF *OLIGODRANES MITIS* CRESSON (DIPTERA: BOMBYLIIDAE) ON FLOWERS OF *ERIGERON NEOMEXICANUS* (ASTERACEAE)[1]

Neal L. Evenhuis[2]

ABSTRACT: Territorality and allied behavior exhibited by *Oligodranes mitis* on flowers heads of *Erigeron neomexicanus* in southern New Mexico is described and illustrated.

Bombyliidae are well known as visitors to many different flowering plants (Graenicher 1910, Robertson 1928, Grant & Grant 1965) and are principal pollinators of certain species (Moldenke 1976, Schmitt 1981, Plichta, unpubl. data). Published observations on plant-insect relationships concerning Bombyliidae have dealt primarily with floral visitation and pollination ecology (Straw 1963, Moldenke 1976, Schmitt 1981). The present paper concerns territoriality exhibited by *Oligodranes mitis* Cresson on flower heads of *Erigeron neomexicanus* Gray (Asteraceae).

On 6-7 and 13 May 1982, observations were conducted by the author at a site 5 mi [8.0 km] N of Aguirre Springs, Doña Ana Co. in the Organ Mts of southern New Mexico, elevation ca. 5000 ft [1524 m]. Observations were made daily from approximately 1000-1600 h. The prominent floral display of *Erigeron neomexicanus*, combined with a small, dry streambed that ran between two large patches of *Erigeron*, was an ideal collecting site for Bombyliidae. The site is located in the northernmost portion of the Chihauhuan Desert, and is characterized by a lack of vegetation save for sporadic growths of *Salvia, Opuntia, Erigeron,* and other small flowering annuals. The site is at the eastern base of the Organ Mts and sharply grades into a pinyon-juniper woodland less than a mile away.

While collecting the many bombyliids that frequented the flowering *E. neomexicanus* (e.g., *Pantarbes, Geminaria, Oligodranes, Mythicomyia, Apolysis, Villa, Lepidanthrax* and *Aphoebantus*), it was noted that when disturbed, males of *Oligodranes mitis* would fly from their perches on the *E. neomexicanus* flower heads and return a few seconds later. The time between leaving the flower head and returning varied according to the degree of disturbance; however, males would almost invariably return to the same flower head. This type of behavior is similar to the territorial behavior

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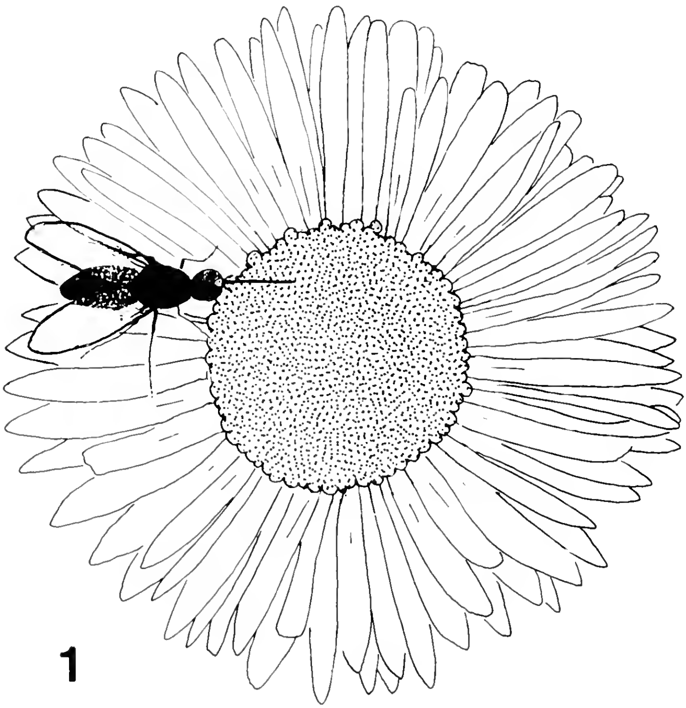
exhibited by species of *Bombylius*. The males of *Bombylius* hover over marked territories and, after being disturbed from their territory, will eventually return to the same territory (Cunningham-van Someren 1979, Evenhuis, unpubl. data). Females of *O. mitis* did not exhibit territorality but instead moved from flower to flower when disturbed and fed much more frequently.

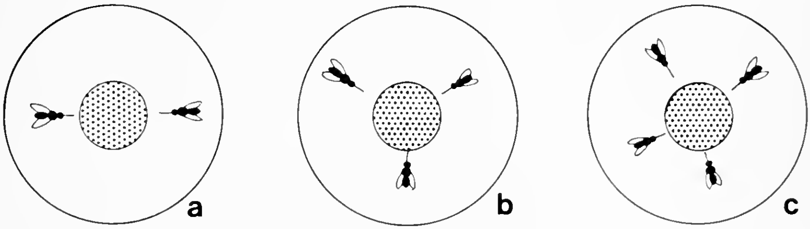
After alighting, the *Oligodranes* male placed itself on the outer ray petals with its proboscis directed inward toward the disc flowers (Fig. 1). When it fed, it moved forward slightly to probe among the corollas of the disc flowers in search of nectar with its long proboscis. After feeding, the fly would again move backward to the ray petals resuming its original position. Feeding in males was infrequent; they spent most of the time in the resting position described above.



1

Fig. 1. Resting position of a male *Oligodranes mitis* Cresson on a flower head of *Erigeron neomexicanus* Gray.

Usually only one *Oligodranes* individual (male or female) would occupy a single flower head; however, ocassionally more than one fly was found on a single flower (observed in 12 out of 58 cases). As many as 4 individuals of *O. mitis* were observed on the same flower (2 observations). When another individual alighted upon an occupied flower, the original occupant would not attempt to chase the new occupant away but would instead space itself 180° from the other indiviual (Fig. 2a). This equidistant spacing also held true in cases when there were more than two individuals on the same flower head (i.e., with three individuals, the spacing would be 120° apart, with four it would be 90°).



2

Fig. 2. Spacing of *Oligodranes* on *Erigeron* during multiple occupation. a) ca. 180° spacing with 2 individuals; b) ca. 120° spacing with 3 individuals; c) ca. 90° spacing with 4 individuals.

When viewed from above, movement on the flower head by more than one fly while feeding was always in a clockwise direction. When one fly came within ca. 20° of another fly, one or the other would move away, maintaining the equidistant spacing. During these confrontations, often the larger individual, whether male or female, would remain in its position and the smaller fly would move away (in a clockwise direction). Occasionally, when the smaller one failed to move away as the larger one approached, the larger one, after getting close enough, would kick its middle leg outward to push away the smaller individual. This was the only physical contact observed between individuals on the same flower and was seen three times during the course of these observations.

Captures of other species of *Oligodranes* at this site, other localities in New Mexico, and Arizona, all on various species of *Erigeron*, lead me to conclude that *Erigeron* flowers play an important role in the biologies of adult species of *Oligodranes*, much as other flowers do in the Old World genus *Usia* (DuMerle 1971) [both genera have been recently placed in the subfamily Usiinae (Hull 1973, Hesse 1973)]. Though not observed here, territoriality exhibited by males of *Oligodranes mitis* presumably is related to courtship and mating as in other genera of Bombyliidae.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

c/o BRITISH MUSEUM (NATURAL HISTORY),
CROMWELL ROAD, LONDON, SW7 58BD

ITZN 11/4
(A.N.(S.)) 123

4 October, 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 3, on 30 Spetember 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.	
2384	*Nymphula* Schrank, 1802 (Insecta Lepidoptera): proposal to designate a type species.
2296	*Hybosorus illigeri* Reiche, 1853 (Insecta, Coleoptera): proposed conservation by use of the plenary powers.
2380	*Anthalia* Zetterstedt, 1838 (Insecta, Diptera): request for designation of type species.

(Continued on page 30)

NOTES ON *AUPLOPUS CARBONARIUS*, A SPIDER WASP NEW TO THE UNITED STATES (HYMENOPTERA: POMPILIDAE)[1]

Sal Nolfo[2]

ABSTRACT: Six *Auplopus carbonarius* Scopoli have been captured in New York state within the past fifteen years, five since June 15, 1981. It may be assumed that this Palearctic species is firmly established in the northeastern United States.

Auplopus carbonarius Scopoli

Male — 5 mm to 6 mm in length; dorsum black, lacking iridescence; last tergum white; frons bears two longitudinal white stripes, one adjacent to each compound eye, starting just above the antennal sockets and extending down to the apical edge of the clypeus. Wings faintly infuscate, forewing 6 mm long; second flagellar segment 2.5 times as long as wide; apical margin of the clypeus moderately concave.

Female — 8 mm to 9 mm in length; dorsum black, without iridescence; apical section of mandibles rufous. Wings faintly infuscate, forewing 8 mm long; pygidial plate polished; second flagellar segment 4.0 times as long as wide; apical margin of clypeus broadly angled to form a rounded median point.

This species closely resembles *Auplopus variolarum* Townes and *Auplopus caerulescens subcorticalis* Walsh in Townes (1957) keys. The female is similar to *A. variolarum* but differs in having its legs wholly dark, the clypeus somewhat produced forming a rounded median point, and averaging slightly smaller in size. The male is similar to *A. caerulescens subcorticalis* but lacks the bluish iridescence on the thorax.

Auplopus carbonarius, like many other species of *Auplopus,* builds nests of mud, consisting of single, not side by side, tubes. The females collect small pellets of mud, using their mandibles and mental bristles, and build cells with rows of pellets. The mud is pressed into place with the tip of her gaster or pygidial plate. These barrel-shaped cells are flat topped and approx. 8-10 by 4-5 mm.

It is not known if the cells are constructed before or after the prey is paralyzed, but it is almost certain that it is after. After paralyzing the spider, but before taking it back to the nest, the wasp usually mutilates it. The significance of this habit is unknown. Perhaps this makes the paralyzed prey easier to carry or pack into a cell.

The nest are built in a variety of situations, such as on tree stumps, fences, under stones, under bark, in crevices of tree trunks and on walls.

[1]Received August 12, 1982

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Nests may have been brought into this country in nursery stock or wood products.

One female *A. carbonarius* was captured in Nyack, New York on June 12, 1967, by M. Deyrup (collection of the American Museum of Natural History, New York). Since then five more have been captured in North Bellmore, New York since June 15, 1981, by V. Nolfo. It seems, in all probabilities, that this wasp is established here. One pair will be deposited in the collection at the U.S. National Museum, Wash., D.C.

ACKNOWLEDGMENTS

I am grateful to Howard E. Evans, Colorado State University, and to M.C. Day, of the British Museum of Natural History, for assistance in determining these specimens. I also wish to thank Vincent Nolfo for providing the five specimens from Long Island, New York and Mr. and Mrs. W. Hancock for their translation of Heinrich Wolf's German manuscript.

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(Continued from page 28)

ITZN 59 4 October 1982

The following Opinions and Directions have been published by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature,* volume 39, part 3, on 30 September, 1982:

Opinion No.	
1218 (p. 166)	*Trombidium akamushi* Brumpt, 1910 (Acarina): designation of type species.
1221 (p. 175)	*Baeocera* Erichson, 1845 (Insecta, Coleoptera): designation of type species.
1222 (p. 178)	*Campylosteira* Fieber, 1844 (Insecta, Hemiptera): type species designated.

Direction No.	
112 (p. 194)	PIERIDAE Duponchel, [1835] (Insecta, Lepidoptera): protected.
113 (p. 196)	MORPHIDAE (Insecta, Lepidoptera): further correction to Official List entry.

The Commission regrets it cannot supply separates of opinion.

R.V. Melville,
Secretary

CHIGGERS (ACARI: TROMBICULIDAE) FROM SOME SMALL MAMMALS FROM NIGERIA[1]

John O. Whitaker, Jr.[2], M. Lee Goff[3], John G. Matthysse[4]

ABSTRACT: Six species of chiggers were recorded from mammals from Nigeria: *Gahrliepia (G.) bellieri*, G. *(Schoengastiella)* nr. *combesi*, *Leptotrombidium (Hypotrombidium) legaci*, *Microtrombicula iecensis*, *Neotrombicula nigeriensis*, and *Schoengastia eburnensis*. Of these, only *N. nigeriensis* and *L. legaci* had been reported previously from Nigeria.

Recently, two of us (Whitaker and Matthysse, 1982) presented information on ectoparasites of some small mammals in Nigeria. The present paper presents information on the larval trombiculids or chiggers from that collection. Mammal species collected which were not found infested by chiggers are as follows (with numbers of hosts examined in parentheses): *Arvicanthis niloticus* (2), *Cricetomys gambianus* (6), *Leggada musculoides* (1), *Mastomys natalensis* (6), *Mus musculoides* (2), *Praomys tullbergi* (9), and *Rattus alexandrianus* (1). All of the uninfested hosts were rodents.

Four species of mammals were recorded as hosts for 112 chiggers of 6 species as follows:

Insectivora (Soricidae)

Crocidura flavescens (I. Geoffroy, 1827) The single specimen examined (Ibadan, 18 Apr 1975) of the White-footed shrew (= *C. manni*) yielded 24 larvae of *Leptotrombidum (Hypotrombidium) legaci* (Andre, 1950). This species has been previously reported from a number of different hosts, including *Felis* sp., *Taterillus e. emini*, *Mylomys cunninghamei alberti*, *Lemniscomys s. striatus* and *Gallus domesticus*, from the Ivory Coast, Ghana and the Central African Republic.

Rodentia (Muridae)

Dasymys incomtus (Sundevall, 1847) Two of the 7 Shaggy-haired rats examined (Ibadan; 30 Apr., 12 May 1975) were each infested by 1 specimen of *Schoengastia eburnensis* Taufflief, 1960. This chigger was previously reported from an antelope, *Neotragus pygmaeus*, taken from the Ivory Coast.

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Lophuromys sikapusi (Temminck, 1853) The single specimen of the harsh-furred mouse examined (Ibadan, 23 Apr 1975) was infested by 29 chiggers representing 3 species: 7 *Gahrliepia (Gahrliepia) bellieri* Taufflieb, 1965; 12 *Leptotrombidium (H.) legaci* and 10 *Neotrombicula nigeriensis* (Ewing, 1928). *Gahrliepia (G.) bellieri* was originally described by Taufflieb (1965) from *Crocidura* sp. taken from the Ivory Coast and *Neotrombicula nigeriensis* was described by Ewing (1928) from *Funisciurus auriculatus oliviae* taken in Nigeria.

Rattus rattus (Linneaus, 1758) A total of 53 chiggers of 4 species was recovered from 9 of 13 black rats examined. All rats with chiggers were taken between April 10 and April 22, 1975, at Ibadan. *Leptotrombidium legaci* was represented by 16 larvae on 6 hosts, 12 *Microtrombicula iecensis* Taufflieb, 1960, on 3 host individuals, 24 *Neotrombicula nigeriensis* on 6 host individuals, and a single *Gahrliepia (Schoengastiella)* likely *combesi* Taufflieb, 1966. *Microtrombicula iecensis* was described by Taufflieb (1960a) from *Rattus frugivorus* taken in Brazzaville, the Congo. Taufflieb (1964) described *Gahrliepia (S.) combesi* from *Aethomys* sp. taken near Bangui, Central African Republic. The specimen in the present collection has been damaged, thus precluding positive identification. In all observable characters, this specimen agrees with *G. (S.) combesi.*

Of the 6 species of chiggers collected during this study, only *Neotrombicula nigeriensis* and *Leptotrombidium (H.) legaci* had been previously reported from Nigeria. Host records from shrews and rodents are new for all chigger species except *Leptotrombidium (H.) legaci.*

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TWO NEW SYNONYMS OF *EUTAENIONOTUM GUTTIPENNIS* (STENHAMMAR) (DIPTERA: EPHYDRIDAE)[1,2]

Philip J. Clausen[3]

ABSTRACT: The types of *Notiphila producta* Walker and *Ephydra octonotata* Walker have been examined, lectotypes designated for each, and both are considered junior synonyms of *Eutaenionotum guttipennis* (Stenhammar).

In 1849, Walker describd *Notiphila producta* and, later in the same paper, described *Ephydra octonotata,* both from specimens taken at the same locality. Much later Wirth (1965) listed *producta* (Walker) and *octonotata* (Walker) as species in the ephydrid genus *Hyadina.*

Consequently, during the course of my revision of the genus *Hyadina,* it was necessary to examine the Walker types of each of the above species. My examination proves beyond any doubt that not only are both species conspecific but both are definitely junior synonyms of *Eutaenionotum guttipenis* (Stenhammar). For a complete list of synonymies of *guttipennis,* both *Notiphila producta* Walker and *Ephydra octonotata* Walker should be added to those in Clausen and Cook (1971).

In Walker's descriptions of both species, he made no mention of exactly how many specimens of each species were before him or actually in the type series. If there was ever a series of specimens of each species, apparently only a single specimen of each still exists. Thus, I can either assume these to be holotypes or designate each as a lectotype. For nomenclatorial stability, I am herein doing the latter.

Both lectotypes are deposited in the collection of the British Museum (Natural History) and bear identical data, except for the original determination labels and my lectotype and determination labels. The data on both lectotypes are as follows: "Hudson's Bay, St. Martin's Falls, George Barnston, B.M. 1844-17." The lectotype of *Notiphila producta* Walker is a female and is now so labeled. The lectotype of *Ephydra octonotata* Walker has the abdomen missing and is unlabeled as to sex, but from the size of the specimen I strongly suspect it to be female also. Beneath the

[1]Received June 8, 1982

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lectotype label, each also bears my determination label for *Eutaenionotum guttipennis* (Stenhammar).

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ASHEUM, A REPLACEMENT NAME IN CHIRONOMIDAE (DIPTERA)[1]

James E. Sublette, Mary Sublette[2]

In reviewing the genera of Chironomidae of the world, Dr. Patrick Ashe, University College, Dublin, encountered a senior homonym for a genus name published by Sublette (1964). The following new name is proposed as a replacement for the junior homonym.

Asheum New name Sublette & Sublette

Etymology: This replacement name for *Pedionomus* Sublette, 1964, nec *Pedionomus* Gould, 1840, Birds of Australia, 5, pl. 80. (Aves); nec *Pedionomus* Haag-Rutenberg, 1875, Duetsch. Ent. Zeitschr. 19:42 (Insecta), is dedicated to Dr. Patrick Ashe who pointed out the homonomy.

Gender: Neuter

Type-species: *Pedionomus beckae* Sublette (=*Asheum beckae* (Sublette) n. comb.), by original designation.

LITERATURE CITED

Sublette, James E. 1964. Chironomidae (Diptera) of Louisiana. I. Systematics and immature stages of some lentic chironomids of west central Louisiana. Tulane Stud. Zool. 11(4): 109-150.

[1]Received August 23, 1982

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NEW RECORDS OF CERATOPOGONIDAE (DIPTERA) FROM NORTH CAROLINA[1]

Tommy W. Bowen[2]

ABSTRACT: Eighteen species of ceratopogonids (Diptera: Ceratopogonidae) are reported from North Carolina for the first time. They include: *Atrichopogon levis, A. fusculus, Forcipomyia brevipennis, F. fimbriata, F. squamipes, F. pluvialis, Dasyhelea major, D. navaiae, Culicoides chiopterus, Parabezzia alexanderi, Jenkinshelea albaria, Johannsenomyia argentata, Probezzia pallida, Bezzia glabra, B. laciniastyla, B. pulverea, B. setulosa,* and *Phaenobezzia opaca.*

Records of North Carolina ceratopogonids are scattered in the literature. Brimley (1938), in the first attempt at cataloging the insect fauna of North Carolina listed 7 species in 6 genera of ceratopogonids. Wray (1967) published a supplement to the Brimley catalogue which added 6 more species and 3 genera. Battle and Turner (1970, 1971) summarized the North Carolina *Culicoides* listing a total of 15 species. Kline and Axtell (1976) collected an additional 4 species of *Culicoides* in a *Spartina* salt marsh in coastal North Carolina. To my knowledge, no other major listing of North Carolina ceratopogonids has been published.

Listed below are 18 species previously unreported from North Carolina. The specimens were collected during 1978 and 1979 at Lake Norman, a large, warm, monomictic, piedmont reservoir in Mecklenburg County, North Carolina. Adults were collected either by ultraviolet and standard fluorescent light traps (LT), emergence traps (ET), or by rearing (R) from pupae collected at the water surface (S). For each species listed, the dates collected, the sex, the number of specimens obtained, and the collection method are given. Voucher specimens are deposited in the Duke Power Company Environmental Services invertebrate collection.

Forcipomyiinae

Atrichopogon (Atrichopogon) levis (Coquillett 1901): 30-VI-78, 1 male, LT.

A. (A.) fusculus (Coquillett, 1901): 19-V-78, 1 male; 30-VI-78, 1 male; 19-X-78, 1 male, LT.

Forcipomyia (Forcipomyia) brevipennis (Macquart, 1826): 23-VI-78, 1 male, LT.

F. (F.) fimbriata (Coquillett, 1901): 19-X-78, 1 male, LT.

F. (F.) squampies (Coquillett, 1902): 19-X-78, 1 male, LT.

F. (Metaforcipomyia) pluvialis Malloch, 1923: 24-VIII-78; 1 male, LT.

Dasyheleinae

Dasyhelea major (Malloch, 1915): 14-IV-78, 10 males, 14 females; 12-V-78, 2 males; 1-VI-

[1]Received May 28, 1982

[2]Duke Power Company, Production Environmental Services, Rt. 4, Box 531, Huntersville, NC 28078.

78, 2 males; 4-VI-78, 1 male; 30-VI-78, 1 male; 15-V-79, 2 males, LT, R.
D. navaiae Waugh and Wirth, 1976: 30-VI-78, 1 male, LT.

Ceratopogoninae

Culicoidini

Culicoides (Avaritia) chiopterus (Meigen, 1830): 28-IX-78, 1 male; 19-X-78, 1 male, LT.

Stilobezziini

Parabezzia alexanderi Wirth, 1965: 15-V-79, 2 male pupae, S.

Sphaeromiini

Jenkinshelea albaria (Coquillett, 1895): 17-VIII-78, 1 male, R.
Johannsenomyia argentata (Loew, 1861): 1-VI-78, 1 female; 14-VII-78, 1 male; 28-VII-78, 3 females, LT.
Probezzia pallida Malloch, 1914: 26-V-78, 1 male; 1-VI-78, 9 males, 10 females; 9-VI-78, 1 male; 7-VII-78, 1 male; 15-V-79, 12 males, R.

Palpomyiini

Bezzia (Aspinabezzia) glabra (Coquillett, 1902): 12-V-78, 1 male, 1 female; 26-V-78, 2 males; 4-VI-78, 1 male; 8-VI-78, 1 female, 9-VI-78, 2 males, 1 female; 16-VI-78, 2 males; 30-VI-78, 4 males, 1 female, LT, ET, R.
B. (Pseudobezzia) laciniastyla Dow and Turner, 1976: 30-VI-78, 1 female, LT.
B. (P.) pulverea (Coquillet, 1901): 14-IX-78, 1 male, ET.
B. (P.) setulosa (Loew, 1861): 19-V-78, 2 males; 4-VI-78, 1 male; 30-VI-78, 2 males; 31-VIII-78, 1 male, LT.
Phaenobezzia opaca (Loew, 1861): 14-IV-78, 1 male, 17-V-78, 1 female; 1-VI-78, 1 female, 7-VI-78, 1 male; 15-V-79, 1 female, ET, R.

ACKNOWLEDGMENTS

The author wishes to express his appreciation to William L. Grogan, Jr. and Walter I. Knausenberger for verification of identifications, and to Kenneth L. Manuel and Willis W. Wirth for reviewing the manuscript.

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SEXUAL DIMORPHISM OF TARSAL CLAWS IN ANTHONOMINE WEEVILS (COLEOPTERA: CURCULIONIDAE)[1,2]

Peter Kovarik, Horace R. Burke[3]

ABSTRACT: Sexual dimorphism of the protarsal claw tooth of several species of anthonomine weevils is discussed and selected examples are illustrated. This dimorphic character occurs in a scattered fashion in the subfamily. In the genus *Anthonomus* it is found mostly in closely related species in the nominate subgenus and in all species of the subgenus *Anthonomorphus*. Other genera containing species with sexual dimorphism of the claws are *Achia, Coccotorus* and *Furcipus*. The character was not found in any other subfamilies of Curculionidae which have toothed claws.

Dieckmann (1968) was the first to point out that some of the European species of the genus *Anthonomous* Germar have sexual dimorphic protarsal claws. In his revision of the Anthonomini of the western Palearctic region he described such claws for *Anthonomus pomorum* L. and *Anthonomus pedicularius* (L.). Morris (1976) briefly mentioned dimorphism in the tarsal claws of *Anthonomus conspersus* Desbrochers and *A. pedicularius,* illustrating the latter. Read (1981) added *Furcipus rectirostris* (L.) to this short list of anthonomine species showing secondary sexual characters of the tarsal claws.

During our study of the systematics of North American anthonomines, we surveyed a wide array of species of the subfamily to determine the incidence and distribution of this dimorphism. Approximately 75 species, representing nearly all of the genera of Anthonominae and subgenera of *Anthonomus*, were investigated. Additional observations were made on several other genera of Curculionidae whose species have toothed tarsal claws similar to those of the anthonomines.

Sexual dimorphism of the tarsal claws in the anthonomines involves only the protarsi. Tarsal claws of weevils in this subfamily are each usually provided with a tooth which arises on the inner surface of the claw near the base. The tooth may be short or it may extend almost the full length of the tarsal claws. Occasionally the tarsal claws of anthonomines are simple and there are a few which have the tooth arising from the underside of the claw rather than on the inside.

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[2]Technical Contribution No. 18082. Texas Agricultural Experiment Station, College Station, Texas 77843.

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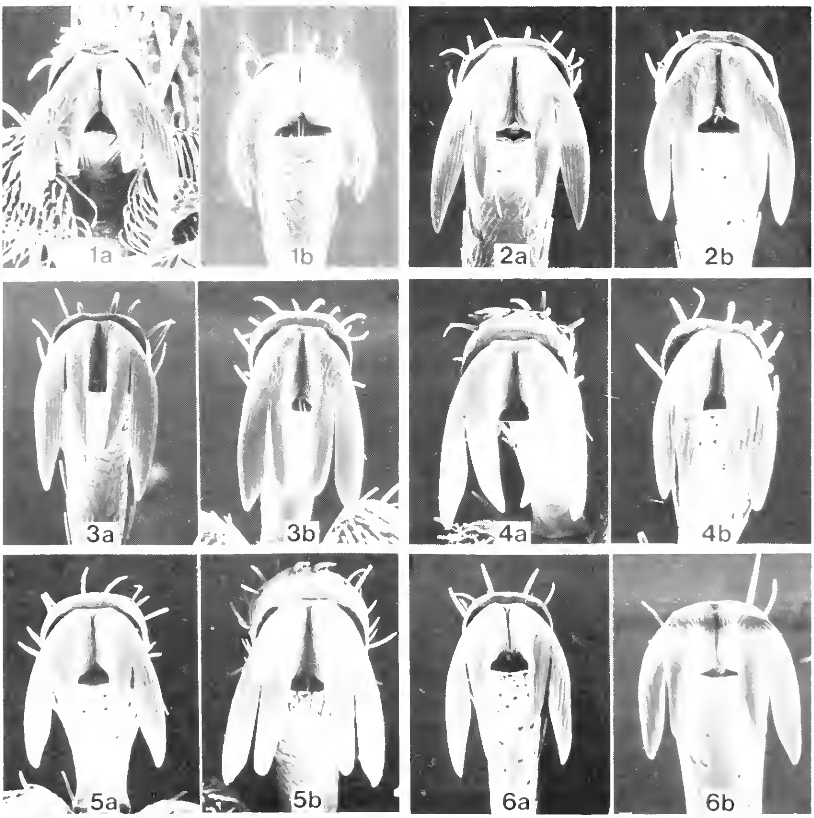
In species where sexual dimorphism is present the tooth on the protarsal claw of the female is usually sharply pointed apically (Figs. 2a, 3a, 4a, 5a, 6a) while that of the male is somewhat rounded and blunt at the apex (Figs. 2b, 3b, 4b, 5b, 6b). The reverse is true in *Anthonomus nebulosus* LeConte where the tooth of the female has a blunt apex (Fig. 1a) and that of the male is more sharply pointed (Fig. 1b). The claw of the female is usually distinctly shorter than that of the male in species with dimorphic claws, although in *Anthonomus texanus* there is only a slight difference in length between the sexes. Another difference noted is that the female tooth often



Figs. 1-6. Protarsal claws of species of *Anthonomus*. In each figure a=female, b=male. Fig. 1. *Anthonomus nebulosus* LeConte. Fig. 2. *Anthonomus grandis* Boheman. Fig. 3. *Anthonomus hunteri* Burke and Cate. Fig. 4. *Anthonomus texanus* Dietz. Fig. 5. *Anthonomus fulvus* LeConte. Fig. 6. *Anthonomus peninsularis* Dietz.

curves inward and forms a greater angle with the claw; the tooth of the male claw lies close to the claw so that the two are more or less parallel.

The distribution of the sexual dimorphic claws in the subfamily is somewhat scattered. In addition to *Anthonomus,* they occur in the genera *Furcipus* Desbrochers, *Coccotorus* LeConte and in some species of *Achia* Champion. Species of *Furcipus* and *Coccotorus* have occasionally been placed in *Anthonomus*, indicating their apparent close phylogenetic relationships to members of the latter genus. Furthermore, this affinity seems to be with species in the nominate subgenus *Anthonomus*, some of which also have sexual dimorphic claws. The majority of species of the subgenus *Anthonomus,* however, are not dimorphic in this character. Species of the subgenera *Anthonomorphus* Dietz and *Parathonomus* Dietz also exhibit dimorphism of the claws; these taxa (at least the latter) are likewise relatively close phylogenetically to the species in the nominate subgenus which are dimorphic. It seems, therefore, that dimorphism of the tarsal claw occurs mostly in a relatively small number of species which have the closest relationships to *A. pedicularius*, the type species of the genus. The presence or absence of tarsal claw dimorphism may therefore be useful as an indicator of phylogenetic relationships in the subfamily. One exception to this general pattern is *Anthonomus testaceosquamosus* Linell. This species, a member of the *A. squamosus* Group, has sexual dimorphic claws but on the basis of overall characters does not appear to be closely related to other species having the character.

Species of the subgenus *Antonomorphus* exhibit more distinct protarsal claw dimorphism than most other anthonomines. There is a relatively small amount of difference in the sexual dimorphic tooth of the claw within this subgenus (Figs. 2-6). *Anthonomus grandis* Boheman and *A. hunteri* Burke and Cate are considered to be closely related (Burke and Cate 1979) on the basis of overall characters and this relationship is also reflected in the tarsal claws (Figs. 2, 3). The most noticeable difference between the claws of the two species is in the more slender tooth of *A. hunteri.* Two other species, *A. texanus* Dietz and *A. cognatus* Burke, are considered by Burke (1964) to constitute a species pair within the subgenus. This relationship is supported by the claw characters. Similarity of claws of the two species is more striking in males than in females. *Anthonomus peninsularis* Dietz is not especially closely related to any of the other species in the subgenus; both males and females have a shorter tooth than that of the other species (Fig. 6). The remaining member of the subgenus, *A. fulvus* LeConte, is a distinctive species which appears to have no close relatives in the subgenus. The female tooth (Fig. 5a) of *A. fulvus* is somewhat intermediate in length between that of *A. peninsularis* and other members of the subgenus. The male tooth (Fig. 5b) is, however, one of the longest in the subgenus.

The basis for the difference in the tarsal claw teeth of the two sexes in these anthonomines is not known. This may be an adaptation in the male which plays some part in grasping the female during copulation. In addition to showing some phylogenetic relationships within the subfamily, the character may also be used with ease to distinguish the sexes.

Relatively few other curculionids have toothed claws like those of the anthonomines. None of the species with toothed claws examined from other subfamilies show sexual dimorphism of the tooth of the tarsal claw.

ACKNOWLEDGMENT

Special thanks are due Jim Ehrman, Electron Microscopy Center, Texas A&M University, for technical assistance in preparation of the SEM photographs included here.

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SEASONAL FLIGHT PATTERN OF PLECOPTERA FROM NORTH OTTER CREEK, VIRGINIA[1]

Boris C. Kondratieff, Joseph L. Despins[2]

ABSTRACT: Adult stoneflies were collected by a blacklight trap for one flight season from North Otter Creek, a 4th order Virginia stream. A total of 324 specimens were collected. representing 11 species of Perlidae and Perlodidae. Five species dominated: 2 species were collected for about a 7-week period, 5 over a 4-week period. Few stoneflies were collected by the trap when air temperature dropped below 7 C.

Little information exits on emergence patterns and flight period of adult stoneflies in eastern North America. Studies which report this type of information have employed tent or other emergence traps (i.e., Harper and Pilon 1970 and White et al. 1979). Blacklight traps can provide similar data. They are easy to employ and capture large numbers of specimens, often including rare species. Resh et al. (1975) pointed out the advantages and disadvantages of light trapping and the types of information obtainable. Fernando (1961) indicated that regular light trapping is a useful method of characterizing colonization cycles of many insects.

Some seasonal flight information for southeastern stonefly species has been reported by Morse et al. (1980). Our paper presents the pattern of adult stonefly occurrence over the flight season in 1981, based on blacklight trap collections from a Virginia stream.

Study Area

North Otter Creek (37°27'30"N, 79°27'30"W), a tributary of the Roanoke River Basin, lies at the boundary between the Blue Ridge and Piedmont Plateau physiographic provinces in the northern portion of Bedford County, Virginia. It is formed by the confluence of Overstreet and Gunstock creeks. The sampling site was located on the N.A. Boone Farm, off County Route 639, approximately 1700 m below Bedford Lake, a small 14.5 ha impoundment.

The substrate was mostly pebble (16-64 mm) with some cobble (64-256 mm), and silt accumulations were present in pool areas. The stream averaged 5 m wide and had a 16 m/km gradient. Dissolved oxygen concentrations were near saturation (> 90%) throughout the study period. The stream water pH ranged from 6.9-7.1 and was soft (mean alkalinity: 3.1 mg/l $CaCO_3$). Riparian vegetation was dominated by American

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sycamore (*Platanus occidentalis* L.) and speckled alder (*Alnus serrulata* Aiton).

Methods

A standard Ellisco Inc. general purpose blacklight insect trap (with GE F15T8/BL bulb) was operated continuously from 15 April to 20 September 1981. The trap was set 40 m from the stream margin and trap contents were examined, identified and enumerated every 24 hours. Daily fluctuations in air temperature were measured using a recording hygrothermograph (Cole-Parmer Instrument Co.). There were no other streams near the trap site.

Results and Discussion

A total of 324 specimens representing 11 species were collected. The seasonal pattern of stoneflies attracted to the trap is illustrated in Fig. 1. Five species were numerically dominant: *Perlesta placida* (44% of all stoneflies collected), *Acroneuria arenosa* (24%), *Isoperla dicala* (11%), *Acroneuria abnormis* (10%), and *Eccoptura xanthenes* (7%). All except

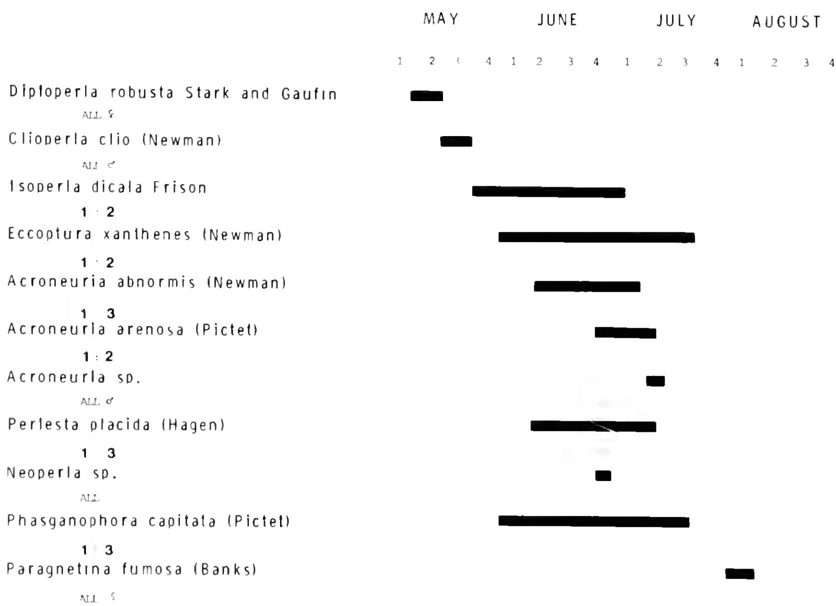

Fig. 1. Seasonal flight of adult stoneflies from May to August 1981, North Otter Creek, VA.

Diploperla robusta, Clioperla clio, and *I. dicala* (Perlodidae) belong to the family Perlidae, and members of both families are known to be readily attracted to light (Frison 1935, Hitchcock 1974, Stark and Gaufin 1979). The first stonefly, *D. robusta,* was trapped on 11 May and the last stonefly, *Paragnetina fumosa* on 3 August 1981. *Eccoptura xanthenes* and *Phasganophora capitata* exhibited the longest flight periods of about 7 weeks (Fig. 1). *Diploperla robusta, C. clio, Acroneuria* sp., and *Neoperla sp.* had very short flight periods of less than 1 week. These species were considered rare at this site. *Acroneuria abnormis, C. clio,* and *P. placida* have approximately 4 week flight periods. Morse et al. (1980) reported similar flight periods for some of the same species in South Carolina.

Nearly 73% of all stoneflies were collected in June, representing 7 of 11 species. *Clioperla clio* and *D. robusta,* are spring emerging species collected only in May during this study. Adults of *P. fumosa* have been recorded from April to September, however we collected it only in August. Maximum air temperatures averaged highest in June (Fig. 2) the month when almost two-thirds of all stoneflies were collected. Few adults were collected when air temperatures dropped below 7°C.

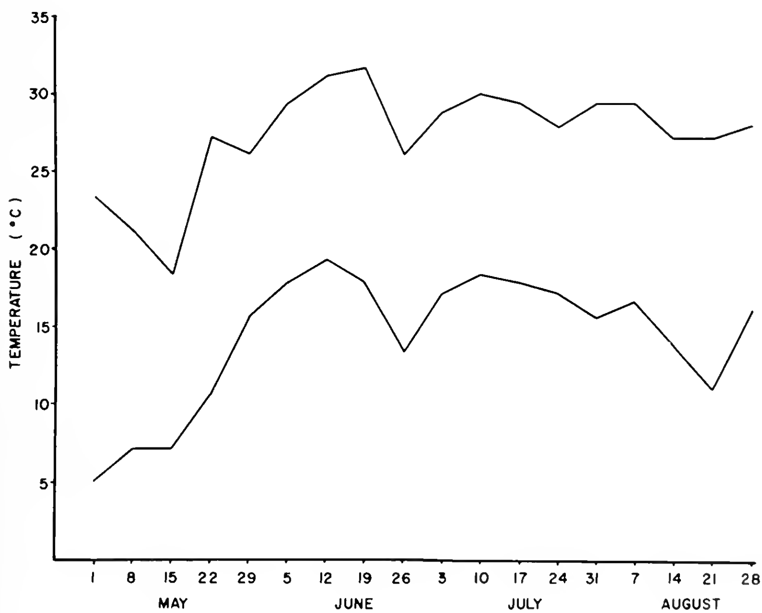

Fig. 2. Weekly range of air temperatures from May 1 to September 1, 1981, North Otter Creek, VA. Upper line is maximum, lower minimum.

Throughout the sampling period, less males were collected than females (Fig. 1) and the sex ratio was less than 1:2. Eighty-eight percent of females either carried extruded egg masses or were void of eggs, indicating that egg laying was occurring or had occurred. Active flying by females probably accounted for the higher capture rate of this sex.

No attempts were made to test light trap efficiency or effects of light intensity. Relative abundance of individuals or sex captured/hour was not recorded. Benthic surveys of North Otter Creek indicated the presence of nymphs of all the species attracted to the trap except *Acroneuria* sp., *D. robusta,* and *Neoperla* sp. Five species: *Amphinemura nigritta* (Provancher), *Leuctra* spp. (2 species), *Sweltsa onkos* (Ricker), and *Hastaperla brevis* (Banks) were collected only by kicknet during the period of trap operation. Adults of these genera typically are not attracted to light.

The majority of the species collected by the trap were widespread boreal species. These included *D. robusta, C. clio, I. dicala, A. abnormis, P. placida,* and *P. capitata.* No exclusively Appalachian species were collected even though the collecting site was at the boundary with the mountainous Blue Ridge Province. Stark (1979) considered *E. xanthenes* Appalachian, however in Virginia it occurs throughout the state. *Paragnetina fumosa* and *A. arenosa* are typical Piedmont and Coastal Plain species.

ACKNOWLEDGMENTS

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NESTS AND PREY OF TWO LITTLE-KNOWN SPECIES OF *CERCERIS* (HYMENOPTERA: SPHECIDAE)[1]

Howard E. Evans[2]

ABSTRACT: *Cerceris gnarina* Banks and *C. wyomingensis* Scullen were studied at montane sites in Colorado. In both cases the burrows penetrated the soil at about a 90 degree angle and cells were built in a more or less radial pattern from the bottom of the burrow. *C. gnarina* preyed on *Baris striata* (Curculionidae), *C. wyomingensis* on *Graphops nebulosa* (Chrysomelidae).

Only about a third of the approximately 80 Nearctic species of *Cerceris* have been studied in the field. What is known suggests that there is relatively little diversity in nest structure but that each species is moderately to strongly host-specific, preying upon a limited assemblage of beetles (Scullen and Wold, 1969; Evans, 1971; Evans and Rubink, 1978). This paper concerns two little-known species I have studied briefly in Colorado, both appearing typical of the genus with respect to nest structure and also with respect to prey selection.

Cerceris gnarina Banks

This species has nested for two consecutive summers (1981-82), during late June and early July, in the center strip of a little-used dirt road in Hewlett Gulch, near Poudre Park, Larimer Co., Colorado, at about 1800 m elevation. The soil here is a fine-grained silty loam, with many stones on the surface but not below 3-5 cm. In 1981 there were two nests 3.5 m apart, each with a small tumulus and a vertical hole penetrating the center. Females provisioned slowly, taking up to an hour to return with prey. When not provisioning they remained within the burrow entrance, facing out. One prey-laden female was followed by a satellite fly, *Senotainia trilineata* (Wulp) (Sarcophagidae).

On 12 July one nest was excavated. The tumulus was 1 cm high, 6.5 cm in diameter, the burrow nearly vertical, 5 mm in diameter, terminating at a depth of 16 cm. There were 8 cells, at depths of 15-18 cm, forming a somewhat radial pattern from the bottom of the burrow, each at the end of a short side-burrow that had been closed off. Six of them contained wasp larvae in various stages of development, one of them had 15 weevils but no egg or larva, and the remaining cell had only beetle fragments. All weevils,

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including those taken from provisioning females, appeared to belong to the same species. Twelve that were saved for identification proved to be *Baris striata* (Say) (Curculionidae).

Cerceris wyomingensis Scullen

A single nest of this species was located in the steeply sloping bank of a gully at Chimney Rock, a geological formation on the Colorado-Wyoming border, 40 km SW of Laramie, Wyoming, at an elevation of 2350 m. There was no tumulus, simply an open hole which penetrated the slope at about a 90 degree angle. The burrow was 4 mm in diameter and 45 cm long. When the nest was excavated on 2 September 1981, there was a single beetle at the end of the burrow and a single cell 4 cm from the terminus. The cell contained 6 beetles and a wasp egg on the topmost beetle. All beetles were *Graphops nebulosa* (LeConte) (Chrysomelidae).

At Great Sand Dunes National Monument, in southern Colorado, a male *C. wyomingensis* was one of several species of bees and wasps being used as prey by *Philanthus basilaris* Cresson.

ACKNOWLEDGMENTS

The *Cerceris* were identified by George R. Ferguson, Oregon State University, the beetles by D.R. Whitehead and R. White of the Systematic Entomology Laboratory, USDA.

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ANNOUNCEMENT AND CALL FOR PAPERS

The 34th annual meeting of The Lepidopterists' Society will be held July 7-10, 1983 at the Fawcett Center for Tomorrow, Ohio State University, Columbus, Ohio. For a PROGRAM AND REGISTRATION FORM and other pertinent details write to the Ohio Biological Survey, 484 West 12th Ave., Columbus, Ohio 43210 (614) 422-9645 or to Eric H. Metzler, 1241 Kildale Square, North, Columbus, Ohio 43229 (614) 265-6507.

SOUTHERN RANGE EXTENSION OF *AMELETUS CRYPTOSTIMULUS* (EPHEMEROPTERA: SIPHLONURIDAE)[1]

Robert D. Davic[2]

ABSTRACT: *Ameletus cryptostimulus* Carle, previously known only from western Virginia, is newly recorded from Macon County, North Carolina.

Ameletus cryptostimulus Carle has been known only from small streams at high elevations in Giles County, Virginia (Carle 1978). Here nymphs of *A. cryptostimulus* are reported from a small mountain stream in Macon County, North Carolina, although Traver's (1932) *Ameletus* sp. B from North Carolina almost surely was *A. cryptostimulus*.

The unnamed stream, located on the U.S. Geological 7.5 minute Highland map (35°5'N, 83°14'W), is spring-fed, and has an elevation ranging from 1036 m to 1049 m. Stream width is less than 1 m; water depths range from 0.7 cm to 5.9 cm annually. The stream flows through an oak-hickory-deciduous heath second growth forest, with numerous *Rhododendron* sp. shrubs dominating the stream bank vegetation. Soil composition of the hill slope is utisol ashe loam series. Topsoil is dark brown humus loam with a pH of 4.3 to 5.3.

A total of 48 *A. cryptostimulus* nymphs were collected from 408 Surber samples taken from 4 random sections of the stream. Collection dates and the number of *A. cryptostimulus* per square meter of stream-bed were as follows: 23-24 June 1980 (0.9), 13-14 August 1980 (0.2), 2-3 October 1980 (0.0), 29-30 December 1980 (3.3), 23-24 May 1981 (4.1), and 21-22 August 1981 (1.2). The largest nymphs (head width and total length) were collected during the two August time periods. The temporal pattern of the density data suggests a summer emergence period which differs from the April-May emergence observed by Carle (1978) in the western Virginia populations.

Nymphs of other Ephemeroptera collected with *A. cryptostimulus*, including their total numbers, from the 408 Surber samples were as follows: *Paraleptophlebia* sp.-596, *Stenonema meririvulanum* Carle and Lewis-485, *Habrophlebia vibrans* Needham-175, *Seratella sordida* (McDunnough)-119, and *Stenacron carolina* (Banks)-6. The relative rarity of *A. cryptostimulus* suggests that a casual collector would likely overlook it, which may explain its exclusion from previous species lists of

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the southern Appalachian Mountains. The similarity of the North Carolina habitat to the type-locality in Virginia (e.g. small stream at high elevation) indicates that other cryptic populations of *A. cryptostimulus* should exist at high elevations throughout the southern Appalachians.

I thank Dr. F.L. Carle for identification of the *Ameletus* and *Stenonema* nymphs and Dr. J.D. Unzicker for identification of the other species. I also thank Dr. B.A. Foote for reading the manuscript. This work was supported by grants from Sigma Xi and The Highlands Biological Station.

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SOCIETY MEETING — NOVEMBER 4, 1982

The American Entomological Society's second regular meeting of the 1982-83 year was held Thursday, November 4 at the Academy of Natural Sciences of Philadelpha. Ten members and four guests attended. The speaker for the evening was Dr. Dennis Joslyn, Assistant Professor of Zoology at the Camden Campus of Rutgers State University. Dr. Joslyn spoke on "Autocidal Control of Salt Marsh Mosquitoes."

Of the approximately 60 species of mosquitos that are known from New Jersey, the salt marsh mosquito, *Aedes sollicitans* is the most abundant. Since it is a major pest species and a vetor for eastern equine encephalitis virus, controlling its' populations is important. Dr. Joslyn is interested in developing a genetic strategy to complement current pest management practices.

With a diploid chromosome number of six, the genetics of mosquitoes is potentially simpler than that of *Drosophila.* An effective laboratory selection procedure carried out in Florida on the Central American species, *Anopheles albimanus*, has yielded a strain with defined chromosomal translocations and inversions in which only males were resistant to Propoxur. Analogous genetic manipulations of the salt marsh mosquito should be possible. Such a strain could be mass cultured to yield males that could be released in the wild after sterilization. Matings between these males and the wild monogamous females would result in nonviable offspring. A lively discussion followed Dr. Joslyn's talk.

On notes of local entomological interest, Dr. William Day mentioned that alfalfa plant bugs, *Adelphocoris lineolatus*, found in the fall, may be so darkly colored that field identification can be difficult. He suggested that the dark coloration was probably an adaptation to absorb more heat. Drs. Ronald Romig and Charles Mason reported on their attempts to trace the spread of *Lydella thompsoni* into southeastern Pennsylvania. *Lydella* is an introduced parasite of the European corn borer.

Harold B. White
Corresponding Secretary

A BLIND *HOMOLOPHUS BICEPS* (ARACHNIDA: OPILIONES)[1]

R.G. Holmberg[2], E.G. Kokko[3]

ABSTRACT: Scanning electron microscopy of a harvestman, *Homolophus biceps*, that lacked both eyes and ocular tubercle revealed no indication of external damage or healing. Internally, light microscope sections showed no evidence of eyes. The brain had no or very degenerate optic nerve masses. The ventral nerve cord was also reduced. Of the three possible causative mechanisms *i.e.*, physical damage, genetic change and biochemical disruption, the last is the most plausible.

There are three suborders of the Opiliones, of which two, the Laniatores and Palpatores, typically have two eyes. Members of the third suborder, the Cyphophthalmi, are usually blind. Though the degree of eye development varies between species (Curtis, 1970; Juberthie and Muñoz-Cuevas, 1973), it is a rare event for a species with eyes to produce eye-less individuals. Thus when we found a blind specimen of a normally sighted species, we tried to discover how it became blind. As the specimen was preserved 18 years previous to our study, we were limited to a morphological and anatomical inquiry of the cause and extent of the abnormality.

Materials and Methods

The eye-less specimen, an adult female *Homolophus biceps* (Thorell), was collected by A.L. Turnbull between 14 May and 8 June 1963 near Seven Persons, Alberta (49° 51'N, 110° 54'W, an area of short grass prairie). The specimen was taken along with another female and eight immatures that are apparently normal. After removal from the ethylene-glycol and water mixture of the pit-trap, the specimen was preserved in ethanol. When the abnormality was noted, the specimen was taken through a dehydration series of ethanol to 100%, critical point dried with carbon dioxide, mounted, sputter coated with gold (15 nm thick), and examined with a scanning electron microscope (SEM). Then the specimen was removed from its mount and infiltrated and embedded in plastic (Spurr, 1969). After polymerization, it was sectioned (7 μm) and stained (1% aqueous toluidine blue) for light microscopy.

For SEM comparisons a normal adult female that was collected in

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Osoyoos, British Columbia was treated in the same fashion.

For light microscopy comparisons we used previously prepared slides of normal subadult to adult females that were collected near Cypress Lake, Saskatchewan. These specimens had been fixed in Brasil's fluid, embedded in paraffin, sectioned (6 μm), and stained with Mallory's triple stain.

Nomenclature of the nervous system follows Bullock and Horridge (1965).

Results

When we examined the abnormal specimen with SEM, there was no evidence of either any damage to the integument or of any, even rudimentary, development of an ocular tubercle (Fig. 1). There were a few shallow indentations in the region near where the ocular tubercle should have been, but these were also observed in the normal specimen (Fig. 2) and are almost certainly artifacts of cuticle collapse caused by drying.

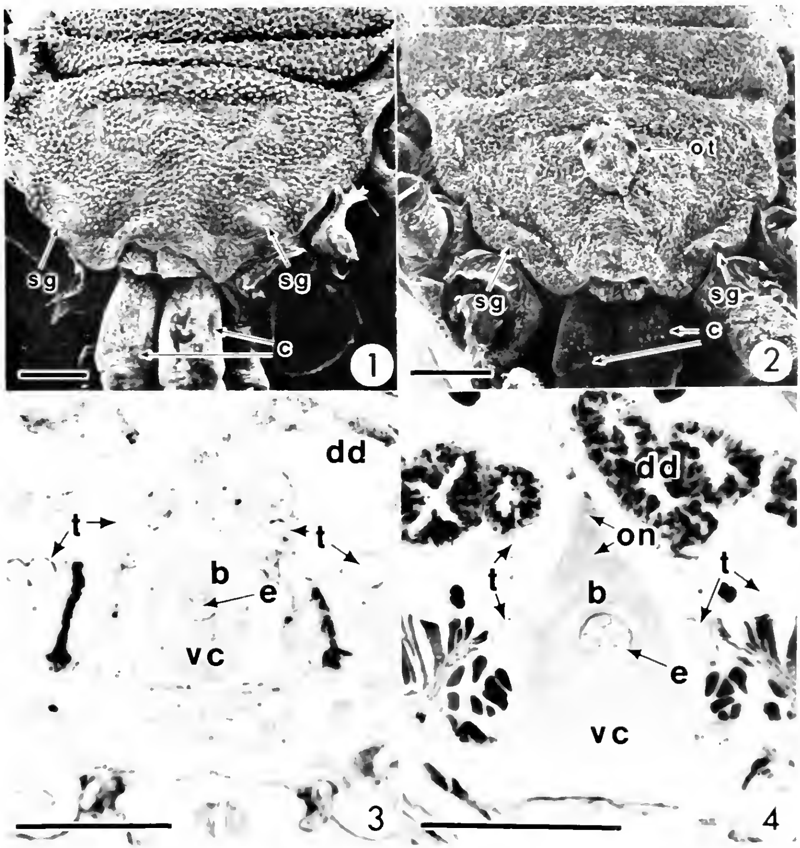
Light microscopy of the abnormal specimen revealed that the tissues were, considering their history, remarkably well preserved (Fig. 3). However, there was substantial (microbial?) degradation of the digestive diverticulae, and most structures within the brain and ventral nerve cord were very difficult or impossible to distinguish. There was no evidence of an ocular tubercle, eyes or optic nerves. Optic nerve masses were absent or very much reduced. The ventral nerve cord was also less developed than normal specimens (cf. Fig. 4). The specimen was mature but not gravid.

Discussion

From the morphological and anatomical evidence, we conclude that the abnormality was not caused by physical damage. Normally a large wound such as removal of the entire ocular tubercle would cause an opilionid to bleed to death or at least show some irregularities in the cuticle when the wound was repaired during moulting.

A second possible explanation *i.e.,* genetic change, is also unlikely. In cavernicolous species, eye reduction is common and may range from simple eye depigmentation, through absence of eyes, to absence of both eyes and ocular tubercle (Goodnight and Goodnight, 1960). Thus in cavernicolous species at least, degeneration of the eyes seems to be a gradual phenomenon and the result of many gene changes. However if the situation described here involves only a single genetic change, other closely related species occasionally should show the same kind of abnormality (*i.e.,* lack of eyes and ocular tubercle and reduced brain and ventral cord).

The most probable cause of the abnormality was a biochemical imbalance that occurred during the opilionid's development. Biochemical disruptions may be caused by "exotic" chemicals such as pesticides as well as high temperatures. Juberthie (1968) has shown that in the opilionid *Odiellus gallicus* temperatures between 20 and 23.5°C before or during somite differentiation may cause anopthalmia and indicated that some individuals may survive this disruption.



Figures 1,2. Scanning electron micrographs of an anterior-dorsal view of the cephalothorax of *H. biceps*. Fig. 1. Eye-less specimen. Note the chelicerae (c) and the openings of the scent glands (sg). Fig. 2. Normal specimen with ocular tubercle (ot). Figures 3,4. Light micrographs of cross-sections through brain. Fig. 3. Maximum extent of brain (b) in eye-less specimen. Note esophagus (e), digestive diverticulum (dd), trachaeae (t), and ventral cord (vc). Fig. 4. Maximum extent of brain in a normal subadult female. Note optic nerve masses (on). The position of this section is slightly anterior to Fig. 3. Bars represent 0.5 mm.

ACKNOWLEDGMENTS

We thank J.C. Cokendolpher, Texas Tech University, for bringing the abnormal specimen to our attention; C.D. Dondale, Biosystematics Research Institute (Ottawa, Ontario), for granting us permission to examine it; and C. Juberthie, Laboratoire Souterrain (Moulis, France), for his valuable comments.

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INTERNATIONAL COMMISSION ON ZOOLGOCIAL NOMENCLATURE

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

ITZN 59

8 December, 1982

The following Opinions have been published by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature*, volume 39, part 4, on 7 December, 1982:

Opinion No.

1227 (p. 233) *Tinea bjerkandrella* Thunberg, 1784 and *Phalaena (Noctua) cardui* Hubner, 1790 (Insecta, Lepidopera): conserved.

1231 (p. 243) *Blatta germanica* Linnaeus, 1767 (Insecta, Dictuoptera): conserved and designated as type species of *Blatella* Caudell, 1903.

1238 (p. 262) *Mycteromyia* Philippi, 1865 (Insecta, Diptera): designation of type species.

The Commission regrets that it cannot supply separates of Opinion.

R.V. MELVILLE, Secretary

NORTH DAKOTA FLEAS. VIII. TWO NEW GEOGRAPHIC RECORDS FROM THE NORTHERN FLYING SQUIRREL (SIPHONAPTERA)[1]

Omer R. Larson[2]

ABSTRACT: *Opisodasys pseudarctomys* (Baker) and *Epitedia faceta* (Rothschild) are reported for the first time from North Dakota on *Glaucomys sabrinus* (Shaw).

Since 1937 a total of 44 species or subspecies of fleas have been reported from North Dakota. This paper adds two species to that list.

On October 29, 1981, a freshly killed northern flying squirrel, *Glaucomys sabrinus* (Shaw), from the city of Grand Forks (Grand Forks County) was brought to my laboratory. It harbored a large population of ectoparasites, including mites, larval ticks, mallophagans and three species of fleas. The latter were identified as *Orchopeas caedens* (Jordan) (1 ♂, 2 ♀), *Opisodasys pseudarctomys* (Baker) (2 ♂, 2 ♀) and *Epitedia faceta* (Rothschild) (5 ♂, 3 ♀). Voucher specimens of the fleas are in the Invertebrate Museum, University of North Dakota.

Orchopeas caedens is common on red squirrels throughout their North American range, and occasionally occurs on other sciurids. The other two species of fleas are true parasites of flying squirrels and constitute new records for North Dakota. *Opisodasys pseudarctomys* has a transcontinental distribution (Lewis 1974), and is known regionally from north-central Minnesota (Benton, et al. 1971). *Epitedia faceta* has not been previously reported west of Pennsylvania (Benton 1980). This range extension of 1500 km is interesting since flying squirrels from Manitoba, Minnesota, Iowa, Wisconsin, Michigan, Illinois and Ohio have been examined for fleas in other studies. It is tempting to view the local occurrence of *E. faceta* as a disjunct population reflecting post-glacial movement of flying squirrels. However, *E. faceta* is primarily a nest flea with adults present only in the colder months. Since flying squirrels and their nests are seldom collected at such times, it may be that *E. faceta* occurs throughout the intervening area, at least across southern Canada. Apparently, there are not specimens or reports to substantiate this hypothesis, but winter collections of flying squirrel nests would probably resolve the question.

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ACKNOWLEDGMENTS

I wish to thank Dr. Paul B. Kannowksi, University of North Dakota, for providing the flying squirrel, and Dr. Allen H. Benton, State University College, Fredonia, NY, for verifying my identification of *E. faceta*.

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SOCIETY MEETING — FEBRUARY 4, 1983

The twelve members and twenty-one guests who attended the February 4, 1983, meeting of the American Entomological Society at the Academy of Natural Sciences of Philadelphia were treated to an absorbing talk by Dr. Paul W. Schaefer. Dr. Schaefer, an entomologist at the USDA Beneficial Insects Research Laboratory in Newark, Delaware, spoke on "Exploring for Parasites and Predators of the Gypsy Moth in Mainland, China, 1982." His illustrated talk included a rich mixture of geography, culture, and entomology.

Dr. Schaefer reported that in China the gypsy moth (*Lymantria dispar*) is not considered to be a major forest pest and defoliation rarely occurs. The populations there are kept under control by natural parasites and predators. Nevertheless, Dr. Schaefer and two other American forest entomologists had no difficulty finding the gypsy moth throughout northeastern China where they travelled and were successful in identifying a large number of its natural enemies. *Glyptoapanteles liparidis* was found to be the most important parasite. Several differences between the Chinese and American populations of gypsy moths were illustrated by Dr. Schaefer. In China the larvae are more brightly colored with red and yellow and they frequently retreat under rocks in the day time. The adult males are darker and females can fly. This latter observation was documented by photographs of large concentrations of egg masses around outdoor lights. The Academy of Forestry of the People's Republic of China, who sponsored Dr. Schaefer's visit, provided the utmost in hospitality. Although Chinese officials did not permit live insects to leave the country. Dr. Schaefer feels that his visit was a successful step toward locating natural enemies of the gypsy moth that could eventually be useful in controlling gypsy moth populations in this country. A small collection of Far Eastern insects was displayed after the talk.

In the period for notes of local entomological interest, Dr. Kenneth Frank inquired if anyone had observed the Ailanthis silk moth in Philadelphia in recent years. Joseph Harrison responded that he had observed a colony about six years ago but that the populations are much reduced compared to about fifty years ago, partly due to loss of the host tree. Dr. Paul Schaefer reported a record of sorts. A gypsy moth egg mass found in the University of Delaware woodlot contained 1,038 eggs. Typically large egg masses in regions of an expanding populations may contain about 700 eggs.

Harold B. White
Corresponding Secretary

NEW RECORDS AND DESCRIPTIONS OF *ALLOPERLA* (PLECOPTRA: CHLOROPERLIDAE) FROM THE OZARK-OUACHITA REGION[1]

Bill P. Stark[2], Kenneth W. Stewart[3], Jack Feminella[3]

ABSTRACT: The male of *Alloperla ouachita* n. sp., from Arkansas is described and compared with other members of the *A. leonarda* Ricker group. Additional records of *A. caudata* Frison, *A. hamata* Surdick and *A. leonarda* from the Ozark-Ouachita region are given and a key to male *Alloperla* known from this area is presented.

Since the Frison (1934, 1942) descriptions of *Alloperla caudata* from the Ozarks, no additional *Alloperla* species have been recorded in studies of stoneflies of this region (Stark & Stewart 1973; Stewart et al. 1974). Recent field work on the Little Missouri River in Arkansas revealed one species new to science and the first record of *A. hamata* Surdick from west of the Mississippi River. *A. hamata* and an additional species, *A. leonarda* Ricker, were subsequently found among material from Missouri in the Monte L. Bean Museum.

In order to facilitate regional studies, the new species is described herein, and a key to male *Alloperla* known to occur in the area is presented. Specimens utilized in this study have been deposited in the Monte L. Bean Museum, Brigham Young University (BYU), North Texas State University Museum (NTSU), Bill P. Stark Collection (BPS), and the United States National Museum (USNM).

Allopera hamata Surdick

Surdick (1981) described this species from Alabama, but illustrations of the male genitalia are given here in facilitate comparison with other regional species. Our specimens differ slightly from Alabama specimens described by Surdick (1981) in fine detail of the epiproct tip. In Ozark-Ouachita populations the widest part of the serrate apex occurs proximal to the base, while in Alabama specimens the widest part of the serrated region occurs anterior to the basal tooth (Figs. 1, 2). These populations are, however, not presently considered to be specifically distinct.

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Material examined — ARKANSAS: *Montgomery Co.*, Little Missouri Riv. 20-VI-80, E.J. Bacon and J.W. Feminella, 1♂ (BPS). MISSOURI: *Christian Co.*, Bull Crk., 10-V-72, B.K. Newman, 29♂ (BYU).

Alloperla ouachita **Stark & Stewart, n. sp.**
(Figs. 3, 4)

Male. — Forewing length 6-7 mm; body length 5-7 mm. General color white in alcohol; abdominal stripe absent. Epiproct tip ca. 2X long as wide; lateral margins covergent near base, gradually diverging to apical third then slightly convergent to horns. Anterior margin bluntly upturned, rounded with a pair of prominent lateral horns; dorsal aspect with a broad mesal carina, widest at apex; fine setae along lateral margins. Cowl with prominent membranous lateral lobes. Lateral brushes on segments 7-9.

Types. — Holotype ♂ (ISNM #100682) and 16 ♂ paratypes (BPS and NTSU) from Arkansas, Montgomery Co., Little Missouri Riv., 20-VI-80, E.J. Bacon and J.W. Feminella.

Etymology. — The specific name, *A. ouachita*, is based on the mountain range in which it is collected.

Diagnosis. — *A. ouachita* is a member of the *A. leonarda* complex which also includes *A. furcula* Surdick and *A. natchez* Surdick & Stark. It is most closely related to *A. leonarda* and speciation probably is the result of isoiation in the Ouachita Mountains of ancestral populations of *A. leonarda.* The two species are distinguished by characters given in the key below.

Allopera cuadata Frison

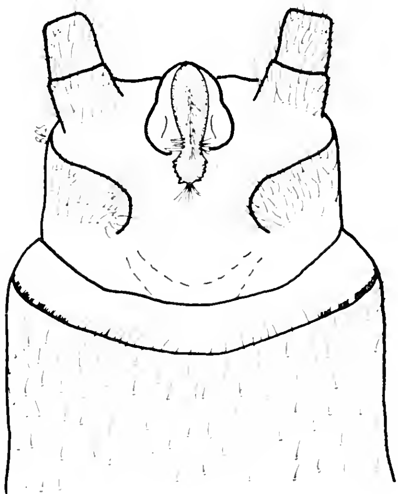
Frison (1942) and Hitchcock (1974) have adequately characterized this species, but illustrations of the male genitalia (Figs. 5, 6) are given to facilitate comparison with other Ozark-Ouachita species. The records below include the first Missouri localities for the species.

Material examined. — MISSOURI. *Christian Co.*, Bull Crk, Hwy W, S of Ozark, 10-V-72, B.K. Newman, 13 ♂ (BYU); same location, 17-V-72, B.K. Newman, 17 ♂ (BYU). *Greene Co.*, Little Sac Riv, abv. Fellows Lake, 16-V-72, R.W. Baumann, 2 ♂ (BYU); same location, 25-V-72, R.W. Baumann, 4 ♂ (BYU). *Taney Co.* Blue Crk, nr. Swan, 23-V-72, R.W. Baumann, 2 ♂ (BYU); Bull Crk, Hwy. 176, 12-17-V-72, B.K. Newman, 22 ♂ (BYU). OKLAHOMA: *Delaware Co.*, Flint Crk, Flint, 6-VI-73, B. Stark, 2 ♂, 2 ♀ (BPS).

Alloperla leonarda Ricker

Harper & Kirchner (1978) and Ricker (1952) have adequately diagnosed this species, but illustrations of male genitalia (Figs. 7, 8) are given to facilitate comparisons with other regional species. The record below represents the first Missouri locality for the species.

Material examined. — MISSOURI: *Christian Co.*, Bull Crk, Hwy W, S of Ozark, 10-V-72, B.K. Newman, 13 ♂ (BYU).



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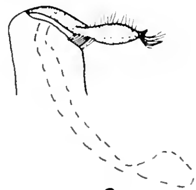

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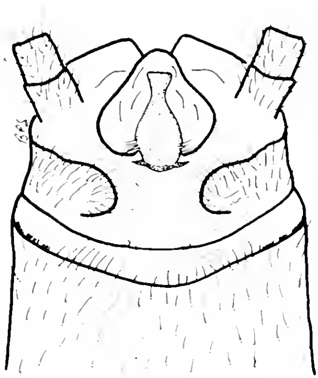

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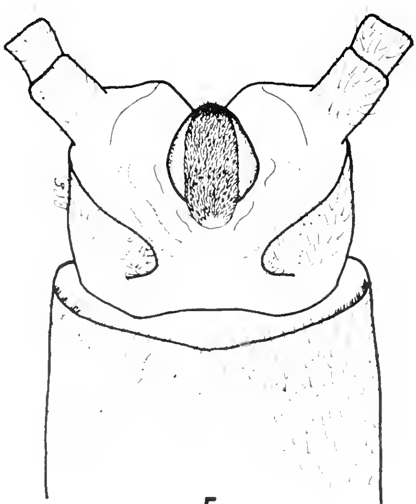
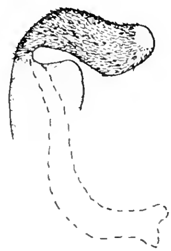
Fig. 1-4. *Alloperla terminalia*. Fig. 1. *A. hamata* male, dorsal. Fig. 2. *A. hamata* epiproct, lateral. Fig. 3. *A. ouachita*, male, dorsal. Fig. 4. *A. ouachita*, epiproct, lateral.





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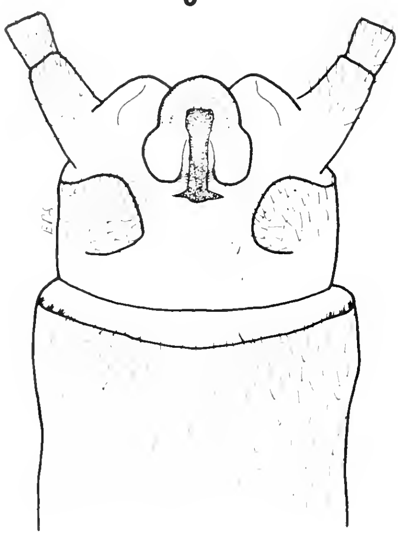

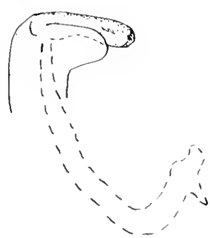

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Fig. 5-8. *Alloperla terminalia. A. caudata,* male, dorsal. Fig. 5. *A. caudata,* male, dorsal. Fig. 6. *A. caudata,* epiproct, lateral. Fig. 7. *A. leonarda,* male, dorsal. Fig. 8. *A. leonarda,* epiproct, lateral.

KEY TO OZARK-OUACHITA MALE *ALLOPERA*

1. Epiproct cowl with enlarged membranous lateral lobes (Fig. 4) 2
   Epiproct cowl without enlarged membranous lateral lobes (Fig. 2) 3
2. Lateral margins of epiproct almost parallel (Fig. 7); lateral aspect of epiproct of almost uniform thickness (Fig. 8) .... *leonarda*
   Lateral margins of epiproct sinuate; Epiproct narrow at base, widest at apical third (Fig. 3); lateral aspect of epiproct distinctly inflated in apical half (Fig. 4).... *ouachita*
3. Epiproct apex with lateral serrations (Fig. 1); dorsal aspect with scattered fine long setae .... *hamata*
   Epiproct apex without lateral serrations (Fig. 5); dorsal aspect densely covered with short golden brown setae .... *caudata*

ACKNOWLEDGMENTS

We are grateful to R.W. Baumann, Monte L. Bean Museum, Brigham Young University and E.J. Bacon, Southern Arkansas University for the loan of material.

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ARTHROPODS FROM A SAW-WHET OWL (*AEGOLIUS ACADICUS*) NEST IN CONNECTICUT[1]

James R. Philips[2], Michael Root[3], Peter DeSimone[3]

ABSTRACT: Analysis of saw-whet owl (*Aegolius acadicus*) nest material collected in Sharon, CT yielded 6 species of insects and 14 species of mites, as well as phoretic nematodes. None of the species had previously been found in saw-whet owl nests and the list includes 3 new mite records for the State of Connecticut.

Saw-whet owls (*Aegolius acadicus*) (Gmelin)) are the smallest owls in eastern North American and occur in western, central and northeastern United States, as well as Canada and Mexico. They feed largely on rodents and nest in tree-holes, but they have not been studied as extensively as other eastern owls, and there are no published records of parasites or other arthropods found in saw-whet owl nests.

Owl nests provide a prime habitat for many kinds of arthropods. The owls themselves represent only one potential food source; there is also a wide variety of organic material, including carrion in the form of prey remains, undigested pellets regurgitated by the owls, and plant material in the nest. Thus the nests attract a wide variety of saprophagous, predatory and parasitic arthropods which may be present in great numbers (Philips and Dindal 1977, 1979b). Owl nests may also contain unique taxa - for example, the beetle *Trox tytus* Robinson is known only from barn owl (*Tyto alba* (Scop.)) nests (Vaurie, 1955) and Fain and Philips (1977a, 1977b, 1978a, 1979) have described a number of new mite genera and species from a screech owl (*Otus asio* (L.)) nest. The objective of this study was to survey the arthropod fauna of a sample of saw-whet owl nest material.

Methods

During a survey of breeding birds of prey in northwestern Connecticut, a saw-whet owl nest was located by the junior authors in a tree-hole in a dead black cherry (*Prunus serotina* Ehrh.) in Sharon, CT. The hole was 8.2m high and a sample of nest material was collected on 13 June 1978 while the one chick in the nest was banded. The sample of nest material was highly odoriferous and contained decaying prey remains as well as pellets and plant matter. The sample was shipped to the senior author for analysis. However, upon arrival it was found that conditions had become anaerobic

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and the sample had become a mass of semi-liquefied material. This prevented quantitative analysis, but the material was examined under a dissecting microscope before disposal.

Results

Although no invertebrates were still alive in the sample at the time of analysis, 204 arthropods were found intact. These represented 14 species of mites and 6 species of insects (Table I). In addition, hundreds of nematodes were found attached to 4 of the trogid beetles on the sides of the elytra and pronotum, and on the prosternum, metasternum, and first abdominal segment. Hundreds of unattached nematodes were also found underneath the elytra of one trogid beetle and one silphid beetle. The prey remains in the sample included skulls of woodland jumping mice (*Napaeozapus insignis* (Miller)) and red-backed voles, (*Clethrionomys gapperi* (Vigors)).

Discussion

The role beetles play as hosts for other invertebrates needing food or transportation was dramatically illustrated in this sample by the finding of the nematodes and 6 species of mites associated with the beetles. No nematodes have previously been found on trogid beetles. Both the subelytral and externally attached nematodes seemed to be phoretic rather than parasitic. The externally attached nematodes were dauerlarvae, the third larval instar which is the usual phoretic stage formed under adverse conditions. According to Croll and Matthews (1977), rhabditid nematodes such as *Pelodera* form these larvae and attach by a secretion to beetles like *Phodius.* Crowson (1981) stated that a considerable variety of nematodes have such phoretic associations with beetles. However the unusual circumstances of this record prevent the assumption that this is a frequent association between nematodes and trogids. On the contrary, examination of 3,433 additional specimens of trogid beetles in museums and in the field has not yielded another incidence of an external infestation of dauerlarvae. However, phoretic nematodes have been found on mites of the genus *Macrocheles,* which are phoretic on trogid beetles (Philips and Dindal 1979a). The *Macrocheles* found in this nest represent a new species (R.M. Emberson pers. comm.).

Both parasitic and phoretic mites were found on the trogid beetles. Subelytral forms included an undescribed genus of pyemotid mite, *Histiostoma* sp. B., *Eviphis* sp., and *Poecilochirus necrophori* Vitzth. No mites have previously been reported from underneath the elytra of trogid beetles. The undescribed pyemotid mites were found on only one trogid, on the anteroventral side of the elytra attached to membranous tissue and underneath both wings attached to cuticle at the wing insertion. Other pyemotid mites parasitize many beetle families (Cross and Krantz, 1964, Cross et al. 1975) and it is likely that these are also parasites.

All specimens of *Histiostoma* sp.B. were found under the elytra of 4 trogid beetles. These anoetid mites were all in the hypopus stage, a form adapted for phoresy possessing a posteroventral sucker plate and lacking mouthparts. Anoetid hypopi are of widespread occurrence on insects; many species occur on trogid beetle exteriors (pers. obs.) and one species of *Pelzneria* has been found underneath the elytra of *Nicrophorus* (Springett, 1968). It is surprising that in this sample, *Histiostoma* sp.B. occurred only on *Trox* underneath the elytra, *Histiostoma* sp.A. occurred only on the exterior of *Nicrophorus,* and no mites occurred on *Carcinops.* Anoetid mite hypopi have been found on *Carcinops* in other birds' nests (pers. obs.).

Three trogid beetles harbored 4 *Eviphis* females under or over the wings, and 7 more *Eviphis* were found separately in the sample material. Eviphidids have not previously been found associated with trogid beetles, but the family generally disperses by phoresy. *Alliphis halleri* Can., for example, is transported by *Nicrophorus* (Springett 1968).

Four *Poecilochirus* duetonymphs were found under the elytra and on the exterior of 2 trogid beetles; the rest occurred similarly on 2 *Nicrophorus. Poecilochirus necrophori* Vitz. deutonymphs are typically phoretic on *Nicrophorus,* and this relationship has been studied by Springett (1968). The mites feed on small fly larvae, fly eggs, and carrion encountered by their beetle host, whose larvae feed on carrion.

While some mites colonize owl nests with the assistance of flying insects, other reach the nests on various prey species. Three mammal associates were found in the sample. *Dermacarus newyorkensis* Fain and *Glycyphagus hypudaei* (Koch) hypopi have posteroventral claspers adapted for gripping hair; these species have not previously been found in Connecticut. Both species utilize many rodent hosts, but *D. newyorkensis* is known from woodland jumping mice, while *G. hypudaei* is known from the red-backed vole (Whitaker and Wilson 1974), which were the two rodents whose remains were found in the nest.

The only vertebrate parasite found was an engorged chigger, *Euschoengastia peromysci* (Ewing), which mainly parasitizes white-footed mice (*Peromyscus leucopus* (Raf.)). Perhaps white-footed mice were also among the owl's prey, or the chigger might have been parasitizing one of the rodents whose remains we found. Another possibility is that white-footed mice may previously have used the owl nest site as a nest and denning site of their own.

Most of the other species found were either saprovores or fungivores. *Acotyledon paradoxa* Ouds. is a fungivore known from screech owl and great horned owl (*Bubo virginianus* Gmelin)) nests in New York, mice nests in Maryland, and from the USSR (Fain and Philips 1978b) so this find represents a new record for the State of Connecticut. *Cosmoglyphus* is another fungivore, while the oribatid mites are species associated with decomposing plant material. Overall, the community appears to be dominated by carrion insects and their associated mites. Scavenging fly larvae serve as food for predators like the histerid and silphid beetles and the mesostigmatic mites, which may also feed on nematodes and other mites. The silphid beetles also feed directly on the carrion, while the trogid beetles eat the hair from the carrion and feathers lost by the owls. No avian parasites were found, but the development of anaerobic conditions in the sample before analysis caused our results to be very incomplete. A thorough study of saw-whet owl nests is needed to accurately determine the composition of the arthropod community, the presence and density of nidicolous saw-whet parasites, and how the arthropod community changes during the nesting period.

Table I. Arthropods from a saw-whet owl (***Aegolius acadius*** (Gmelin)) nest in Connecticut.

CLASS	ORDER	FAMILY	GENUS & SPECIES	NUMBER	STAGE
Insecta					
	Coleoptera				
		Elateridae	Elaterinae sp.	1	larva
		Histeridae	*Carcinops* sp.	1	adult
		Silphiade	*Nicrophorus pustulatus* Hersch.	3	adults
		Trogidae	*Trox aequalis* Say	12	adults
	Diptera				
		Muscidae	*Fannia* sp.	1	larva
		Scatopsidae	sp.	1	larva
Arachnida					
	Acarina Mesostigmata				
		Eviphididae	*Eviphis* sp.	11	adults
		Macrochelidae	*Macrocheles* n. sp.	8	adults
		Parasitidae	*Poecilochirus necrophori* Vitz.	16	adults, nymphs
	Prostigmata				
		Pyemotidae	n.g.	18	adults
		Pygmephoridae	*Bakerdania* sp.	1	adult
		Trombiculidae	*Euschoengastia peromysci* (Ewing)	1	larva
	Astigmata				
		Acaridae	*Acotyledon paradoxa* Ouds	7	hypopi, nymphs
			Cosmoglyphus sp.	1	hypopus
		Anoetidae	*Histiostoma* sp.A.	89	hypopi
			Histiostoma sp.B	8	hypopi
		Glycyphagidae	*Dermacarus newyorkensis* Fain	6	hypopi
			Glycyphagus hypudaei (Koch)	18	hypopi
	Oribatei				
		Galumnidae	*Pergalumna* sp.	1	adult
		Parakalumnidae	*Protokalumma depressa* (Banks)	1	adult

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AN ANNOTATED CHECKLIST OF THE STONEFLIES (PLECOPTERA) OF MAINE[1]

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ABSTRACT: A total of 92 species representing nine families and 37 genera are contained in the first comprehensive checklist of Maine Plecoptera. Nineteen additional species which occur in adjacent states and provinces, but which have not yet been collected in Maine, are also listed. County distributions and adult collection dates are included for species occurring in the state. Twenty one species are reported from Maine for the first time.

Although previous records of Plecoptera from Maine are scattered throughout the literature, the study of Maine species has been generally neglected. Studies by Proctor (1946), Mingo, et al. (1979), Rabeni and Gibbs (1979) and Mingo and Gibbs (1980) have added to the understanding of Maine species but have concerned either limited geographic areas or specific watersheds.

The checklist presented herein represents the first attempt to compile a comprehensive inventory of Plecoptera species occurring in Maine. It is based primarily upon specimens collected by the author and reports contained in the literature. At present it contains nine families, 37 genera and 92 species. In addition five species new to science have been collected and are currently under study.

The classification system used in the checklist follows that of Illies (1966) and Zwick (1973) as reviewed by Baumann (1976). The earliest and latest dates of collection follow each species name and are based solely upon adult specimens. County distributions are included below each species name and are based upon adult as well as immature specimens. The inclusion of a county name in parentheses following a single date of collection indicates that adults of that species were collected only from that county on the date given. Additional county records listed for these species refer to immature specimens only.

Nineteen additional species have been reported from adjacent states and provinces but have not yet been collected in Maine. These species are indicated with a double asterisk. The territory concerned is listed for each of these species and the appropriate literature citation is given. Nine species previously reported from the state but not collected by the author during this study are indicated with a plus sign. The county of record is listed for each of these species and the appropriate literature citation is given. New state distribution records are indicated with a single asterisk.

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Nemouridae

Amphinemurinae

Amphinemura	
A. nigritta (Provancher)	30 July - 7 September
Aroostook, Piscataquis and Somerset County	
A. wui (Claassen)	3 June - 16 August
Piscataquis and Somerset County	

Nemourinae

Nemoura	
**N. trispinosa* Claassen	6 May - 3 June
Piscataquis County	
Ostrocerca	
O. albidipennis (Walker)	17 May (Penobscot County)
Penobscot, Piscataquis and Washington County	
**O. complexa* (Claassen)	23 May
Franklin County	
+*O. prolongata* (Claassen)	
Penobscot County (Needham and Claassen, 1925)	
O. truncata (Claassen)	nymphs only
Hancock, Piscataquis and Somerset County	
Paranemoura	
P. perfecta (Walker)	4 May - 2 June
Penobscot, Piscataquis, Somerset and Washington County	
P. sp. A	4 May - 7 July
Piscataquis and Washington County	
Podmosta	
P. macdunnoughi (Ricker)	5 May - 15 May
Hancock, Piscataquis and Washington County	
Prostoia	
P. completa (Walker)	5 May - 26 June
Penobscot, Piscataquis and Washington County	
**P. similis* (Hagen)	10 June
Somerset County	
Shipsa	
S. rotunda (Claassen)	4 May - 11 May
Penobscot and Washington County	
S. sp. A	19 June
Penobscot County	
Soyedina	
S. vallicularia (Wu)	4 May - 25 June
Somerset and Washington County	
**S. washingtoni* (Claassen)	25 May
Piscataquis County	
Zapada	
Z. sp. A	24 April
Piscataquis County	

Taeniopterygidae

Brachypterinae

Bolotoperla	
B. rossi (Frison)	5 May - 12 May
Penobscot and Washington County	

Oemopteryx
**O. contorta* (Needham and Claassen) — 24 April - 8 May
Piscataquis County
***O. glacialis* (Newport)
Quebec (Ricker, et al., 1968)
Strophopteryx
S. fasciata (Burmeister) — 31 March - 5 May
Hancock and Penobscot County
Taenionema
**T. atlanticum* Ricker and Ross — 8 May - 1 June
Piscataquis and Somerset County

Taeniopteryginae

Taeniopteryx
T. burski Ricker and Ross — 22 March - 16 April
Hancock, Penobscot and Washington County
T. maura (Pictet) — 7 April - 16 April
Penobscot County
T. nivalis (Fitch) — nymphs only
Penobscot, Piscataquis and Washington County
T. parvula Banks — 22 March - 4 May
Hancock, Penobscot, Piscataquis and Washington County

Capniidae

Allocapnia
+*A. illinoensis* Frison
Southern Maine (Ross and Ricker, 1971)
A. maria Hanson — 9 April - 29 March
Hancock County
A. minima (Newport) — 25 February - 5 May
Hancock, Penobscot, Piscataquis and Washington County
***A. nivicola* (Fitch)
New Brunswick (Ross and Ricker, 1971)
New Hampshire (Fiance, 1977)
Nova Scotia (Ross and Ricker, 1971)
Quebec (Ricker, et al., 1968)
***A. pechumani* Ross and Ricker
New Brunswick (Ross and Ricker, 1971)
Nova Scotia (Ross and Ricker, 1971)
Quebec (Ross and Ricker, 1971)
A. pygmaea (Burmeister) — 1 March - 16 April
Hancock, Kennebec, Penobscot, Piscataquis and Washington County
+*A. recta* (Claassen)
Southern Maine (Ross and Ricker, 1971)
***A. vivipara* (Claassen)
Quebec (Ross and Ricker, 1971)
+A. zola Ricker
This species occurs in a diagonal band from the southwestern flanks of the Appalachians to the hill country of Maine and New Brunswick (Ross and Ricker, 1971).
Capnia
C. manitoba Claassen — 14 April - 1 June
Piscataquis County
***C. vernalis* Newport
Quebec (Ricker, et al., 1968)

Nemocapnia
*******N. carolina* Banks
Quebec (Harper and Hynes, 1971 and Harper, 1971)
Paracapnia
P. angulata Hanson — 13 April - 27 May
Hancock, Penobscot and Washington County
P. opis (Newman) — 9 April - 3 June
Hancock, Piscataquis and Washington County
Utacapnia
***U. labradora* (Ricker)
Quebec (Ricker, et al., 1968)

Leuctridae
Leuctrinae

Leuctra
***L. baddecka* Ricker
Nova Scotia (Ricker, 1965 and Hitchcock, 1974)
L. duplicata Claassen — 17 June
Washington County
L. ferruginea (Walker) — 3 June - 28 September
Aroostook and Piscataquis County
L. grandis Banks — 1 June
Piscataquis County
***L. laura* Hitchcock
New Hampshire (Hitchcock, 1969 and 1974)
***L. maria* Hanson
New Hampshire (Hanson, 1941 and Hitchcock, 1974)
L. sibleyi Claassen — 1 June - 26 June
Penobscot, Piscataquis, Somerset and Washington County
L. tenella Provancher — 14 June - 16 August
Hancock and Piscataquis County
L. tenuis (Pictet) — 25 June - 23 August
Piscataquis and Washington County
***L. triloba* Claassen
Quebec (Ricker, et al., 1968)
L. truncata Claassen — 7 August - 22 August
Hancock and Piscataquis County
**L. variablis* Hanson — 29 August
Piscataquis County
Paraleuctra
P. sara (Claassen) — 29 April - 10 June
Aroostook, Piscataquis and Washington County

Pteronarcyidae

In the classification system used by Illies (1966) and Zwick (1973) the family Pteronarcyidae contains two eastern genera: *Allonarcys* and *Pteronarcys*. The validity of *Allonarcys* has been questioned and has recently been placed into synonymy with *Pteronarcys* by Stark and Szczytko (1982).

Pteronarcys
P. biloba (Newman) — 3 June (Piscataquis County)
Aroostook, Franklin, Penobscot and Piscataquis County
P. comstocki (Smith) — nymphs only
Aroostook and Hancock County

P. dorsata (Say) 10 May - 22 May
Aroostook, Hancock, Oxford and Washington County
P. proteus (Newman) nymphs only
Aroostook and Piscataquis County

Peltoperlidae
Peltoperlinae

Peltoperla
***P. arcuata* Needham**
Quebec (Ricker, et al., 1968)
Tallaperla
**T. maria* (Needham and Smith) 9 June (Somerset County)
Franklin, Oxford, Piscataquis and Somerset County

Perlodidae
Isoperlinae

Isoperla
+*I. bilineata* (Say)
Hancock County (Proctor, 1946)
***I. cotta* Ricker**
Quebec (Ricker, et al., 1968)
I. dicala Frison 10 June - 13 July
Penobscot and Washington County
I. francesca Harper 14 June - 7 July
Piscataquis and Washington County
I. frisoni Illies 10 June - 12 July
Hancock, Piscataquis and Washington County
I. holochlora (Klapalek) 24 July - 15 August
Aroostook and Piscataquis County
I. lata Frison 10 June (Washington County)
Penobscot and Washington County
**I. marlynia* Needham and Claassen nymphs only
Washington County
+*I. montana* (Banks)
Hancock County (Needham and Classen, 1925)
**I. namata* Frison nymphs only
Piscataquis County
**I. orata* Frison nymphs only
Aroostook and Piscataquis County
I. signata (Banks) 17 June - 11 July
Hancock, Penobscot and Washington County
**I. similis* (Hagen) 19 May (Washington County)
Piscataquis and Washington County
+*I. slossonae* (Banks)
Piscataquis County (Frison, 1942)
I. transmarina (Newman) 27 May - 14 June
Penobscot, Piscataquis and Washington County
I. sp. A. 23 May - 3 June
Piscataquis County
I. sp. B. 1 June
Piscataquis County

Perlodinae

Arcynopteryx
**A. compacta* (MacKacklan) nymphs only
Piscataquis County

Cultus
*C. *decisus* (Walker) — nymphs only
Aroostook, Piscataquis and Somerset County
Diura
**D. *nanseni* Kempny
New Hampshire (Ricker, 1964)
Quebec (Ricker, et al., 1968)
Helopicus
+H. *subvarians* (Banks)
Washington County (Frison, 1942)
Isogenoides
**I. *doratus* (Frison)
Quebec (Ricker, et al., 1968)
*I. *frontalis* (Newman) — nymphs only
Piscataquis County
I. *hansoni* Ricker — nymphs only
Piscataquis and Washington County
**I. *olivaceus* (Walker)
Quebec (Ricker, et al., 1968)
Malirekus
M. *hastatus* (Banks) — nymphs only
Aroostook, Piscataquis and Washington County

Chloroperlidae
Chloroperlinae

Alloperla
A. *atlantica* Baumann — 10 June - 12 July
Piscataquis and Washington County
*A. *banski* Frison — 13 July
Penobscot County
A. *caudata* Frison — 10 June - 7 July
Piscataquis and Washington County
A. *chloris* Frison — 8 June - 30 July
Piscataquis County
*A. *concolor* Ricker — 1 June - 14 June
Piscataquis County
A. *idei* (Ricker) — 6 June - 13 July
Washington County
A. *leonarda* Ricker — 17 June
Washington County
*A. *voinae* Ricker — 18 July - 15 August
Piscataquis County
**A. *vostoki* Ricker
Nova Scotia (Ricker, 1947)
Hastaperla
H. *brevis* (Banks) — 10 June - 30 July
Hancock, Penobscot, Piscataquis and Washington County
H. *orpha* (Frison) — 27 May - 24 June
Hancock, Penobscot and Washington County
Rasvena
**R. *terna* (Frison)
New Hampshire (Fiance, 1977)
Suwallia
S. *marginata* (Banks) — 18 July - 29 August
Piscataquis County

Sweltza

S. lateralis (Banks)	25 May - 1 June
Piscataquis County	
S. mediana (Banks)	1 June - 21 June
Piscataquis County	
**S. naica* (Provancher)	20 May - 3 June
Piscataquis County	
S. onkos (Ricker)	29 May - 10 June
Washington County	

Paraperlinae

Utaperla

***U. gaspesiana* Harper and Roy
New Hampshire (Fiance, 1977)
Quebec (Harper and Roy, 1975)

Perlidae

Acroneuriinae

Acroneuria

A. abnormis (Newman)	10 June - 14 July
Aroostock, Penobscot, Piscataquis, Somerset and Washington County	
A. arenosa (Pictet)	30 June - 3 August
Penobscot County	
A. carolinensis (Banks)	12 June - 3 August
Aroostook and Penobscot County	
A. lycorias (Newman)	10 July (Penobscot County)
Penobscot and Washington County	

Perlesta

P. placida (Hagen)	30 June - 16 August
Hancock, Penobscot and Washington County	

Perlinella

P. drymo (Newman)	29 May - 17 June
Penobscot and Washington County	

Perlinae

Neoperla

**N. freytagi* Stark and Baumann	4 July - 27 July
Washington County	
+*N. mainensis* Banks	
Kennebec County (Banks, 1948)	

N. mainensis was originally described by Banks (1948) as a subspecies of *Neoperla clymene* (Newman). It has since been elevated to species status by Stark and Baumann (1978) in their revision of the *Neoperla* species complex.

**N. stewarti* Stark and Baumann	30 June
Penobscot County	

Paragnetina

P. immarginata (Say)	17 June (Washington County)
Aroostook, Franklin, Penobscot, Piscataquis and Washington County	
P. media (Walker)	17 June - 13 July
Penobscot, Piscataquis and Washington County	

Phasganophora

P. capitata (Pictet)	10 June - 20 July
Aroostook, Hancock, Penobscot, Piscataquis and Washington County	

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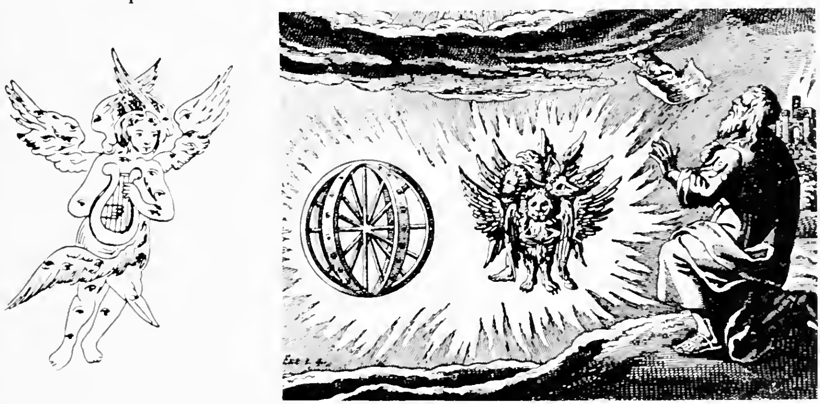
COMMENTARIES IN CULTURAL ENTOMOLOGY

3. AN ENTOMOLOGICAL EXPLANATION OF EZEKIEL'S WHEELS?[1]

Charles L. Hogue[2]

A category of aberrant angels was created when the Hebrew prophet Ezekiel recorded his vision of four cherubim by the Chebar canal in Babylon during his exile there around the year 592 B.C. (Holy Bible, Ezekiel 1: 1-28). These heavenly creatures, said to be manlike, were hardly described as such. In their depictions of Ezekiel's vision through the centuries, artists have had to employ considerable license in anthropomorphizing "four-winged, four-faced spirits with eyes over their entire bodies" (Figs. 1 a-b). Only in the twentieth century did an entomologist suggest an alternate explanation of the nature of the cherubim.



a b

Figure 1. Artists' impressions of Ezekiel's vision. Fig. 1a. Eyed cherub [p. 35, fig. 21 *from* E. Schimitschek. 1968. Insekten als Nahrung, in Brauchtum, Kult und Kultur, *In* J.C. Helmcke et al. eds., Kukenthal's Handbuch der Zoologie (2 ed.) 4(2) 1/10: 1-62, *after* G. Eicke. 1964. unpub. seminar report. Forstl. Fakult. Univ. Göttingen]. Fig. 1b. Ezekiel and his vision (p. 125 *from* W.L. Phelps. 1933. Matthew Merian's Illustrated Bible. William Morrow, New York. *after* W. Merian. 1650. Bybel Printen. Amsterdam.

In his little book on the relationships of beetles and human history, "Aus der Käferweld," Karl Sajó (1910) offered the idea that Ezekiel actually recounts an eclectic image of scarabaeine and coprine dung beetles

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and their habits; that is to say, the prophet envisioned a montage of the several deified species known in Egypt and the Middle East, namely *Scarabaeus sacer, S. variolosus, S. cicatricosus, S. puncticollis, Kheper aegyptiorum, Gymnopleurus flagellatus, Copris hispanus,* and *Catharsius sesostrus* (Bodenheimer, 1928:111, species added by me) (Fig. 2). It is

Figure 2. Three scarabaeines and coprines deified in the Middle East during ancient times. Fig. 2a. *Copris hispanus* brooding dung ball. Fig. 2b. *Scarabaeus cicatricosus* in flight showing salient features discussed in text. Fig. 2c. *Kheper aegyptiorum* rolling dung ball.

reasonable to assume that, as a priest, Ezekiel should be intimately aware of such beetles and their habits because of the prominent religious status they held at the time in area culture. Indeed, the ball of dung rolled by these beetles symbolized the sun to the ancient Egyptians whose political influence extended through much of the Middle East (Weise, 1927).

Sajó (p. 50) briefly justifies his conclusion on the basis of physical clues to the identity of the cherubim as scarabs as well as apparent etymological similarities between names for beetles and the word "cherub" (Heb. k'rubh, kĕrubh, kerūb).

He mentions the obvious references in the Biblical text to beetle elytra and flight wings (paraphrasing the Lutheran translations of parts of verses 5-11 in Chapter 1 in the Heilige Schrift): "Sie waren Tiergestalten und ihre Flügel gingen oben auseinander; durch zwei Flügel berührte eines das andere und zwei Flügel bedeckten ihre Leiber." ("They were animal-like and their wings went out above from one another; by two wings they touched one another and two wings covered their bodies.") He is further convinced by the implications of verse 12 in the 10th chapter that the "eyes" covering the cherubim bodies are equivalent to the pits found on certain *Scarabaeus,* especially *cicatricosus:* "Und ihr ganzer Leib, Rücken, Hände und Flügel, . . . waren voll Augen um und um; . . . . " ("And their whole body, backs, hands and wings, . . . were full of eyes all around; . . . . ") Further, because he considers as cognates the Semitic k'rubh (cherub) and various Aryan words for beetle and like animals, Skarabaeus, Carabus (Latin, beetle), Kerb, Kerf, Käfer (German, beetle), there is an etymological argument for the beetle nature of the cherubim as well (Sajó, 1910:47f).

Even if they are familiar with his argument, however, it is unlikely that biblicists would be convinced by Sajó's explanation of Ezekiel's cherubim as non-human forms. Haran (1962), for example, stresses the variability of their form, which, though composite, is definitely human in shape and not comparable even with the fictitious griffin or similar Mesopotamian mythical creatures. Greenberg, a linguist to whom I introduced Sajó's ideas, also disagrees with Sajó's etymological argument. He believes "kerūb" relates the Akkadian "karību," a protective genius, to a basic quadriped form, like the griffin of Greek and Mesopotamian mythology but generally follows Haran's views on the humanoid nature of the cherubim. He summarizes (Greenberg, 1980), ". . . nothing either in the texts or in the iconography of ancient Israel, or of the contexts in which the Akkadian supposed cognate appear, lends the slightest support to the view that there was anything beetle-like about the cherubs . . . I am not suprised, then, that no one, to my knowledge, has taken up Sajó's notion."

It would seem fatuous, therefore, to debate Sajó's ideas with Bible scholars. Yet, like Sajó, I am an entomologist intrigued with the possible connection between Ezekiel's cherubim and beetles, and therefore, reintroduce the issue here as one of interest to readers concerned with cultural entomology (Hogue, 1979).

In reviewing the current English versions of the Old Testament (King James-KJ, Modern Language-ML, Living Bible-LB, Revised Standard-RS, New American-Standard-NAS and Jerusalem Bible-JB), I have found considerable support for Sajó's thesis from the descriptive standpoint, allowing for imprecise and varied interpretations of the original language, redactions, and the non-scientific background of the original authors. The text of the LB is expressed in a language most closely approximating contemporary English, and I shall quote it below as the primary source for discussion.

Cherubim figure prominently in both the first and tenth chapters of the book, but the account presented in chapter one is probably closest to the original (Irwin, 1943). The first pertinent verses are 5-6, "Then from the center of the cloud, four strange forms appeared that looked like men, except that each had four faces and two pairs of wings!" The "four faces" I shall take up below (when detailed in verse 10); the four wings, of course, are typical of Coleoptera and insects in general. Verses 7-9 describe anatomical details: "Their legs were like those of men (i.e. jointed), but their feet were cloven like calves' feet . . . ." The latter phrase could be a reference to the bifid tarsal claws; but a more likely reference, because Ezekiel presumably had no magnifying lens, is to the forked outline of the apex of the mid and hind legs produced by the elongate apical tibial spine diverging from the tarsus itself and easily seen with the naked eye. Verse 7, continues, " . . . and shone like burnished brass." (copper, bronze?) a possible allusion to the dull metallic greenish or coppery sheen of various species, such as *Kheper aegyptiorum.*

In verse 8 he says, "And beneath each of their wings I could see human hands." By "beneath" he could have meant either *below* or *on a lower level.* In the former case he may have been likening to hands the hind wings with their heavy, articulated veins radiating finger-like from the base; in the latter case, his reference may have been to the five-pointed ("fingered") tibiotarsi of the front legs, which can be seen easily from above.

The beginning of verse 9 suggests a physical impossibility if, indeed, beetles are being described. "The four living things were joined wing to wing . . . ." This reference, however, is expanded upon in the 11th verse, "Each had two pairs of wings spreading out from the middle of his back. One pair stretched out to attach to the wings of the living beings on each side, and the other pair covered his body." Since I doubt that beetles or angels would find it possible to fly in this manner, I believe that the central portion of verses 11 and 9 could mean what the rest of verse 11 explains, simply that there were two pair of wings basally attached to the body, one pair of flight wings and a second pair of protective elytra.

The remainder of verse 9 reads, ". . . and they flew straight forward without turning." Verse 12 repeats this, "Wherever their spirit went they went, going straight forward without turning." The flight of scarabs, though deviating at times, is forceful and persistent, and often directional (Halffter and Matthews, 1966:90-91).

Verse 10 is symbolic, based, at least in part, on scarab anatomy, "Each had the face of a man in front, with a lion's face on the right side of his head, and the face of an ox on his left side, and the face of an eagle at the back of his head!" The large lateral eyes, and rounded clypeal corona seen from the underside of the head explain the first reference; the last easily derives from the horn on the back of the head of *Copris* and certain *Catharsius,* which resembles an eagle's beak. The remaining two views might be imagined from material aspects of any of the beetles and more likely are absolute symbols to complete an ancient Mesopotamian allegorical animal tetrad, possibly the four leading deities of Babylon: Nabu, the human-faced revealer; Nergal, the lion-faced god of the netherworld; Marduk, represented by a winged bull; and Ninib, the eagle-faced god of hunting and war *or* are from figures in Solomon's Temple (Layman, 1971:414; Pfeiffer and

Harrison, 1962: 710). Finally, the flashing colors of some species and darting flight are reiterated in verses 13 and 14, "Going up and down among them were other forms that glowed like bright coals of fire or brilliant torches, and it was from these the lightning flashed. The living beings darted to and fro, swift as lightning."

Two points about flight are added in verse 24, "And as they flew, their wings roared like waves against the shore . . . When they stopped they let down their wings." Scarab wings make loud buzzing noise in flight and are carefully folded at rest.

Sajó fails to follow with what I can suggest to be even more exciting imagery in continuing verses of chapter one describing the vision of the wheels. "Ezekiel's wheels" have puzzled biblical scholars and religious artists perhaps even more than the nature of the cherubim themselves (fig. 1b).[3] Assuming the correct precedence of the scarab as a model for the cherub, would it not be logical to assume that the wheels were originally not such at all but the round dung balls fabricated by and closely tended by these beetles (Fig. 2c)?

The possibility of equivalence of the scarab ball and the wheel symbol is suggested by the equation, dung ball = sun (Egypt) = winged sun disc (Egypt-Assyria) = solar wheel (Assyria) (Goldsmith, 1929:81-83, 93-94). Several points of comparison, from additional text in chapter 1, also relate the "wheels" to dung balls: Verse 15 says, "As I stared at all of this, I saw four wheels *on the ground* beneath them, one wheel *belonging* to each." I add the emphases in this passage to stress the fact that dung balls are rolled on the ground and that each has a definite beetle "owner."

In verse 16 the color and basic structure of the wheels (balls) are described, "The wheels looked as if they were made of polished amber (other versions read, color of beryl-KJ, NAS, tarshish stone-ML, chrysolite-RS, JB) and each wheel was constructed with a second wheel crosswise inside (footnote, "Literally, a wheel within a wheel . . . "). the color comparison to "amber" is not entirely explainable but, dull or olive green are compatible with the muddy green of balls made from fresh bovine dung, although the soil-smeared balls of some may take on a yellowish color upon drying. The other color comparison might have been inspired by the blue-green and blue glazes applied to scarab amulets so common at the time. The LB translation adds the word "crosswise" to the description of the wheels' construction; the other versions merely mention "wheels within wheels," an arrangement easily compared to the layered structure that these balls may assume from the packing and rolling activities of their beetle makers (Klemperer, 1982a:79; Halffter and Matthews, 1966).

[3]Interpretations even include "flying saucers" (M. Sachs. 1980. The UFO Encyclopedia. Perigee Books, New York).

Verse 17 relates the ability of the "wheels" to ". . . go in any of four directions without having to face around" a natural capability of a rolling sphere as opposed to a flat wheel.

Verse 18 is incomplete and inconsistent with the fuller corresponding verse 12 of the repeated account of the nature of the cherubim and wheels in Chapter 10,"The four wheels had rims and spokes (some translators note confusion in the earliest Hebrew manuscripts at this point) and the rims were filled with eyes around their edges." Here too the LB is also incomplete and we fall back to the KJ version, "And their whole body, and their backs, and their hands, and their wings, and the wheels, were full of eyes, round about, even the wheels that they four had," which clearly indicates that the cherubim were eyed all over (as were the wheels?).

This is a very telling verse in its reference to such a bizarre feature as eyes on the corpus and wings of the angels. Yet certain scarabs of the region (e.g. *S. cicatricosus*) display diffuse oval punctae or elliptical depressions over the entire body which could appear to the purblind, lay viewer as eyes. In fact, this large type of puncture is described by beetle anatomists as "ocellate" or "ocellée" (Janssen, 1940:9). Many depictions of cherubim show eyes dispersed over the body (Fig. 1a).

It is reasonable to assume that the reference to eyes on the wheels (balls) is an embellishment and pseudepigraphon of the author of Chapter 10, who most likely was a later editorializer of a single original account of the nature of the animal forms and associated structures (Irwin, 1943), although he may be preserving a notation lost from the primary narration.

In verses 19-20 there is a statement about the control of the "wheels" by the cherubim, "When the four living beings flew forward, the wheels moved forward with them. When they flew upwards, the wheels went up too. When the living beings stopped, the wheels stopped." This is a plausible description of the purposeful rolling of the dung ball by the scarabs. (I cannot explain the rising of the balls with beetles in flight, however.)

Verse 21 ascribes the "spirits" of the living beings to the balls, "For the spirit of the four living beings was in the wheels. . ." could the "spirits" be the larvae or pupae of the beetles? The idea is consistent with the correlation made by early Egyptian scarab cultists between the metamorphosis of insects and the birth (egg), life (larva), death (pupa) and resurrection (imago) stages of human life (Harpaz, 1973:23).

The remaining verses repeat earlier passages in the chapter, except verse 26, which in part gives another clue to the natural basis of the vision, "For high in the sky above them was what looked like a throne . . . , and upon it sat someone who appeared to be a man." The basis of this imagery might lie in the habit of some scarab females to remain atop the dung ball brooding it and keeping it upright during the period of larval development. This behavior is best developed in *Copris* (Klemperer, 1982b) (Fig. 2a), but *Scarabaeus* can assume a position atop its ball for short periods as well. Of course, Ezekiel would have had to had special knowledge to know this for *Copris* since brooding occurs only in vaulted underground chambers. But such knowledge could have been common among priests of the time who surely studied such an important animal assiduously. (It is interesting that the ML uses the term "vault" to describe the place occupied by the man on the throne.)

Other references to cherubim (Genesis 3:24, Exodus 25:18, II Samuel 22:11, I Kings 6:23, Revelations 4:6, 7) doubtlessly are to separate prototypes and are not necessarily equal to those in Ezekiel's portrait.

Therefore, altogether, we have an elaborate imagery consistent with a natural phenomenon. The etymological questions remain unresolved. If the Semitic and Aryan words equated by Sajó are indeed true cognates or others found to relate beetles to cherubim, our argument is strengthened, especially if they have known religious significance, e.g. Kheper (Egyptian, to exist, the Father of the Gods, Creation), corpus (Latin, body, vehicle of our earthy existence, predecessor of the soul) (see Sajó, 1910:49). That cherubim were scarabs is, of course, not provable; and since it deviates radically from traditional explanations, Biblical scholars, theologians and Fundamentalists will probably find ludicrous the suggestion that Ezekiel's cherubim and wheels were based on his supposed experience with dung beetles. However, the naturalistic method in Bible exegesis is as valid as any and has a basis in logic and history unlike most canonical, theosophic analyses, and surely represents as parsimonious an approach as literalism since it answers more, and raises fewer questions. Without facts to follow, attempting to reconstruct what influenced the mind of authors in antiquity can never be more than speculation; but from their writings, however fragmented and edited, basic ideas often shine through. Thus it would appear to me that whoever recorded the original of the story before us in Chapter 1 was a holy man of the seventh to sixth centuries with personal experiences and priestly training in Judea and Babylonia where the theophany of scarabs was understood, if not firmly believed and taught, as in proximate Egypt. The prophet appears to have been trained in this cult and possibly a direct observer of the events of scarab life.

ACKNOWLEDGEMENTS

I would like to thank Dr. W.D. Edmonds, scarabaeid specialist at the California Polytechnic University, Pomona, and Jay Bisno of the Archaeology Section of my own institution for criticising preliminary versions of this paper and assisting with technical and linguistic matters. Much appreciated also are the many fine suggestions for improvement of the manuscript provided by Dr. D Keith McE. Kevan, of McGill University and the review of the final draft by Dr. Edgar N. Raffensperger of Cornell University. The cooperation of the foregoing individuals does not necessarily imply agreement with the ideas presented.

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REDESCRIPTION OF *CICINDELA SPECULANS* BATES AND ITS RELATIONSHIP TO OTHER NEOTROPICAL *CICINDELA* (COLEOPTERA: CICINDELIDAE)[1]

Robert R. Murray[2]

ABSTRACT: The original description of *Cicindela speculans* Bates is incomplete and in error in respect to the maculation, elytral microserrulations, and shape of the aedeagus. This species has been assigned inaccurately to the subgenus *Cylindera*. The sculpturing of the head and thorax and the apical hook of the aedeagus indicate that *C. speculans* is related most closely to *C. hemichrysea* Chevrolat of the *C. argentata* Fab. species complex, subgenus *Brasiella*. The male syntype is redescribed and illustrated.

Bates (1890) described *Cicindela speculans* from a male and female collected by H.H. Smith in Omilteme, Guerrero, Mexico, el. 8000 ft. Bates indicated that the maculation consists of a humeral lunule, basal portion of the middle line, and marginal line which are mirror-like or shining. The apical margins of the elytra were described as being non-serrulate. Bates believed that *C.speculans* was most closely related to *C. praecisa* Bates.

Cazier (1954) presented a taxonomic review of the Mexican *Cicindela* but representatives of some species, including *C. speculans,* were not available to him. He indicated in a footnote that it would probably key out beyond couplet 37 but did not otherwise key the species. His illustration was copied from Bates (1890) and follows it in respect to the maculation. Cazier stated that *C. speculans* was probably more closely allied to *C. viridisticta* Bates than to *C. praecisa* on the basis of the smooth lateral elytral margins and non-serrate elytral apices.

Rivalier (1954) in this division of the American *Cicindela* tentatively placed *C. speculans* in the subgenus *Cylindera,* also without examining specimens.

Recently I have examined the male syntype of *C. speculans* in connection with studies of Mexican and Neotropical cicindelids and found that Bates' observations pertaining to the maculation were incomplete and that his description of the elytral apices as being non-serrulate was in error. This error probably caused Cazier and Rivalier to misplace *C. speculans* in respect to its relationship with other Mexican *Cicindela. Cicindela speculans* is redescribed, illustrated, and its position within *Cicindela* is determined more accurately in this paper.

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Cicindela speculans Bates
(Figures 1, 2, 3, 4)

Head: Distinctly wider than thorax, deeply excavate between eyes. Labrum unidentate, convex, tan to creamy white; anterior margin narrow, dark brown, medially produced; with single irregular row of 8 submarginal setae; length slightly more than half width. Antenna having basal 4 segments cupreous with green reflections, scape with 1 erect subapical seta, several erect setae on segments 3 and 4; distal 7 segments ferrugino-testaceous, covered with fine setae, Clypeus dark brown, glabrous, finely alutaceous. Gena dark greenish black, shining, glabrous, shallowly striate. Frons and vertex brown, concentrically striate, becoming rugose toward posterior margin, bare except for 1 pair anterior supraorbital setae and 1 pair medial supraorbital setae.

Thorax: Pronotum same color as vertex of head, widest at apical third, narrowest at base, without posterior angles, obliquely striate anteriorly and posteriorly, becoming rugose medially, with scattered decumbent setae laterally and anteriorly; median longitudinal line shallowly impressed, represented by broad depressions at anterior and posterior ends; anterior and posterior transverse lines obscure. Sternal region smooth, shining, dark greenish black; proplura, prosternum bare; mesepisternum, mesepimeron each with 1-2 suberect setae; mesosternum bare; metepisternum with 2-3 suberect setae at anterior margin, 5-7 suberect setae at posterior margin; metepimeron bare; metasternum with 30 or more suberect setae. Legs with pro- and mesocoxae having several setae on anterior half, bare posteriorly; protrochanter with single subapical seta; femora greenish bronze with cupreous reflections, becoming testaceous at apex, setae sparsely arranged in longitudinal rows; tibiae testaceous, becoming darker toward apex, with rows of sparse stout suberect setae; tarsi testaceous with violaceous or green reflections.

Abdomen: Venter dark greenish black; with few scattered, fine, suberect setae; setae numerous at apical margin of 6th segment.

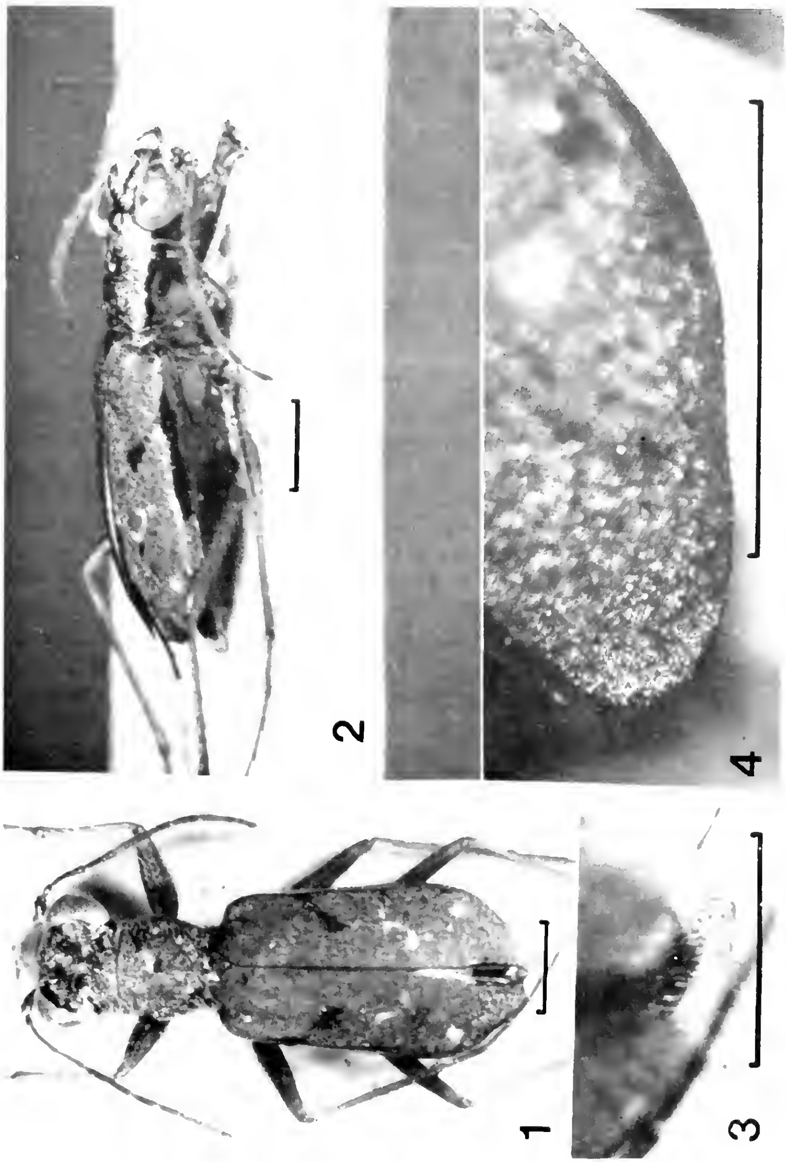
Elytra: Colored as vertex, granulate-punctate; punctures shallow, green, frequently confluent; foveae absent; gradually widened to apical 1/4, then narrowing until just before apex, then turned obliquely anteriorly; apex with short spine. Maculation with humeral lunule, marginal line and base of middle line connected, shining brownish black; medial portion of middle line white, transverse for half elytral width, bending apically, then returning medially forming an oblique C; marginal line ending just behind junction with middle line; basal portion of apical lunule present as white spot separated from lateral margin by 1-1.5 times its diameter. Apical 1/5 of elytra finely microserrulate.

Genitalia: Apex of aedeagus of ♂ syntype protruding, apex hooked at right angle, length of hook 1-1/2 times length of metathoracic tarsal claw.

Measurements: (in mm): Labrum width 0.78, labral length 0.41, head width 1.59, greatest width between eyes 1.04, pronotal width 1.18, pronotal length 1.04, elytral length (apex of scutellum to apex) 3.33, total elytral length 3.52, metathoracic tibial length 2.26, total length (frons to elytral apex) 5.38, apical hook of aedeagus 0.22.

Label data (from top to bottom): 1) (disc with red margin - printed) Type; 2) (printed) Sp. figured.; 3) (printed) Omilteme, Guerrero, 8000 ft., July. H.H. Smith; 4) (handwritten) speculans Bates ♂; 5) (inverted - printed) T.E.S.; 1890.

Diagnosis: *Cicindela speculans* is easily distinguished from most Mexican and Central American *Cicindela* on the basis of its small size and bicolored maculation (Figs. 1,2). It is rivaled in size by *C. hemichrysea* Chevrolat, *C. viridisticta* Bates and *C. wickhami* W. Horn. It can be distinguished from *C. viridisticta* by having apical microserrulations (Fig. 4). It can be distinguished from *C. hemichrysea* and *C. wickhami* by the bicolored,



Figs. 1–4. *Cicindela speculans* Bates, male syntype (scale line = 1 mm). Fig. 1: dorsal habitus, Fig. 2: lateral habitus, Fig. 3: apex of median lobe, Fig. 4: microserrulations on lateral apical margin, right elytron.

almost complete maculation. *Cicindela hemichrysea* usually has greatly reduced maculation, typically represented by the internal portion of the middle line and basal portion of the apical lunule which are white. *Cicindela wickhami* likewise has totally white maculation. The female syntype of *C. speculans* in the BMNH was examined by G.G. Kibby, and the bicolored maculation is similar to that of the male (pers. comm.).

DISCUSSION

Bates (1890) did not completely describe the maculation of *C. speculans.* It was illustrated as being totally dark. Furthermore, the elytral apices were described as being non-serrulate when in fact they are distinctly microserrulate. Cazier (1954) perpetuated the error with his discussion and copy of Bates' illustration of *C. speculans.* These authors believed that *C. speculans* is most closely related to *C. praecisa* or *C. viridisticta.* Rivalier (1954) placed *C. speculans* (as *specularis)* in the genus *Cylindera* without having seen specimens. He also placed *C. praecisa* and *C. viridisticta* in *Cylindera.* The genera used by Rivalier are recognized only as subgenera by most American cicindelid specialists. In this same paper Rivalier described the genus *Brasiella* as containing species of small size (around 7 mm in length) with a short labrum having 6-10 submarginal setae, protruding eyes, elytra with metallic spots, and often fragmented or partially reduced maculation. Furthermore, Rivalier states that the genus is best defined by the shape of the aedeagus which is almost always provided with a sharp, right-angled hook and by the absence of a flagellum in the internal sac. These characters, with the exception of those of the internal sac, which was not dissected, are all possessed by *C. speculans.*

In a subsequent paper (Rivalier 1955) *Brasiella* is divided into 3 species groups based on genitalic characters. 1) The typical (*C. argentata* Fab.) species complex is characterized by the distinct, right-angled aedeagal hook and by all 4 components of the internal sac being strongly sclerotized with the arciform piece being spiny and oriented longitudinally. The 13 species of this group,including *C. hemichrysea* (*C. argentata hemichrysea* in Cazier (1954)), range from the southwestern US to Paraguay and Argentina. 2) A Brasilian group containing 2 species is characterized by a sharply hooked aedeagus, a large oblique arciform piece in the internal sac and a lightly sclerotized foliaceous appearing shield-shaped piece in the internal sac. 3) A Central and South American group containing 2 species is characterized by the apical hook of the aedeagus being reduced or absent and by the complicated architecture of the internal sac.

On the basis of the shape of the aedeagus and distributional data, in addition to its similarity in respect to head and pronotal sculpturing, *C. speculans* appears to be most closely related to the *C. argentata* species complex and probably is nearest to *C. hemichrysea.*

Cicindela speculans will key to *C. argentata* (= *C. hemichrysea*) in couplet 43 of Cazier (1954). These 2 species can be separated as follows.

A. Maculation unicolored, white; maculation usually reduced, occasionally nearly complete but without marginal line; elytral coloration black or dark brown. . . . . *C. hemichrysea*

A'. Maculation bicolored (Figs. 1, 2); marginal line, humeral lunule and base of middle line shining brownish black, remainder of middle line and remnant of apical lunule white; maculation nearly complete, with marginal line; elytral coloration brown . . . . *C. speculans*

ACKNOWLEDGMENTS

My thanks are extended to G.G. Kibby, British Museum (Natural History) for the loan of the male syntype of *C. speculans* and his drawing of the maculation of the female syntype. E.C. Bashaw, USDA, SEA, College Station, Texas graciously allowed me to use the photographic equipment in his care. H.R. Burke and J.C. Schaffner, Texas A&M University critically reviewed the manuscript and contributed helpful suggestions for its improvement.

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INSECT AND SPIDER COLLECTIONS OF THE WORLD

A new work entitled "Insect and Spider Collections of the World" is now being compiled by Dr. Ross H. Arnett, Jr., Florida State Collection of Arthropods, P.O. Box 1269, Gainesville, FL 32601, Dr. G. Alan Samuelson, Bishop Museum, P.O. Box 19000-A, Honolulu, HI 96819, Drs. Robert E. Woodruff and John B. Heppner, Division of Plant Industry, P.O. Box 1269, Gainesville, FL 32601, and Dr. Gerardo Lamas, Museo de Historia Natural "Javier Prado," Universidad Nacional Mayor de San Marcos, Aptd. 434, Lima 14, Peru.

The purpose of this work is to produce a standard list of museums and collections of the world containing specimens of insects and spiders useful for study of systematists; to provide a suitable coden for each collection for use in journals and monographs to refer to the place of deposit of specimens of insects and spiders; and to describe these collections, including the size, type of housing, and similar data.

Questionnaires are being sent to all institutions listed in previous works. Any collections not included in previous lists may be added by writing to the compilers for information and a questionnaire.

EUROPEAN RHAGIONIDAE IN EASTERN NORTH AMERICA: RECORDS OF NEWLY DISCOVERED SPECIES (DIPTERA)[1]

L.L. Pechuman, E. Richard Hoebeke[2]

ABSTRACT: The Palearctic species *Rhagio strigosus* Meigen (Diptera: Rhagionidae) is newly discovered in New York State; this is a new North American record. In addition, *R. tringarius* (L.) is reported from Massachusetts and New York which represent new United States records. Diagnostic characters of *R. strigosus* are illustrated to aid in its separation from other native and introduced species in North America. An existing key to the eastern species of *Rhagio* is modified to include *R. strigosus.* A possible means of introduction is hypothesized.

The discovery of *Rhagio strigosus* Meigen in the Genesee Region of New York State is the first record of this common European species in North America. A collection of 5 specimens at Bergen (Genesee County), New York, in 1981-82, by Patricia Ferris, would seem to indicate that this species may be established here. A male specimen was taken from a garage window around August 8, 1981, and a female specimen was taken September 3, 1982. Three dead and damaged specimens also were taken from sills of garage windows at the same location in early August 1982; one specimen was a male, while the sex of the other specimens were not determined as they lacked the head or most of the abdomen. Further attempts to collect this distinctive species in the vicinity of Bergen in late July and early August 1982 proved unsuccessful.

In eastern North America, the genus *Rhagio* Fabricius is comprised of 15 species, 4 of which are introduced. Chillcott (1965) revised the eastern nearctic species and reported for the first time the presence of the European species *R. tringarius* (L.) (from Lockeport, Nova Scotia) and *R. lineola* F. (from Ottawa, Ontario). Thompson (1969) reported the occurrence in North America of a third European species, *R. scolopaceus* (L.), based on collections of specimens from the metropolitan Boston area (Massachusetts) in June 1949, 1963, and 1968. Our discovery of *R. strigosus* in New York marks the fourth European species of *Rhagio* to be found introduced into North America.

Rhagio strigosus, a species common throughout much of Europe, is easily separated from most other eastern North American *Rhagio. R. strigosus* looks like *scolopaceus* in habitus and is likely to be confused with it. Thompson (1969) modified Chillcott's (1965) key to the eastern nearctic species of *Rhagio* to include *R. scolopaceus.* Here, Thompson's

[1]Received September 2, 1982. Accepted March 5, 1983.

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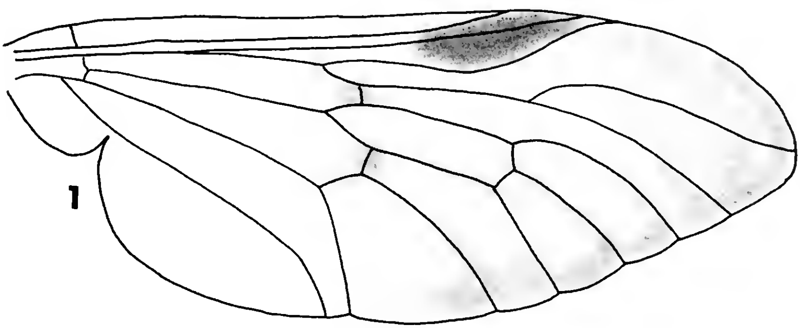
couplet #4 (p. 142) is modified to incorporate *R. strigosus.*

4. Notopleural shelf and metepimeron bare .... 4a.
— Notopleural shelf and metepimeron haired.................................. 5.
4a. Wings strongly patterned; proepisternum bare and haired.................... 4b.
— Wings clear; proepisternum bare .... *tringarius* (L.)
4b. Proepisternum bare; stigma of wing isolated from radial fork (Fig. 1); third antennal segment smaller than the second, ovate or broader than long (Fig. 2) .... *strigosus* Meigen
— Proepisternum haired; stigma usually connected to radial fork by dark patch; third antennal segment larger than second, longer than broad (Fig. 3) ..... *scolopaceus* (L.)

The specimens of *R. strigosus* from Bergen, NY, key out readily in the European literature (Lindner, 1925; Oldroyd, 1969). The determination by us was verified by comparison with several European specimens identified



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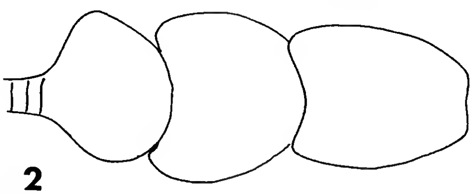

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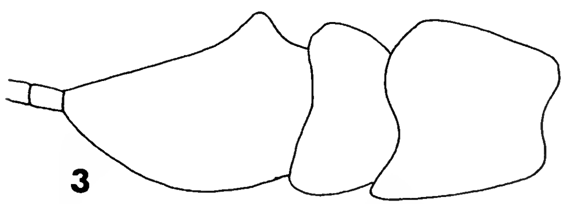

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Figs. 1-3. *Rhagio* spp. 1, Wing of *R. strigosus* Meigen. 2, Antennal segments 1-3, *R. strigosus* (after Oldroyd, 1969). 3, Antennal segments 1-3, *R. scolopaceus* (L.) (after Oldroyd, 1969).

by E. Lindner, and given to the Cornell University Insect Collection through the kindness of Wolfgang Schacht (Zoologische Staatssammlung, Munich).

Chillcott (1965) noted that the "larvae of *Rhagio* are frequently intercepted in the soil on imported plant materials...". It would then seem probable that *R. strigosus,* like the other introduced *Rhagio* species, was introduced through nursery importation. In the second half of the nineteenth century, the city of Rochester (Monroe County), New York, had the proud claim to the title of "The Flower City: Center of Nurseries and Fruit Orchards." It is well documented (McKelvey, 1940) that some of the prominent nurseries of the greater Rochester area (notably the Ellwanger and Barry nurseries) in the mid-1800's acquired extensive purchases of nursery stock from abroad, especially Europe. This early and extensive importation of nursery and floriculture stock in New York, prior to any U.S. imposed quarantine restrictions, may be responsible, at least in part, for the presence of other exotic species in the area surrounding Rochester. We offer this hypothesis as one possible explanation for the mode of introduction for *R. strigosus.*

A thorough search was made of the Cornell University Insect Collection's unidentified Rhagionidae for additional specimens of *R. strigosus.* No material was found. However, 2 specimens of another introduced species of *Rhagio* were discovered which represent new U.S. records, *R. tringarius,* first reported in North America by Chillcott (1965) from Lockeport, Nova Scotia, is now recorded from Massachusetts and New York. The following locality records extend its known distribution in eastern North America:

UNITED STATES: Massachusetts: Berkshire Co., Lenox (Eastover), 7 July 1982, L.L. Pechuman, coll. (1 ♂). New York: Chenango Co., Jam Pond Bog nr. German, 7 August 1980, D.J. Bickle, coll. (♂)

These specimens key to *R. tringarius* in the European literature and in Chillcott (1965). They also compare well with European representatives of *R. tringarius* in the Cornell collection.

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NEW SPECIES AND DISTRIBUTION NOTES OF MEXICAN AND BOLIVIAN *IDIODONUS* (HOMOPTERA: CICADELLIDAE)[1]

Dwight M. DeLong[2]

ABSTRACT: Six new species of *Idiodonus, I. albifrons* n.sp., *E. sexpunctatus* n.sp. *I. marginatus* n.sp., *I. pallidus* n.sp., *I. nigrifrons* n.sp., all from Mexico and *I. costatus* n.sp. from Bolivia are described. A new name *Idiodonus beamerellus* is proposed for *I. beameri* DeLong (1946) preoccupied by *I. beameri* Ball (1937). New distribution notes are given for *I. wickhami* Ball.

The *Idiodonus* of Mexico were treated by DeLong (1946) who listed 35 species, 32 of which were described as new. Six species are being described at this time, five from Mexico and one from Bolivia. A new name *Idiodonus beamerellus* is proposed for *I. beameri* DeLong (1946), preoccupied by *I. beameri* Ball (1937). Notes on new distribution records of *I. wickhami* Ball are cited.

The male genital structures in this genus are of little or no specific value. Color patterns and the female 7th sternum are therefore used for species identifications. All types are in the DeLong collection, Ohio Stae University.

Idiodonus albifrons n.sp.
(Figs. 1, 7)

Length of female 4.5 mm. Male unknown. Crown broadly rounded, appearing parallel margined 2 1/2 times as wide between eyes at base as long at middle. Color: face white without markings. Crown sordid yellow with a large black spot just above margin next to each eye and 2 smaller black spots between them. Pronotum gray, tinged with yellow. A small black spot near anterior margin behind each eye. Scutellum yellow, 2 proximal small, black spots at middle. Forewings grayish subhyaline, veins brownish.

Female seventh sternum with posterior margin excavated about 1/4 distance to base, and bearing a spatulate process which extends to length of lateral angles.

Holotype female: Chilpancingo, Gro. Mexico 25-X-1941, DeLong, Good and Caldwell colls.

I. albifrons is related to *I. schwartzi* (Ball) (1911, p. 197) and can be separated from it by the 2 large black spots close to the eyes, the 2 smaller central proximal spots, the 2 black spots on the pronotum, the 2 proximal minute black spots on the scutellum and by the mesally spatulate 7th sternum of the female.

[1]Received June 21, 1982. Accepted March 25, 1983.

[2]Department of Entomology, Ohio State University, Columbus, Ohio.

Idiodonus sexpunctatus **n.sp.**
(Figs. 2, 8)

Length of female 5.5 mm. Male unknown. Crown slightly produced, approximately 1 1/2 times as wide at base between eyes as long at middle. Color: face pale yellowish with remnants of black arcs and a black spot just below each ocellus next to each eye. Crown yellowish, tinted with orange, with 2 proximal large black spots at apex and 2 minute round black spots just basad of larger spots. Pronotum tinted with a faint dark brown transverse mark at center. Forewings pale gray subhyaline, veins brown.

Female 7th sternum with posterior margin slightly produced between the lateral angles, bearing a median squarish notch 1/6 length of segment, with a convexly rounded base.

Holotype male: Mexico, Rio Frio, D.F. (K-47) 18-X-1941, DeLong, Plummer, Caldwell, Good colls.

I. sexpunctata is related to *I. andanus* DeLong (1946, p. 29) and can be separated from it by the 2 small proximal black spots on the middle of the crown, by the absence of small spots on the pronotum and by the squarish excavation of the 7th sternum of the female.

Idiodonus marginatus **n.sp.**
(Fig. 3)

Length of male 4.5 mm. Female unknown. Crown broadly rounded, only slightly produced, half as long at middle as wide at base between eyes. Color: face pale yellow. Crown pale brown with a broad marginal black transverse band between eyes. Pronotum pale brownish with dark gray coloration on caudal margin. Scutellum yellowish with a dark brown T-shaped mark at middle. Forewings grayish subhyaline, veins mostly brown except white claval veins.

Male genital plates elongate, triangular, 3 times as long as wide at middle, apices pointed.

Holotype male: Mexico, Tulancingo, Hidalgo (K-129) 25-X-1945, Stone, DeLong, Hershberger, Elliot colls.

I. marginatus is related to *I. turpiter* DeLong (1946, p. 28) and can be separated from it by the black transverse band on the margin of the crown.

Idiodonus pallidus **n.sp.**
(Figs. 4, 9)

Length of female 5 mm, male 4.6 mm. Crown slightly produced and broadly rounded, 1 1/2 times as wide at base between eyes as long at middle. Color: face pale yellowish with remnants of brown arcs each side. A small round black spot next each eye below ocellus. Anterior coronal margin narrowly whitish with 4 transverse elongate black spots, 2 near apex, 2 near eyes. Remainder of crown brown with darker brown coloration along with the white margin. Pronotum brown, scutellum brown with a white V-shaped wedge at middle each side. Forewings brown, veins brown except the terminal portion of claval veins next to commissure and the veins of posterior apical cells, which are white.

Female 7th sternum with posterior margin slightly produced and broadly shallowly notched at center, 1/6 distance to base.

Male plates elongate, triangular, 5 times as long as wide at middle.

I. pallidus is related to *I. anademus* DeLong (1946, p. 29) and can be separated from it by the elongate spots on the crown, the white spots on the scutellum and the white claval veins of the forewing.

Idiodonus nigrifrons n.sp.
(Fig. 5)

Length of male 5 mm. Female unknown. Crown slightly produced, broadly rounded, half as long at middle as wide at base between eyes. Color: face black, crown yellow with a black transverse band in front of eyes. Pronotum yellow, a large irregular shaped spot behind each eye with a black, broken, transverse band extending across basal part of pronotum, brownish irregular pigment on apical protion. Scutellum yellowish with a dark brown spot near each basal angle. Forewings grayish subhyaline, veins brown.

Male genital plates elongate, triangular, 4 times as long as wide at middle, apices sharply pointed.

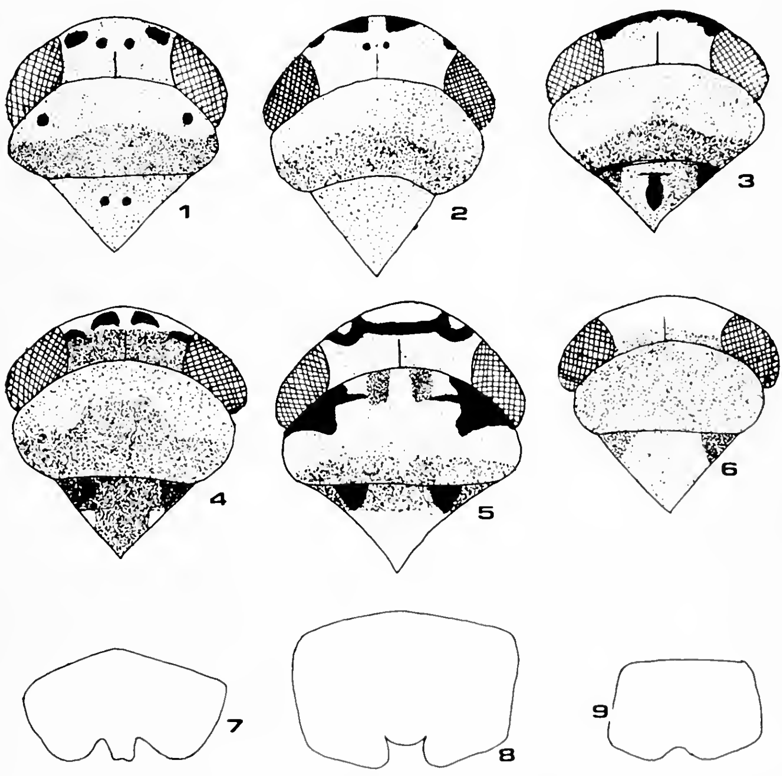

Fig. 1. *Idiodonus albifrons* n.sp. head, pronotum and scutellum. Fig. 7 female 7th sternum. Fig. 2. *I. sexpunctata* n.sp. head, pronotum and scutellum, Fig. 8, female 7th sternum. Fig. 3. *I. marginatus* n.sp. head, pronotum and scutellum. Fig. 4. *I. pallidus,* n.sp. head, pronotum and scutellum, Fig. 9 female 7th sternum. Fig. 5. *I. nigrifrons* n.sp. head, pronotum and scutellum. Fig. 6. *I. costatus* n.sp. head, pronotum and scutellum.

Holotype male: Mexico, Huanchinango, Puebla (K.-170) 25-X-1945, Stone, DeLong, Hershberger, Elliott colls.

I. nigrifrons is related to *I. vinculus* DeLong (1946, p. 15) and can be separated from it by the black face, the black transverse band on the apical portion of the crown and the black spots on the pronotum and scutellum.

Idiodonus costatus n.sp.
(Fig. 6)

Length of male 4.2 mm. Female unknown. Crown scarcely produced, almost 3 times as wide at base between eyes as long at middle. Color: face white, crown white, basal portion along margin brownish. Pronotum brownish, scutellum brownish, caudal half sordid whitish, basal angles dark. Forewings brown with costal margin broadly white.

Male genital plates elongate, triangular, 3 times as long as wide at middle, apices tapered, pointed.

Holotype male: Bolivia, Santa Cruz, 19-VIII-1980, Donald Foster coll.

I. costatus is related to *I. rubellus* DeLong (1946, p. 15) and can be separated from it by the white crown, the absence of black spots on the crown, the absence of red coloration and the broad white costal wing margin.

Idiodonus beamerellus n.n. for *I. beameri (1946) preoccupied by Idiodonus beameri* Ball (1937)

Idiodonus wickhami Ball was described from specimens collected in Arizona. It has been collected abundantly in Mexico, especially at higher altitudes, 6,000 to 9,000 feet. Records at hand are: Mt. Popo, D.F. 11,000 ft., Mexico City D.F. 7,500 ft., La Guarda D.F. 8,500 ft., Chapingo, D.F. 9,900 ft., Toluca D.F. 9,700 ft., Rio Frio D.F. 10,300 ft., Zitacuara, Mich. 6,700 ft., Carapan, Mich. 5,000 ft., Zacapu, Mich. 6,500 ft. and Pueblo, Pue. 8,500 ft.

A reddish form has been collected at Santa Cruz, Bolivia by Donald L. Foster.

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A DESCRIPTION OF THE FEMALE OF *HYDROPTILA JACKMANNI* BLICKLE (TRICHOPTERA: HYDROPTILIDAE), WITH BIOLOGICAL NOTES[1]

Alexander D. Huryn[2]

ABSTRACT: A description of the female of *Hydroptila jackmanni* Blickle is given. Included are notes on the flight period, distribution, and habitat of this species as it occurs in Ohio.

During a recent survey of the caddisflies inhabiting the Little Muskingum River watershed, Monroe and Washington Counties, Ohio (Huryn 1982), an undescribed female of the genus *Hydroptila* was encountered. Through associations of male and female flight periods, local distributions, and terminalia morphologies, I determined this female to be *H. jackmanni* Blickle.

In Ohio, *H. jackmanni* is restricted to the Appalachian Plateau with collections being made in Monroe, Portage and Summit Counties. Light trap collections of associated males and females were made at Haskell Run, Cuyahoga Valley National Recreation Area, Summit County (June 27, 1980; 12 males, 48 females), and Wildcat Run, Perry Township, Monroe County (June 9, 1981; 10 males, 61 females). Both collections were made along relatively unperturbed, second order streams of moderate gradient, which flowed through dense, mixed-deciduous forest areas. Other members of *Hydroptila* collected in association with *H. jackmanni* were *H. amoena* Ross, *H. callia* Denning, *H. consimilis* Morton and *H. waubesiana* Betten. *Hydroptila jackmanni* apparently is univoltine with peak emergence occurring in mid-June (Huryn 1982).

Hydroptila jackmanni Blickle

Male. — Blickle (1963).

Female. — Length from front of head to tip of abdomen 2.8-3.8 mm (N=10). Eighth abdominal segment as in Figure 1. Conspicuous, well sclerotized, "flange-like" clasper grooves are lateral (Figure 1A). Internally, anterior margins of clasper grooves are sites of attachment of apodemes of eighth segment. Eighth sternite short and trapezoidal in outline (Figure 1B). Posterior margin of eighth sternite emarginate with a group of four stout setae at each apex. Eighth tergite showing a similar setal arrangement but with no posteromesal emargination. Approximately midway between the dorsal and ventral setal groups are two smaller setae.

Females of *H. jackmanni* are easily distinguished from other described

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members of the genus by the presence of the conspicuous clasper grooves. However, as females are known for only about one-quarter of the 60 species of *Hydroptila* recorded from North America (Blickle 1979), determination of *H. jackmanni* based on collections of females without associated males should be regarded as tentative.

Specimens of *H. jackmanni* are depositied in the collection at the University of Georgia.

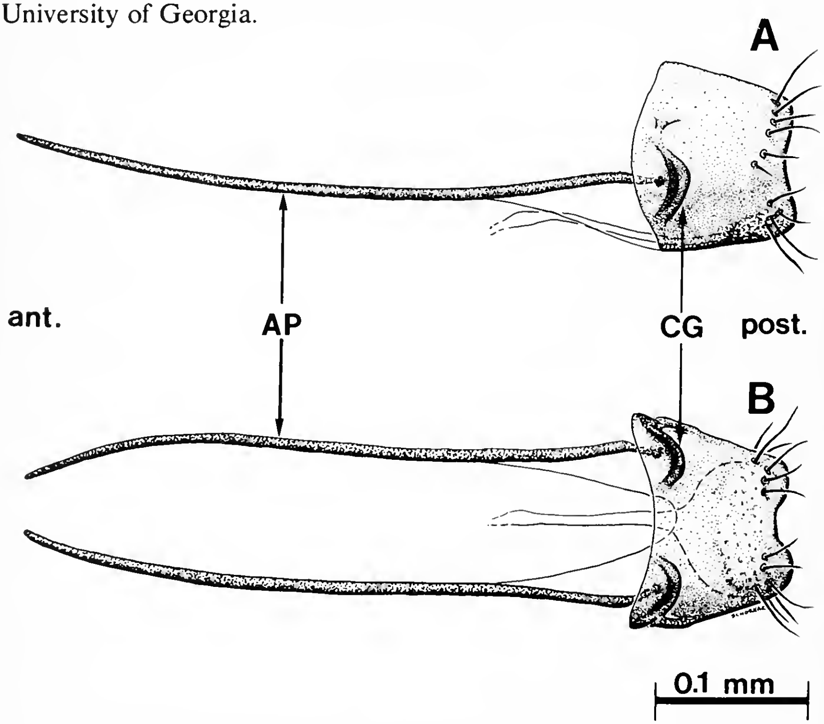

Figure 1. Eighth abdominal segment of the female of *H. jackmanni.* A. lateral view. B. sternite. (AP=apodeme, CG=clasper groove).

ACKNOWLEDGMENTS

The Ohio Biological Survey provided partial funding for this study. The drawings were executed by M. Shornack at the Cleveland Museum of Natural History.

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A NEW RECORD OF ATTACKS BY *PEDILUS* (PEDILIDAE) ON *MELOE* (MELOIDAE: COLEOPTERA)[1]

Laurent LeSage, Yves Bousquet[2]

ABSTRACT: Two specimens of the pedilid beetle, *Pedilus lugubris* (Say), were found on a male meloid, *Meloe angusticollis* Say in Rigaud, Québec. They had severely damaged the meloid beetle by partially chewing the elytra. Photographs of the beetles and of the elytral damage are provided.

The first North American record of *Pedilus* attacking *Meloe* adults was reported by Say (1826), who stated that the type-specimen of *Pedilus impressus* (Say) was found attached to the side of an adult *Meloe angusticollis* Say. Leech (1934) observed elytra of *Meloe niger* Kirby partially eaten by *Pedilus monticola* (Horn), and Pinto & Selander (1970) made similar observations involving *Pedilus terminalis* (Say) attacking *Meloe angusticollis* Say and *M. americanus* Leach. The purposes of this note are to present a new record of attack by *Pedilus* and to illustrate the damage caused to the elytra of meloid beetles.

During a collecting trip at Rigaud, Québec (45° 29'N; 74° 18'W) on May 17, 1982 we found a male and a female of the blister beetle *Meloe angusticollis* Say crawling on a trail in a deciduous forest. The male meloid (Fig. 1a) attracted attention because it was bearing two smaller black beetles, *Pedilus lugubris* (Say) (Fig. 1b) on its dorsal surface. All beetles were brought to the laboratory and placed together in a transparent plastic container for observations. Apparently the meloid beetles did not pay attention to the two *Pedilus* but seemed stressed by their confinement in the plastic container. The two *Pedilus* were very active, crawling on the dorsal surface of the male meloid and feeding on its elytra; indeed, the examination of the gut content of one *Pedilus* revealed several setae and small pieces of cuticle similar to those found on *Meloe*. They also quickly located the meloid female and began the same activity on its elytra. Maximum elytral damage was not observed because the *Pedilus* were killed and preserved for determination. The purpose of such a chewing behavior is still a mystery.

An examination of the Meloe beetles in the Canadian National Collection, about 400 specimens, did not reveal any specimens with similar damage to the elytra. Consequently, attack by *Pedilus* on *Meloe* seems to be a rare phenomenon. However, more material and additional observa-

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tions are needed to determine if this rarity is real or apparent, and we hope our note will stimulate research in this area.

We would like to acknowledge Mr. C. Beddoe for the habitus photographs and our colleagues Drs. J.M. Campbell and E.C. Becker for the determination of the beetles and their comments on the manuscript.

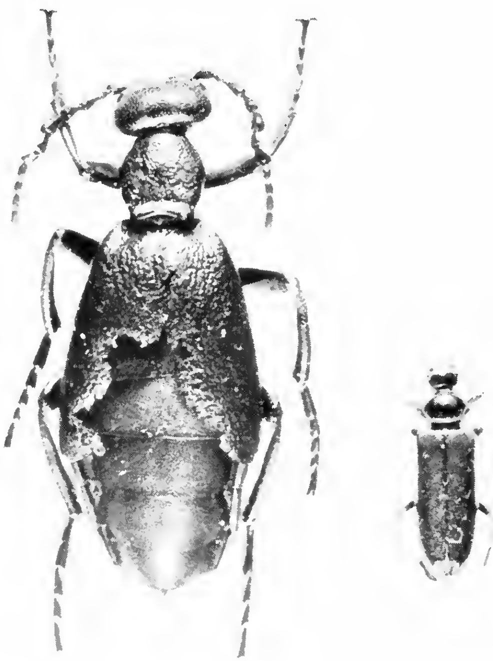

Figure 1. Dorsal view of: left, *Meloe angusticolis* Say; right, *Pedilus lugubris* (Say); both at the same scale (enlargement: about 3 times).

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LECTOTYPE DESIGNATION FOR *EUSCAPHURUS SALTATOR* CASEY (COLEOPTERA: EUCINETIDAE)[1]

Richard A. Rochette[2]

ABSTRACT: A lectotype and eight paralectotypes are designated for *Euscaphurus saltator* Casey.

Casey (1885) described *Euscaphurus saltator* from California without designating a type. Vit (1977) later redescribed it from a specimen (female) from the Horn collection without designating a lectotype. The purpose of this note, therefore, is to select a lectotype for this species.

There are nine specimens in the "type" series from the Casey collection. Spec. Nr. 1-8: "Cal"/"Casey bequest 1925"/"Paratype NMNH (orange-red label, National Museum of Natural History) series #49232"; Spec. Nr. 9: Same data except, "Holotype NMNH series #49232". With Casey (1885) not mentioning any type designation in his paper, one questions the validity of the holo- and paratype labels. These labels were probably added later. Therefore, a male in good condition with the genitalia exposed is hereby designated as the lectotype. The label "Lectotype *Euscaphurus saltator* Casey des. R.A. Rochette XI/3/82" was attached to it. All remaining specimens in this series are hereby designated paralectotypes.

ACKNOWLEDGMENTS

I thank Dr. John M. Kingsolver for bringing this nomenclatural problem to my attention; and also Drs. Richard W. Spellenberg and James R. Zimmerman for reviewing this note.

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NEW RECORDS OF DRYINIDAE (HYMENOPTERA) IN TENNESSEE[1]

R.E. Kelly, L.E. Klostermeyer[2]

ABSTRACT: The known ranges of the dryinids, *Gonatopus ashmeadi* Kieffer, *Neogonatopus agropyrus* (Fenton), *Dicondylus americanus* (Perkins), and *Pseudogonatopus stenocrani* Perkins are extended to include Tennessee.

Seven specimens of Dryinidae were collected with a D-Vac® suction sampler in a 1980-1981 survey of leafhoppers associated with a mixed tall fescue (*Festuca arundinacea* Schreb.) pasture at the University of Tennessee's Plateau Experiment Station, Grassland Farm, located 12.9 km south of Crossville, Cumberland County, Tennessee (Kelly, 1982). Only females were collected and were identified by Dr. Paul H. Freytag, Department of Entomology, University of Kentucky, Lexington, as follows:

Gonatopus ashmeadi Kieffer — 1 specimen each on 19 August 1980, 11 June 1981 and 8 July 1981.

Neogonatopus agropyrus (Fenton) — 1 specimen each on 10 June 1980 and 8 July 1981. Freytag 1977 transferred *agropyrus* from *Gonatopus* to *Neogonatopus*.

Dicondylus americanus (Perkins) — 1 specimen on 27 May 1980. Giri and Freytag (1982) transferred *americanus* from *Haplogonatopus* to *Dicondylus*.

Pseudogonatopus stenocrani Perkins — 1 specimen on 14 October 1980.

These species are new records from the state of Tennessee.

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Kelly, R.E. 1982. Leafhoppers (Homoptera: Cicadellidae) associated with a mixed tall fescue pasture on the Cumberland Plateau in Tennessee. Knoxville, TN: Univ. of Tennessee. M.S. Thesis. 59 p.

[1]Received November 8, 1982. Accepted March 26, 1983.

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THE OCCURRENCE OF *ELLIPES MINUTUS* (SCUDDER) (ORTHOPTERA: TRIDACTYLIDAE) IN KENTUCKY[1]

M. Ann Phillippi[2]

ABSTRACT: Tridactylids collected from ten counties across Kentucky have been identified as *Ellipes minutus* (Scudder). Reports of the species across North America are sporadic and undoubtedly reflect the paucity of collections from their riparian habitat. *Ellipes minutus* has not been previously reported from Kentucky.

The orthopteran family, Tridactylidae, is represented by four species in North America (Guenther 1977), *Neotridactylus apicialis* (Say), *Ellipes gurneyi* Guenther, *E. minutus* (Scudder), and *E. monticolus* Guenther. Across the United States, locality records for the species are widespread (Guenther 1975, 1977, 1980) but scarce (Urquhart 1937), most likely due to the paucity of collections from their riparian habitat and the difficulty in capturing these fast, small, exceptionally strong jumpers (Blatchley 1920, Goodwin and Powders 1968). This author inquired into the distribution of the family after a single individual of *E. minutus* was collected in a Surber sample from a stream in eastern Kentucky.

There are no published reports of the family from Kentucky, and there are no Kentucky specimens housed at the University of Michigan Museum of Zoology in Ann Arbor; the Academy of Natural Sciences in Philadelphia; the National Museum of Natural History in Washington, D.C.; or the Eastern Kentucky University Insect Collection in Richmond. Ninety specimens of *E. minutus* were found in two museums, the University of Louisville and the University of Kentucky from the following counties: Breathitt, Fayette, Graves, Henry, Jefferson, Knox, Leslie, Meade, Oldham, and Pendleton. Collection dates were April 12, 18, 19, 26, and 30; May 3, 18, 19, 26, 26, and 27; June 30; July 16; and Sept. 11 and 24.

These specimens are from ten counties scattered across Kentucky including several physiographic regions as follows: extreme western Kentucky in the Gulf Coastal Plain Province (Graves Co.); in the central Bluegrass (Fayette Co.); along the Ohio River in north-central Kentucky (Meade, Oldham, Jefferson, Pendleton, and Henry Cos.); and in the Cumberland Plateau of eastern Kentucky (Breathitt, Knox, and Leslie Cos.). Based on these few definite records in a wide geographic area, it is probable that *E. minutus* is more common and widespread than is presently known throughout Kentucky and perhaps throughout much of North

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America (Merritt and Cummins 1978) primarily due to the scarcity of collections in its habitat.

Unfortunately, information referring to the purported riparian habitat of *E. minutus* is limited to general statements. Blatchley (1920) observed that *E. minutus* is "more abundant about ponds and lakes than along flowing streams," and other authors refer to its apparent preference for "lakes and watercourses" (Hebard 1934), "moist habitats" (Goodwin and Powders 1968), "streams on moist sand banks where they closely resemble their background" (Rentz 1965), and "lentic and lotic margins near quiet water away from wave or splash effects" (Merritt and Cummins 1978). The Knox County, Kentucky, specimen came from a stream with trees, shrubs, and herbaceous plants on the immediate sandy, silty shore with adjacent cornfields. The stream was clear, and the substrate consisted of a stony, sandy bottom with silt accumulating in the pools. It is postulated that *E. minutus* was accidental in the Surber sample and is typically a riparian or semi-aquatic species.

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Author describes major developments in study of insect populations in tropical environments and brings together various concepts and related studies that explain spatial and temporal patterns of tropical insect diversity.

AMPHIPOEA VELATA (WALKER) (LEPIDOPTERA: (NOCTUIDAE) ATTACKING CORN NEAR FRIENDSVILLE, MARYLAND[1, 2]

James W. Amrine, Jr., Linda Butler[3]

ABSTRACT: The noctuid, *Amphipoea velata* (Walker), was observed attacking 20-30 cm corn in early June in Garrett Co. Md. Larvae made nests by tying leaves together with silk. Feeding habits included general defoliation, tunneling in the stalk, and cutting through the base of the stalk. The larvae fed on several species of weeds in addition to corn. Infestations occurred in grassy-weedy patches and averaged 6.2 larvae per corn plant. Carbaryl treatment produced 40% mortality (many larvae were protected by their leafy retreats).

On June 4, 1980, a sample of "leaf-tying" larvae was submitted to us for identification. The larvae were collected[4] from corn on a farm, 4 miles west of Friendsville, Garrett Co., Maryland. Using the larval key of Crumb, 1956, the specimens were identified to the genus *Septis,* a synonym of *Amphipoea* (=*Apamea*) (Lepidoptera: Noctuidae). Approximately 75 larvae were placed on cabbage looper media; the majority fed and moulted to pupae but only 5 adults emerged. Adults were then identified by Linda Butler, and confirmed by Eric Quinter, American Museum of Natural History, as *Amphipoea velata* (Walker).

The infested field was visited on June 5, 1980; the corn plants were 20 to 30 cm tall. The field was located along the top of a ridge. Cultivation was no-till, and numerous weeds occurred in random patches. The crop was planted on May 5, 1980 with an application of fonofos insecticide. The *A. velata* infestation was generally confined to weedy-grassy areas. The larvae made silken retreats by joining leaf margins together, thus forming curled tubes in corn and grass leaves, or leafy nests in broad-leaved weeds. Small larvae formed retreats by merely folding over leaf margins. Feeding habits included general defoliation, tunneling in the stalk, and cutting through the base of the stalk. Numerous plants were severely defoliated or cut off at the base. Damage to the corn crop was serious enough that the farmer considered plowing and replanting. A survey of another, distant corn field (5 km S.) indicated a light infestation along the forest margin (1 larva per 50

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[2]Published with the approval of the Director of the West Virginia Agricultural and Forestry Experiment Station as Scientific Article #*1796*. This research was supported with funds appropriated under the Hatch Act.

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[4]By Charles B. Sperow, Extension Specialist, Division of Plant and Soil Sciences, West Virginia University, Morgantown, WV 26506

corn plants). A survey of larvae in a sample of 20 infested corn plants within a weedy patch yielded an average of 6.2 larvae (2nd to 5th instar) per plant (range of 1 to 14). Weeds found were quackgrass (*Agropyron repens* (L.)), pokeweed (*Phytolacca americana* L.), jimson weed (*Datura stramonium* L.), blackberry (*Rubus* spp.), and milkweed (*Asclepias syriaca* L.). Larval nests and feeding damage were found in all weed plants except pokeweed.

The infestation was treated with carbaryl insecticide and dicamba herbicide on June 4, 1980, and by the following day, approximately 40% of the larvae were dead or moribund. Apparently, the balance of the larvae were protected by their silken retreats.

A literature search revealed no previous report of attack by this insect on corn or other crops. Forbes (1954), using the name *Apamea velata* Walker, relates that it feeds on grasses and is sometimes common but not injurious. Dethier (1944) described the larva and pupa and gave the following life history details for Massachusetts: overwintering pupae produce adults in the spring and eggs hatch in early May; second generation adults appear in early June and a third generation of adults appears in late July and August, producing larvae which develop to overwintering pupae. The adult male is illustrated by Grote and Robinson (1867) as *Apamea sera.*

No larvae of *A. velata* were observed causing injury during the 1981 growing season. Apparently, this is a fine example of a normally innocuous insect which has the potential to become a pest when conditions are favorable. Because of its voracious feeding habits and immense reproductive potential, future surveillance for outbreaks of this insect is warranted.

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Grote, A.R. and C.T. Robinson. 1867. Description of American Lepidoptera, No. 3. Trans. Amer. Entomol. Soc. 1: 323-360. (Fig. 55, plate 7).

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PHENETICS & ECOLOGY OF HYBRIDIZATION IN BUCKEYE BUTTERFLIES. J.E. Hafernik, Jr. 1983. Univ. of Calif. Press. 109 pp. $16.50.

This paper analyzes interrelationships among North and Central American representatives of *Junonia,* exclusive of the Caribbean region.

NOTES ON THE GEOGRAPHICAL DISTRIBUTION OF THE GULF COAST TICK, *AMBLYOMMA MACULATUM* (KOCH) [ACARI: IXODIDAE][1,2]

Jerome Goddard, B.R. Norment[3]

ABSTRACT: 1982, six specimens of the Gulf Coast tick, *Amblyomma maculatum* (Koch), were taken in two northern Mississippi Counties. Additional specimens were taken during a trip to southwestern Kentucky.

The Gulf Coast tick, *Amblyomma maculatum* (Koch), is a three host species found in the southern United States, generally in areas bordering the Gulf of Mexico and Atlantic Ocean (Bishopp and Trembley, 1945). According to Bishopp and Hixson (1936), it is seldom found in large numbers farther inland than 100 miles. Cooley and Kohls (1944) published on the distribution, hosts, and taxonomy of this species. The Gulf Coast tick has been reported from Florida, Georgia, South Carolina, North Carolina, Virginia, and Delaware on the Atlantic coast and also from Arizona, Arkansas, and California (Bishopp and Hixson, 1936; Lancaster, 1973). It is well established in northeastern Oklahoma (Semtner and Hair, 1973) and is also known to exist in southeastern Kansas. A few specimens taken at Dallas, Texas and Memphis, Tennessee were suggested to have been brought in on livestock shipped from the coastal region. *Amblyomma maculatum* has been reported twice from Arkansas (Lancaster, 1973) and is considered relatively rare in Alabama occurring only in the southern one-third of the state (Cooney and Hays, 1972).

In a current research project concerning the rickettsial organisms associated with the Lone Star tick, *Amblyomma americanum* (L.), ticks were collected weekly throughout the 1982 season in northern Mississippi, with occasional collecting trips to the TVA Land Between the Lakes region in southwestern Kentucky. Ticks were collected by dragging with a flannel cloth in the study area. Six specimens of the Gulf Coast tick were collected in northern Mississippi; four in Noxubee Co. and two in Oktibbeha Co. These locations are 200-250 miles from the Gulf Coast. Also, one specimen was collected in the Land Between The Lakes region of southwestern Kentucky. Subsequently, a search through the student collections in the Medical Entomology collection at Mississippi State

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[2]Publication no. 5265, Mississippi Agricultural Experiment Station.

[3]Department of Entomology, Mississippi State University, Mississippi State, Mississippi 39762.

University revealed 11 more specimens from northern Mississippi, representing Lafayette, Lowndes, and Oktibbeha counties.

The majority of these specimens were collected in July or early August (see records) which is consistent with the findings of Hixson (1940) who reported an adult peak in July. These records further expand the known range of this species. Bishopp and Hixson (1936) suggested that northern records may represent specimens brought in on livestock from the coastal region; however, all of the ticks collected in Noxubee Co., Miss. were found in a national wildlife refuge isolated from pastureland. Also, the specimen from Kentucky was collected in an area free of any known livestock. These records indicate that either the previously reported range of *Amblyomma maculatum* may be incomplete or this species is extending its range northward.

New Records of *Amblyomma maculatum*

Material examined — *Lafayette Co., MS,* Oxford, 21-V-1974, L. Thead, 2 ♀ (SC)*; *Lowndes Co., MS,* Crawford, 14-IV-1982, B. Hinkle, 4 ♀ 1 ♂ (SC); *Marshall Co., KY,* 6 mi. E. Aurora, 2-VIII-1982, J. Goddard, 1 ♂; *Noxubee Co., MS,* Noxubee Wildlife Refuge, 5-VI-1982, J. Goddard, 1 ♀; Noxubee Wildlife Refuge, 2-VII-1982, J. Goddard, 1 ♂; Noxubee Wildlife Refuge, 8-VII-1982, J. Goddard, 1 ♀ 1 ♂; *Oktibbeha Co., MS,* Starkville, 4-VII-1974, D. Wigle, 4♂ (SC); Starkville, 1-VII-1982, S. Winters, 1♂ (SC); Starkville, 10-VII-1982, J. Goddard, 1 ♀.

All of these specimens are deposited in the Mississippi Entomological Museum, Mississippi State University.

*Student Collection

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125th ANNIVERSARY OF THE AMERICAN ENTOMOLOGICAL SOCIETY

The American Entomological Society, publisher of "Entomological News," "Transactions," and "Memoirs" was founded in February, 1859 as the Entomological Society of Philadelphia. Therefore, our Society is observing its 125th Anniversary this year. A special meeting to mark the occasion will be held on February 15, 1984 at the Academy of Natural Sciences, Philadelphia. Members and friends of the Society are invited.

Tentative plans include exhibits of early insect collections, publications, photographs of pioneer entomologists, and a series of short talks on outstanding entomologists who were active in the Society in its early years. Details will be announced in the fall of 1983.

W.H. Day

SOCIETY MEETING OF MARCH 3, 1983

The American Entomological Society's fourth meeting of the 1982-83 year was held Thursday, March 3, in Agricultural Hall on the University of Delaware campus. Eight members and twenty-four guests attended the evening lecture on the "Biology of Mayflies," presented by Mr. David Funk of the Stroud Water Research Center, Avondale, PA. Dr. Paul Burbutis introduced the subject with a spirited reading from Benjamin Franklin's "The Ephemera: An Emblem of Human Life," written in 1778. Mr. Funk, winner of the Photographic Society of America's Silver Medal for Best of Show at last year's North Central Insect Salon held at the Entomological Society of America's North Central Branch Meeting, integrated beautiful slides of mayflies, their habitats, and natural history with a contemporary ecological analysis of species distribution and behavior.

Of the approximately 2000 species of mayflies known, about 600 occur in the United States. The larvae of most species graze on algae and leaf litter on the bottom of streams or rivers. They display a variety of body shapes which are related to current speed, substrate types and behavioral patterns. Adults are sexually dimorphic with males usually having long forelegs and enlarged dorsal surfaces of their compound eyes. The eyes in some species are extremely specialized and have distinctive shapes and colors. Studies on the Salmon River in Idaho and White Clay Creek in Pennsylvania suggest that within a watershed, related species have evolved to minimize competition in a variety of ways. Closely related species may occur in different areas of the watershed and show an upstream-downstream distributional relationship. Temperature variance, both geographic and within a watershed, may effectively limit a species' distribution by lowering fecundity in areas where the annual temperature regime is not optimal. Where related species coexist their life history patterns may be displaced temporarily thereby minimizing overlap in their periods of maximal growth. A similar displacement in the emergence period minimizes the possibility of interbreeding. In the ensuing question period there was considerable interest in the subimago, a stage found in no other insect order.

In notes of local entomological interest, Roger Fuester said that he had observed mating mourning cloak butterflies within the past week and that ticks, *Dermacentor variabilis*, are now active. Dr. Dale Bray added that a new species of tick close to *Ixodes scapularis*, appeared in the area last year. It has a painful bite. Dr. William Day commented on the warm winter we have had and how spring flowers are blooming very early this year. With continued mild weather we may observe an early emergence of many insects.

Harold W. White
Corresponding Secretary

SOCIETY MEETING OF APRIL 7, 1983

The last regular meeting of The American Entomological Society for the 1982-83 year was held Thursday April 7, 1983 at the University of Delaware. Eight members and nine guests listened to Dr. John Lublinkhof of Biochem Products Montchanin, Delaware speak on "Integrated Use of Microorganisms and Chemicals for Managing Insect Populations."

The main part of Dr. Lublinkhof's talk dealt with *Nosema pyrausta*, a protozoan parasite on the European corn borer, *Ostrinia nubilalis*. As a well-adapted parasite, in the laboratory *Nosema* does not normally kill its host despite high levels of infection. The primary effects of infection are reduced fecundity and longevity of the host. It was reasoned that infected individuals would be weakened and therefore more susceptible to killing by other agents in a field situation. Such an effect was demonstrated for concurrent *Bacillus thuringensis* infection and for treatment with carbaryl or carbofuran.

At the AES Council meeting President Charles Mason announced the following committee assignments for the 1983-84 year:

Finance - William Day (Chairman), Paul Burbutis, Harold White, and Jessie Freese.
Library - Selwyn Roback (Chairman), Joseph Sheldon, Howard Boyd, and Roger Fuester.
Publications - Selwyn Roback (Chairman), Howard Boyd, Daniel Otte, and Charles Mason.
Membership - Joseph Sheldon (Chairman), and Ronald Romig.
Program - Harold White (Chairman), and Carla Ritter.
125th Anniversary Program - Charles Mason, (Chairman), William Day, Howard Boyd,Harold White, Joseph Sheldon, and Selwyn Roback.

Harold B. White
Corresponding Secretary

BOOKS RECEIVED AND BRIEFLY NOTED (Continued)

TIGER BEETLES OF GENUS *CICINDELA* IN ARIZONA. J. Bertholf. 1983. Texas Tech Univ. 44 pp. $7.00.

Systematics and species accounts of the 37 species found in Arizona.

ANTS OF WESTERN TEXAS: MYRMICINAE. J.V. Moody & O.F. Francke. 1982. Texas Tech Univ. 80 pp. $12.00.

Study objective was to determine which ant species inhabit western Texas, define their geographic regions, and explore factors limiting their distributions.

BIOLOGY & POPULATION OF TIGER BEETLE *CICINDELA JAPONICA*. M. Hori. 1982. Physiology & Ecology Japan, Kyoto. 212 pp.

Life history, growth, development, and dynamics of natural population were studied for 8 years by tracing labeled larval burrows and marked adults.

AUSTRALIAN CRICKETS. D. Otte & R.D. Alexander. 1983. Monograph 22, Academy Natural Sciences of Philadelphia. 477 pp. $45.00.

A taxonomic survey and study of 492 species, of which 376 are new.

GUIDE TO LARVAE OF NEARCTIC DIAMESINAE (DIPTERA: CHIRONOMIDAE). J.S. Doughman. 1983. U.S. Geological Survey. 57 pp.

Keys and decriptions to known species of *Boreoheptagyia, Protanypus, Diamesa,* and *Pseudokiefferiella* present in clean, cool arctic-alpine waters.

CHECKLIST OF BEETLES OF NORTH AND CENTRAL AMERICA AND THE WEST INDIES

Several years ago I started the North American Beetle Fauna Project which was aborted in 1981 because of lack of funds. We were able to produce the "Red Version" of the "Checklist of the Beetles of Canada, United States, Mexico, Central America, and the West Indies" and two families of the "Yellow Version" of that checklist. The "Red" list was completed with the help of now Professor Emeritus Richard E. Blackwelder. Only a limited number of copies were produced and it immediately went out of print.

Meantime several parts of the U.S. Department of Agriculture's "A Catalog of the Coleoptera of America north of Mexico" have been issued. Also four additional parts of the "Yellow Version" have been published elsewhere.

Continued requests for the checklist parts have forced me to have some of that work reprinted and to undertake revision of these parts. To do this, I have incorporated the new sections of the "Yellow Version" mentioned above and changed the arrangement and renumbered the families included in the work to conform with the recent changes in the classification.

This new work is entitled, "The Checklist of the Beetles of North and Central America and the West Indies." It covers the same geographical area as intended in the original Project. It is compiled and edited by myself. The present set of volumes (10) includes renumbered parts of the "Red" list, some with minor updating, except for the new parts mentioned above.

It is my intention to continuously revise this work as the need and time permits. All of the new parts are entered into computer storage for ease in updating and revising. Various beetle specialists are invited to revise or help revise these sections.

New family sections may be replaced or added to the work according to the wishes of the owner of the set. All of the volumes are stored in looseleaf notebooks.

Each volume contains a table of contents. One volume is published elsewhere (the Weevils) but may be supplied to those wishing the complete set. The final volume is the bibliography. To find references given in the text use the name of the author of a taxon, the year of publication, and the page number (these appear as citations in the Checklist). However, please note that the present set includes references from 1758 through 1947. Later references will be included in future parts.

These 10 volumes complete this work as it now stands; revisions will be issued as separate works. The titles of the 10 volumes follow.

Vol. 1. The Ground Beetles, Water Beetles, and related groups.
Vol. 2. The Rove Beetles and related groups.
Vol. 3. The Scarab Beetles, Buprestid Beetles, and related groups.
Vol. 4. The Click Beetles, Fireflies, Checkered Beetles, and related groups.
Vol. 5. The Ladybird Beetles and related groups.
Vol. 6. The Darkling Beetles, Strepsiptera, and related groups.
Vol. 7. The Longhorned Beetles.
Vol. 8. The Leaf Beetles and the Bean Weevils.
Vol. 9. The Fungus Weevils, Bark Beetles, Weevils, and related groups.
Vol. 10. Bibliography of the Coleoptera of North America north of Mexico, 1758-1948.

Ross. H. Arnett, Jr. Florida State Collection of Arthropods,
Div. of Plant Industry, P.O. Box 1269, Gainesville, FL 32601

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

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

ITZN 59 6 April 1983

The following Opinions have been published by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature*, volume 40, part 1, on 29 March 1983:

Opinion No.	
1239 (p. 25)	*Attelabus* Linnaeus, 1758 (Insecta, Coleoptera): type species designated.
1240 (p. 27)	HESPERIIDAE Latreille, 1809 (Insecta, Lepidoptera): added to Official List.
1244 (p. 37)	*Stethaspis* Hope, 1837 (Coleoptera, Scarabaeidae): designation of type species.
1245 (p. 39)	*Linyphia tenebricola* Wider, 1834 (Arachnida): to be interpreted in the sense of Kulcyzynski, 1887.

The Commission regrets that it cannot supply separates of Opinions.

ITZN 11/4
(A.N. (S.) 125)

The Commission hereby gives six months notice to the possible use of its plenary powers in the following cases, published in the *Bulletin of Zoological Nomenclature*, volume 40, part 1, on 29 March 1983, and would welcome comments and advice on them from interested zoologists.

Correspondence should be adddressed to the Secretary at the above address, if possible within six months of the date of publication of this notice.

Case No.	
1688	*Pseudopontia* Plotz *v. Gonophlebia* Felder (Insecta, Lepidoptera): settlement of case.
2233	Request for a ruling to correct homonymy in names of the family-groups based on *Myrmecia* (Insecta) and *Myrmecium* (Arachnida).
2269	On family-group names based on *Eurhin, Eurhinus* and *Eurhynchus* (Coleoptera).
2389	*Myzus festucae* Theobald, 1917 (Insecta, Aphidoidea): proposed conservation.
2153	*Calaphis* Walsh, 1862 and *Callaphis* Walker, 1870 (Insecta, Hemiptera, Aphididae): proposals to remove the confusion.
2373	UROPLAT — as the stem of family-group names in Amphibia and Insecta (Coleoptera): proposals to remove the homonymy.
2358	*Oeciacus vicarius* Horvath, 1912 (Insecta, Hemiptera, Cimicidae): 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 may 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 $7.50 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.

Short notes will be published promptly in The Entomologist's Record.

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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.

FREE PUBLICATION: Thomas D. & F. Werner (1981) Grass Feeding Insects of the Western Ranges: An Annotated Checklist. Send requests to either author, Dep't. of Entomology, University of Arizona, Tucson, AZ 85721.

FOR SALE: Over 5000 different butterfly and beetle species from Philippines, China, Indonesia, New Guinea, Brazil, Africa, Europe, and many other areas. Also: Insect pins (famous Austrian trade mark), IMPERIAL black, $14.90 per thousand. Write to: Kamer Co. Ltd., Weilg. 3, A-1191 WIEN, Austria (Europe).

WANTED: Books, bibliographies, and other comprehensive works on ticks (Ixoidoidea), worldwide. Please write beforehand, stating condition and price. Richard G. Robbins, Dept. of Entomology, Smithsonian Institution, NHB 127, Washington, DC 20560.

FOR SALE: *Journal of Medical Entomology*, Vols. 5 (1968) to 16 (1979) complete. Make offer. D. Hilton, Bishop's University, Lennoxville, P.Q. J1M 1Z7 Canada.

WANTED: Information (esp. old correspondence and collection data) on Ernest John Oslar (1859-1944) general collector of western insects. Send information to Dave Ruiter, 1588 S. Clermont, Denver, CO 80222 for inclusion in detailed biography. All material can be returned.

WANTED: Studies on the Comparative Ethology of Digger Wasps of the Genus Bembix by Evans; Beetles of the Pacific Northwest by Hatch (5 vol.); Biology of the Leaf Miners by Hering; The Ecology of Plant Galls by Mani. Write stating condition and price to John E. Holzbach, 229 Maywood Drive, Youngstown, Ohio 44512.

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 fro C.S. Hull, Box 1553, Oxford, Miss. 38655.

RUSSIAN & GERMAN TRANSLATION service. Negotiable prices. E.g., Makarchenko (1978, 1980) available in modern (chironomid) terms for $2.50. P. Spitzer, 1625 McLendon, Ap't. 4, Atlanta, GA 30307.

WANTED: A copy of Arnett's *The Beetles of the United States*. Joseph A. Lankalis, I East High St., Coaldale, PA 18218.

FOR SALE: Republication of Frederick Valentine Melsheimer's 1806 "A Catalogue of Insects of Pennsylvania," the first separate work devoted to American insects. The facsimile lists more than 1300 species of Coleoptera (other orders were not completed), and includes a short biography of Melsheimer. Price: U.S., $5.00 (overseas, airmail $6.50). Checks payable to Entomological Society of Pennsylvania, c/o Entomology Dept., Pennsylvania State University, University Park, PA 16802, U.S.A.

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ENTOMOLOGICAL NEWS

THE AMERICAN ENTOMOLOGICAL SOCIETY

ENTOMOLOGICAL NEWS is published bi-monthly except July-August by The American Entomological Society at the Academy of Natural Sciences, 1900 Race St., Philadelphia, Pa., 19103, U.S.A.

The American Entomological Society holds regular membership meetings on the third Wednesday in October, November, February, March, and April. The November and February meetings are held at the Academy of Natural Sciences in Philadelphia, Pa. The October, March, and April meetings are held at the Department of Entomology, University of Delaware, Newark, Delaware.

Society Members who reside outside the local eastern Pennsylvania, southern New Jersey, and Delaware area are urged to attend society meetings whenever they may be in the vicinity. Guests always are cordially invited and welcomed.

Subscriptions: *Private subscriptions for personal use of members of the Society, domestic and foreign: $9.00 per year postpaid. Subscriptions for institutions such as libraries, laboratories, etc., and for non-members, domestic and foreign: $18.00 per year postpaid. Communications and remittances regarding subscriptions should be addressed to ENTOMOLOGICAL NEWS, The American Entomological Society, 1900 Race St., Philadelphia, Pa. 19103. U.S.A.*

Back issues of most numbers may be obtained by writing to the office of The American Entomological Society, 1900 Race St., Philadelphia, Pa., 19103, U.S.A.

Membership dues: $7.00 per year (regular); $4.00 per year (student).

Manuscripts and all communications concerning same should be addressed to the editor: Howard P. Boyd, Oak Shade Rd., RD7, Tabernacle Twp, Vincentown, New Jersey 08088, U.S.A. Manuscripts will be considered from any authors, but papers from members of the American Entomological Society are given priority. It is suggested that all prospective authors join the society. All manuscripts should follow the format recommended in the AIBS *Style Manual for Biological Journals* and should follow the style used in recent issues of ENTOMOLOGICAL NEWS. Three doublespaced, typed copies of each manuscript are needed on 8½ x 11 paper. The receipt of all papers will be acknowledged and, if accepted, they will be published as soon as possible. Articles longer than eight printed pages may be published in two or more installments, unless the author is willing to pay the entire costs of a sufficient number of additional pages in any one issue to enable such an article to appear without division.

Editorial Policy: Manuscripts on taxonomy, systematics, morphology, physiology, ecology, behavior and similar aspects of insect life and related terrestrial arthropods are appropriate for submission to ENTOMOLOGICAL NEWS. Papers on applied, economic and regulatory entomology and on toxicology and related subjects will be considered only if they also make a major contribution in one of the aforementioned fields.

(Continued on inside of back cover)

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VARIATION IN STRUCTURE OF LIGULA OF TANYPODINAE LARVAE (DIPTERA: CHIRONOMIDAE)[1]

K.J. Tennessen, P.K. Gottfried[2]

ABSTRACT: Variations in the structure of the ligula of Tanypodinae larvae (Diptera: Chironomidae) were found in six of nine genera examined. About 3 percent of the 2370 larvae examined were considered abnormal, possessing either fewer or greater numbers of teeth than typically found, or teeth that were bifid, curved, or otherwise asymmetrical.

Findings indicate that taxonomic keys which rely primarily on the number of ligula teeth should be used with caution. Basic shape and color of the ligula, besides number of teeth, are important characteristics; combinations of other characters are provided here to aid in identifying certain genera.

The number, shape, and color of teeth on the ligula of Tanypodinae larvae have been used as key characters in separating tribes and genera (Beck 1976; Mason 1973; Roback 1978, 1980; Webb and Brigham 1982). We have found that the ligula is a variable structure in certain species, especially in regard to the number of teeth, and this variation can lead to mistaken determinations using present keys which overemphasize ligula morphology. Some larvae simply cannot be keyed to ligula characteristics alone.

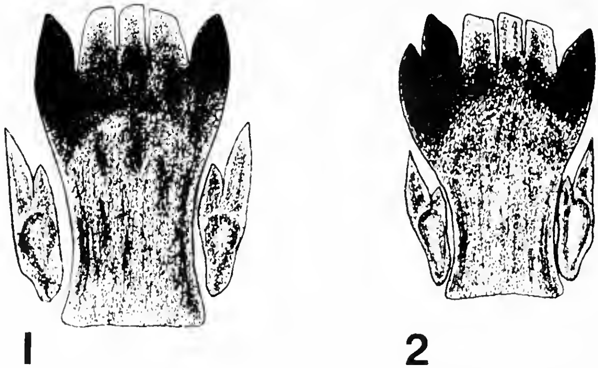
We examined nine genera and found atypical ligulas in six of them. For each genus in which we have observed abnormal ligulas, we describe and illustrate the major types of variations and give a combination of characters by which the larvae may be reliably identified. All specimens examined are from northern Alabama. The drawings were made by tracing photographs; the paraglossae were included since they can be useful in confirming identifications.

Ablabesmyia

The ligula typically bears five black teeth, the tips of which are often translucent; the median tooth is shorter than the first lateral teeth in most species. The ligula of *A. annulata* (Say) is unusual in that the median tooth is at least as long as the first laterals and the apices of these three teeth are truncate (Figure 1). One larva from Alabama (25 examined) has a ligula with an extra lateral tooth, for a total of six teeth (Figure 2). *Ablabesmyia* larvae may be recognized by the presence of more than one basal palpal segment, and most species have one or two dark claws on the anal prolegs.

[1]Received March 3, 1983. Accepted May 21, 1983.

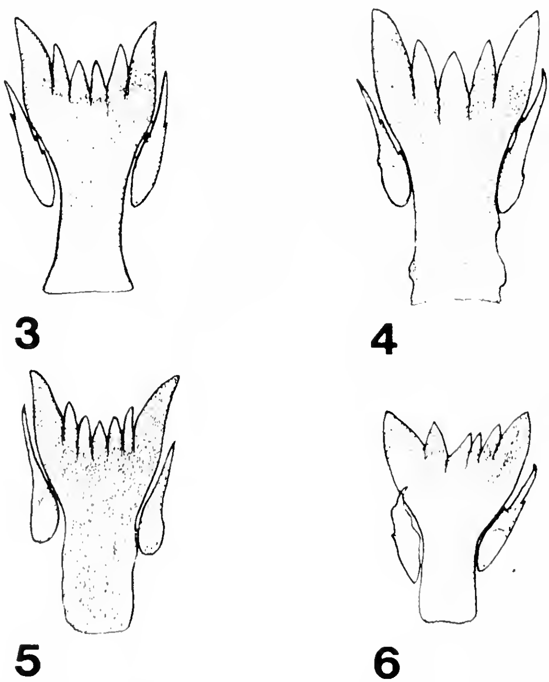
[2]Div. of Air & Water Resources, Tennessee Valley Authority, Knoxville, Tennessee 37902



Figures 1-2. Typical ligula (1) and abnormal ligula (2) of *Ablabesmyia annulata*.

Clinotanypus

The typical *Clinotanypus* ligula has six clear amber teeth (Figure 3). Several *C. pinguis* (Loew) larvae we observed had five or seven teeth (Figures 4 and 5), while another larva had a ligula with six asymmetrical teeth (Figure 6). A total of 9 larvae (3.16 percent) out of the 285 larvae examined possessed atypical ligulas.



Figures 3-6. Typical ligula (3) and abnormal ligulas (4-6) of *Clinotanypus pinguis*.

Because of the variations in the number of teeth between specimens of the same species, the number of ligula teeth is not a totally reliable diagnostic character. In addition, other genera may have the same number of teeth as *Clinotanypus*. Roback (1974) reported *Colelotanypus concinnus* (Coquillett) larvae with six to eight teeth (the usual number of ligula teeth for this genus is seven).

Characters that distinguish *Clinotanypus* larvae from those closely related include: (1) head about 1-1/2 times as long as wide, (2) antennae about 3/4 as long as head, and (3) mandibles hook-like. In addition, a small, lateral spur-like process between the second and third thoracic segments of *Coelotanypus* larvae will help to differentiate them from *Clinotanypus*.

Djalmabatista

The typical ligula of the only North American species, *D. pulcher* (Johannsen), has four black teeth (Figure 7) (See Roback and Tennessen 1978). We have found a high degree of variation in the number and shape of teeth in several populations. Of 1545 larvae examined, 50 (3.24 percent) were atypical. The number of teeth varied from three to six; other configurations included asymmetrical, bifid, and curved teeth (Figures 8-16). The most common abnormal type of ligula had five symmetrical teeth (Figure 12) resembling the *Procladius* ligula and larvae of two South American species of *Djalmabatista* (Roback 1980). Larvae with three teeth cannot be keyed.

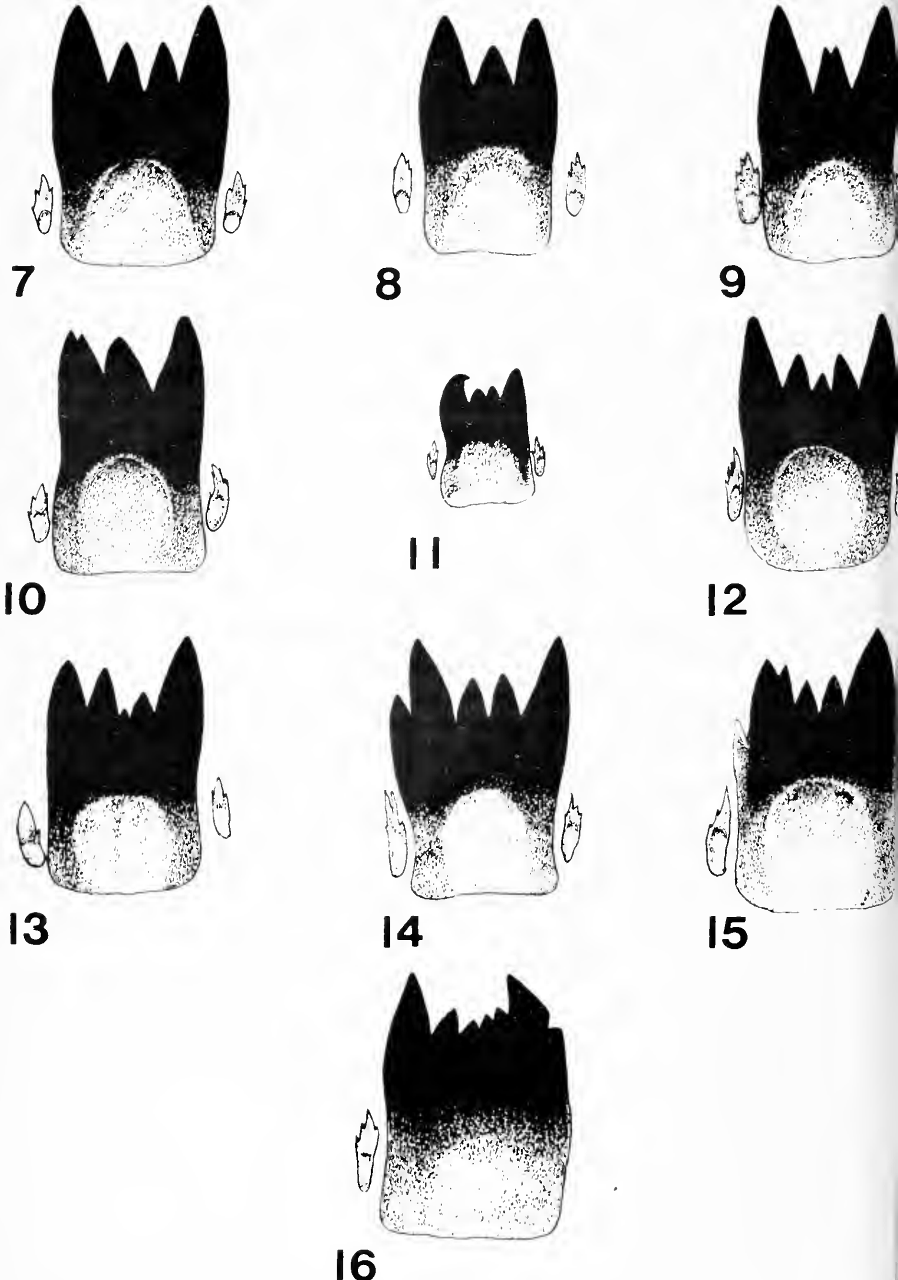
Other diagnostic characters for the genus which should be used in addition to ligula characteristics for accurate taxonomic identification are: (1) blade of antennal segment 1 much longer than combined length of antennal segments 2-4 and (2) mandible with bilobed inner tooth (Roback 1980).

Larsia

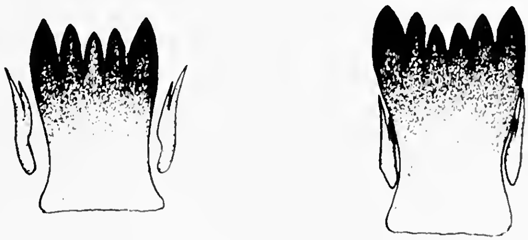
The ligula typically has five dark brown teeth (Figure 17). Out of 110 larva examined, 1 had 6 teeth (Figure 18). The genus is characterized by the combination of: (1) teeth of ligula in concave configuration, with first laterals pointed anteriorly; (2) preanal papillae less than five times as long as wide; and (3) antennas yellow, ant:nnal ratio ± 4.0.

Procladius

The typical ligula of both subgenera (*Psilotanypus* and *Procladius*) has five black teeth, the outer laterals longest, the median shortest (Figures 19 and 24). We examined 223 larvae of *P.* (*Psilotanypus*) *bellus* (Loew) and observed that 10, or 4.48 percent, had atypically shaped ligulas. Variations included four teeth (Figure 20), five asymmetrical teeth (Figures 21 and 22), and six or seven teeth (Figure 23).

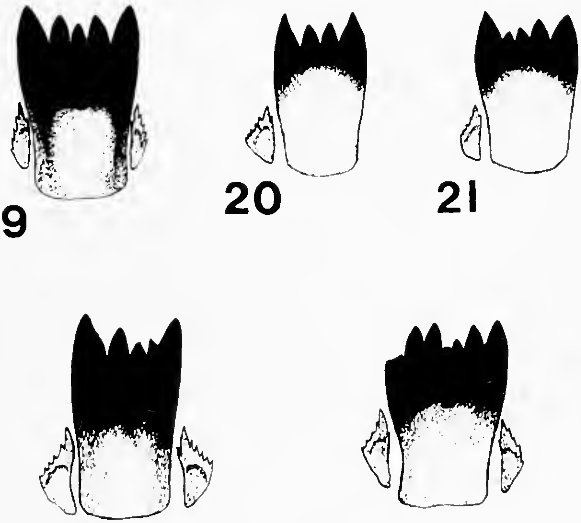


Figures 7-16. Typical ligula (7) and abnormal ligulas (8-16) of *Djalmabatista pulcher*.



17 18

Figures 17-18. Typical ligula (17) and abnormal ligula (18) of *Larsia* sp.



19 20 21 22 23

Figures 19-23. Typical ligula (19) and abnormal ligulas (20-23) of *Procladius bellus.*

A reliable combination of other characteristics for *P. bellus* includes: (1) blade of antennal segment 2 subequal in length to antennal segments 2-4, (2) single tooth on inner margin of mandible, (3) hypopharyngeal pecten with 4-8 teeth, (4) smallest one or two claws of posterior prolegs usually toothed, and (5) ligula of instar IV 61-87 μ (based on Roback 1980).

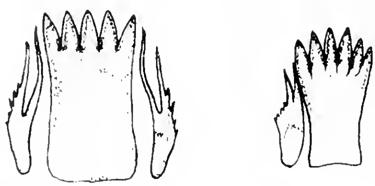
One specimen out of fifty-eight *P. (Procladius) sublettei* Roback larvae examined had an aberrant ligula, with six teeth (Figure 25). Part of one of the median teeth on this specimen was broken off. Otherwise, the specimen resembles an aberrant larvae reported by Roback (1980, Figure 25).

Figures 24-25. Typical ligula (24) and abnormal ligula (25) of *Procladius sublettei.*

Larvae of the subgenus *Procladius* differ little among the species. Roback (1980) offered a provisional key based on size differences. As a group, they differ from *Psilotanypus* in their larger size and the longer apical tooth of the paraglossae (compare Figures 19 and 24).

Tanypus

The typical ligula is pale to light brown, with five teeth; the median tooth and first lateral teeth are as long as or longer than the outer laterals (Figure 26). We have 1 specimen of *T. punctipennis* Meigen with 6 teeth (Figure 27); we examined 12 specimens. The genus is recognizable by the following combination of characteristics: (1) the presence of dorsomental teeth, (2) ligula pale, teeth with tips in convex or straight configuration, (3) body with conspicuous lateral hair fringe, an (4) mandibles thick and bulging in basal three-fourths of their length.



Figures 26-27. Typical ligula (26) and abnormal ligula (27) of *Tanypus punctipennis.*

DISCUSSION

Examination of over 2370 Tanypodinae larvae from northern Alabama revealed that slightly over 3 percent possessed an abnormal ligula, with either more or fewer teeth than dictated for the taxa, or with some type of asymmetry. Although the incidence of ligular abnormalties is low, it shows that most keys rely too heavily on the ligula as a character for distinguishing genera.

The majority of larvae examined were fourth instar, although a few abnormalities were found in second and third instar larvae. Our data indicate that the ligula within the Procladiini is more variable than within the Pentaneurini. For example, some monthly samples of *Djalmabatista pulcher* consisted of over 6 percent abnormal larvae.

Hamilton and Saether (1971) observed deformed chironomid larvae in Lake Erie and in two lakes in British Columbia. Approximately 1 percent of the larvae were affected, the most common deformity being an extremely thickened integument; a few had deformed mouthparts. An analysis of the distribution of deformed larvae in these lakes showed that they occurred in areas receiving industrial discharge or agricultural runoff.

The majority of larvae we examined were from two man-made lakes and three ponds formed in pits from which coal had been stripped in Marion County, Alabama. The percentage of ligula deformities was slightly higher in the combined strip-mine pond samples (Table 1), but was not significantly different that the percentages found in the man-made lakes. Whether certain environmental variables are causative agents during larval development is unknown.

Table 1. Number of larvae with a deformed ligula from three locations in Marion County, Alabama. Numbers in parentheses are numbers of larvae examined.

	Marion County Lake	Strip-Mine Ponds	Buttahatchee Lake
Ablabesmyia	1 (29)	0 (50)	0 (22)
Clinotanypus	1 (35)	4 (73)	4 (177)
Djalmabatista	10 (547)	40 (1014)	0 (2)
Larsia	0 (4)	1 (99)	0 (7)
Procladius	0 (24)	1 (36)	10 (240)
Tanypus	0 (0)	0 (2)	1 (12)
Totals	12 (639)	46 (1274)	15 (460)
	1.88%	3.61%	3.26%

ACKNOWLEDGMENTS

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This volume deals with the sub-families Cliterllariinae, Hermetiinae, Pachygasterinae, plus bibliography.

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A concept oriented collection of 34 laboratory and field behavioral exercises using insects as uniquely suitable animals for behavioral studies.

FOUR ACALYPTRATE DIPTERA REARED FROM DEAD HORSESHOE CRABS[1,2]

Allen L. Norrbom[3]

ABSTRACT: Four species of acalyptrate Diptera were reared from dead horseshoe crabs: *Hecamede albicans* (Meigen) (Ephydridae), *Conioscinella hinkleyi* (Malloch) (Chloropidae), *Coproica vagans* (Haliday) and *C. hirtula* (Rondani) (Sphaeroceridae). The third instar larvae and puparia of *H. albicans* and *C. hinkleyi* are described, and *Urolepsis rufipes* (Ashmead) (Hymenoptera, Pteromalidae) is reported as a parasitoid of *H. albicans.*

In spring and early summer, the beaches of Delaware Bay in the vicinity of Town Bank, New Jersey, become littered with the carcasses of horseshoe crabs, *Limulus polyphemus* L., which crawl ashore to mate and lay their eggs. The decaying crabs provide an excellent larval substrate for a number of Diptera, including the following four species that I was able to rear: *Hecamede albicans* (Meigen) (Ephydridae), *Conioscinella hinkleyi* (Malloch) (Chloropidae), *Coproica vagans* (Haliday), and *C. hirtula* (Rondani) (Sphaeroceridae). These records probably represent an opportunistic use of this locally abundant, temporary resource, as all four species appear to be generalist scavengers.

The flies developed from fifteen dead horseshoe crabs collected from the beach on June 19 and July 5, 1982. The viscera of most of the crabs were dried up or were previously consumed by muscid and calliphorid larvae, leaving mainly the outer sclerotized parts, muscle, and connective tissue. The crabs were placed with moist sand in rearing jars and were stored at 18-23°C. Water was occasionally added to prevent desiccation. Several crabs were dissected and the dipteran larvae and pupae in them collected and preserved or reared separately to allow association with the adults. This paper presents biological observations on these flies and descriptions of some of their immature stages. The morphological terminology of Teskey (1981) is followed in descriptions of the immatures. All specimens studied, unless otherwise noted, were deposited in the Frost Entomological Museum, The Pennsylvania State University or the National Museum of Natural History, Smithsonian Institution, Washington, D.C.

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Hecamede albicans (Meigen)

H. albicans is a common maritime ephydrid found from Massachusetts to Maryland and also in Europe (Wirth 1965). It has been reared previously from rotting lettuce and excrement (Simpson 1976 and pers. comm.) and its congener, *H. persimilis* Hendel, has been found in "foul smelling sand beneath a human carcass" (Bohart and Gressitt 1951) and bred from seaweed (Tenorio 1980). Both species probably develop in a wide range of decaying organic materials.

Adults of *H. albicans* were very common on the dead horseshoe crabs, walking about on their surface and crawling inside them. They frequently extended their mouthparts to feed, or perhaps simply to obtain moisture. Over 200 individuals were reared from the crabs. The larvae were present mainly between the gills and on other moist membranous surfaces, and pupation occurred within the crabs, in the sand, and on the sides of the rearing jar. Descriptions of the third instar larva and the puparium are given below. In both stages, *H. albicans* is very similar to *H. persimilis* (see Bohart and Gressitt 1951; Tenorio 1980), but the tentoropharyngeal sclerite tapers more gradually anteriorly and there are 3 pairs of tubercles on the last segment of the larva.

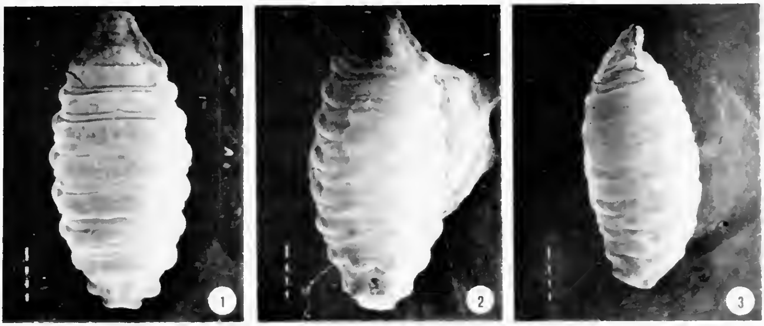
One pupa of *H. albicans* was parasitized by the pteromalid *Urolepsis rufipes* (Ashmead). This wasp previously has been reared from two western Nearctic ephydrids, *Hydropyrus hians* (Say) and *Setecera pacifica* (Cresson) (Burks 1979).

Third Instar Larva (Figs. 4-9): Opaque white; length 4.00 - 4.50 mm; cylindrical, tapering anteriorly, truncate posteriorly. Cephalic segment bilobed anteriorly; antenna (Fig. 5) two segmented, basally surrounded by broader membranous evagination; cephalopharyngeal skeleton about 0.65-0.70 mm long; mandibles (Figs. 6-7) strongly sclerotized, separate, strongly curved anteriorly, with short ventral process at about their midpoint, and with small circular window present at base of ventral process; hypopharyngeal sclerite strongly sclerotized; parastomal bar very slender, not connected posteriorly to tentoropharyngeal sclerite; tentoropharyngeal sclerite gradually tapering anteriorly to acute apex, broad between cornua, strongly sclerotized medially and anteriorly, gradudally weakening dorsally, ventrally, and on apical half of ventral corua; dorsal cornu with small window apically; ventral cornu with larger mesally bent window dorsally near base; pharynx ventrally with longitudinal ridges, and with 2 small dark spots near tips of ventral cornua; anterior spiracle (Fig. 8) short, fan-shaped, six-lobed. Posterior spiracle tube short and cylindrical, slightly projecting in lateral view; spiracular plate (Fig. 9) moderately sclerotized, with inner margins of 3 spiracular openings and ecdysial scar indistinct, and with 4 sets of fine, many-branched hairs. Terminal body segment with 3 pairs of small tubercles (Fig. 4), 1 pair dorsolaterally, 1 pair ventroapically, and 1 pair ventrolaterally.

Puparium (Figs. 1-3): Medium brown, partially translucent; length 2.25 - 2.75 mm, width 1.00 - 1.25 mm. Segmentation obvious, delimited by distinct transverse sutures and ridges. Posterior spiracles very short.

Conioscinella hinkleyi (Malloch)

The chloropid *C. hinkleyi* occurs from Kansas and Pennsylvania south to Georgia and Louisiana (Sabrosky 1965). Kulman (1965) has reared it previously from tents of the eastern tent caterpillar, *Malacosoma americanum*



Figs. 1-3. *H. albicans:* puparium in dorsal, ventral, and lateral views.

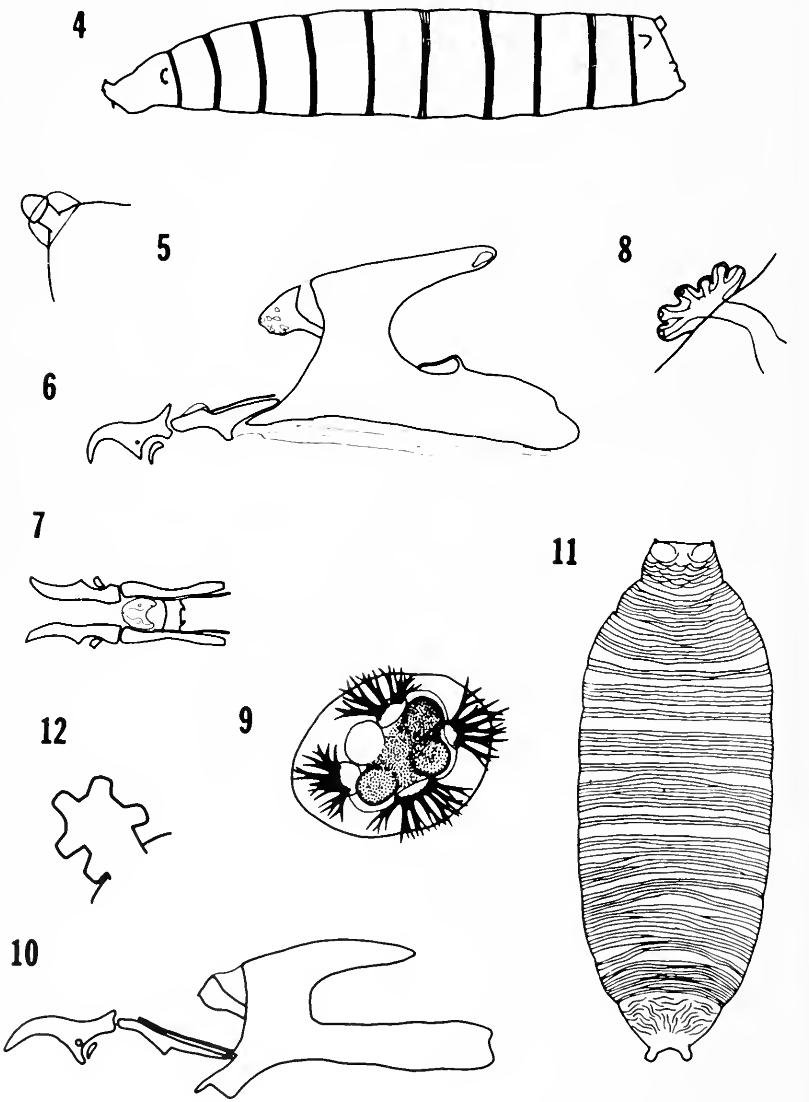
(F.), and Berisford and Tsao (1975), from larval cases of the bagworm *Thyridopteryx ephemeraeformis* (Haworth). Two females were reared in this study; the pupal stage of one was observed to last 7 days. An adult female was also collected on a dead horseshoe crab, and a pupa which failed to develop was found lying on the sand beneath a crab. A phoretic hypopus of a histiostomatid mite was present on the captured adult. Descriptions of the puparium and the remains of the cephalopharyngeal skeleton of the third instar larva are given below.

Third Instar Larva: Cephalopharyngeal skeleton (Fig. 10) about 0.45 mm long; mandibles separate, strongly sclerotized, narrow and slightly curved anteriorly, with narrow ventral process arising just behind middle, and with small circular window present at base of central process; hypostomal sclerite moderately sclerotized; parastomal bar extremely slender, connected to tentoropharyngeal sclerite posteriorly; tentoropharyngeal sclerite weakly sclerotized, especially cornua, anteriorly tapering to finger-like process; dorsal and ventral cornua apparently without windows; pharynx with longitudinal ridges.

Puparium (Fig. 11): Very light golden brown, translucent; length 2.40 mm, width 0.85 mm. Surface transversed by numerous thin, wrinkle-like ridges. Anterior spiracle (Fig. 12) small, with about 5 short lobes. Posterior spiracles slightly projecting.

Coproica vagans **(Haliday)**

C. vagans is a very common, cosmopolitan sphaerocerid frequently found on dung and compost (Richards 1973). Coffey (1966) reared it from chicken, horse, cow, and pig excrement and collected adults on mink droppings. I have also reared it from CMSA media (putrefying mixture of alfalfa meal and wheat bran). Adults of *C. vagans* were very common on the dead horseshore crabs and larvae and pupae were present mainly in the gills and other moist membranous parts. Over 300 individuals were reared. A second generation also developed in the same crabs, although fewer in number than the first generation. Complete development in the crabs and in the CMSA media required 19-23 days, 14-17 for the egg and larval stages and 5-6 for the pupal stage. Goddard (1938) previously described the cephalopharyngeal skeleton of the third instar larva of *C. vagans,* as well as the puparium which is nearly transparent.



Figs 4-9. *H. albicans*: third instar larva; 4 - lateral habitus; 5 - antenna; 6 - cephalopharyngeal skeleton, lateral view; 7 - mandibles, hypopharyngeal sclerite, dorsal view; 8 - anterior spiracle; 9 - posterior spiracular plate.

Figs. 10-12. *C. hinkleyi*: 10 - third instar larva, cephalopharyngeal skeleton; 11 - puparium, dorsal habitus; 12 - puparium, anterior spiracle.

Coproica hirtula (Rondani)

C. hirtula is also a cosmopolitan sphaerocerid, very similar in habit to *C. vagans,* being frequently found in association with dung and refuse of confined animals (Richards 1973). Coffey (1966) reared it (as *Leptocera exiguella* sp. A) from cow, pig, chicken, human, and mink excrement and collected it on sheep dung. A single male emerged from the dead horseshoe crabs.

ACKNOWLEDGMENTS

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BIOLOGY OF *EUXESTA QUATERNARIA* LOEW (DIPTERA: OTITIDAE)[1,2]

Jong S. Yoon, M.T. Mathew, R.E. Holman[3]

ABSTRACT: The picture-winged fly, *Euxesta quarternaria* Loew, was found in southern Florida, closely associated with coconut palm trees. The life-cycle is completed within 37-42 days at 22°C. This species has 2N=12 chromosomes and can be reared in the laboratory. The larvae feed in the apical meristem and other soft growing parts of the palm trees, especially those damaged by lethal yellowing disease.

The life histories of most species of Otitidae are not known. According to Allen and Foote (1967) approximately 450 species have been described, but the larval feeding habits are known for only some 40 species representing 21 genera. The morphology of the immature stages has been studied even less. Thus far, the larvae and pupae have been described for about 10 species in 8 genera, and no adequate descriptions of the eggs or earlier instar larvae have been published.

The genus *Euxesta* includes more than 70 species, most of which are distributed in tropical and subtropical areas (Steyskal, 1968). The larvae of several species have been found in fruits such as oranges, pineapples, melons and apples (see Allen and Foote, 1967). They also attack rotting or damaged onion bulbs and roots of yams. Larvae have been found under the loosened bark of pecan, hickory, American elm, and in the husks of walnuts. The adults of some *Euxesta* species have been reared from larvae in sugarcane and ears of corn (see Allen and Foote, 1967). Nearly all of the reared species of this genus have saprophagous larvae, and very few of the North American species are phytophagous (Oldroyd, 1964).

Euxesta quaternaria Loew is known to be present in the West Indies (Bahamas, Cuba, Saint Thomas, Jamaica) and Panama (Steyskal, 1968). Recently the authors found large numbers of these flies on palm trees in southern Florida even though the presence of them was known earlier in this area (Steyskal, 1983, personal communication). These flies were associated mainly with palm trees affected by diseases including "lethal yellowing." In an attempt to discover any possible relationship between *E. quaternaria* and palm tree diseases, a study of the biology of this species was undertaken.

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MATERIALS AND METHODS

Studies were conducted on both field-collected and laboratory-reared specimens. Eggs and larvae were collected from the soft growing parts (cambial tissues) of the coconut palm trees (*Cocos nucifera* and Malayan dwarf) in southern Florida. These eggs along with the cambial tissue were brought to the laboratory and placed in vials. The hatched larvae were fed on modified *Drosophila* food (Yoon et al., 1972) and/or young coconut fruits. Larval vials were kept in mason jars with moistened sand in the bottom. The 3rd instar larvae pupated in the sand. The adults were studied in both natural and laboratory conditions. The laboratory rearing was done at room temperature (22°C) with a relative humidity of 70%.

The chromosomes were prepared by removing the brain ganglia of the larvae in physiological saline and allowing them to swell in a hypotonic solution of 1% sodium citrate for 10 minutes. The ganglia were then transferred to aceto-orcein stain for 10-15 minutes, mounted in 45% acetic acid solution and then squashed with thumb pressure. Slides were examined and photographed on a Zeiss phase photomicroscope. Kodak panatomic-x 35 mm film and Kodak polycontrast rapid paper F were used in photography (Yoon et al., 1972).

OBSERVATION AND DISCUSSION

The life cycle of the picture-winged fly, *E. quaternaria,* is shown in Figure 1. The eggs are deposited on the soft growing parts of the palm trees. The elongate, oval-shaped eggs (Fig. I. D), 2-3 mm long, vary in numbers from approximately 100-300 per female. The eggs are bone white in color and they hatch within 2-4 days at room temperature (22°C).

The larvae (Fig. I. E) undergo two molts and develop into 3rd instar larvae. The third instar larvae are about 8-10 mm long and 1.4-1.7 mm in width. Well-developed mouth hooks are present in the larvae (Fig. II. B2). It was observed in nature that all larval instars were very active and fed on the soft parts of the palm tree (Fig. II. B), including apical meristem, inflorescence and young fruits. Generally larvae require about 21 days to pupate at 22°C. In laboratory conditions, due to unknown reasons, some larvae took more than one month to pupate. It was found that in the laboratory they pupated in moist paper tissues and/or moistened sand. In nature the larvae pupate in sand at the base of the palm trees. They remain in the pupal stage (Fig. I. F) for about 14-16 days. The pupae are light brown in color.

The adults (Fig. 1.A. & B) emerged on the 14-16th day after pupation. The adults are about 5-6 mm long. The females can be distinguished easily by their elongated pointed telescoping ovipositor (3-4 mm in length) which

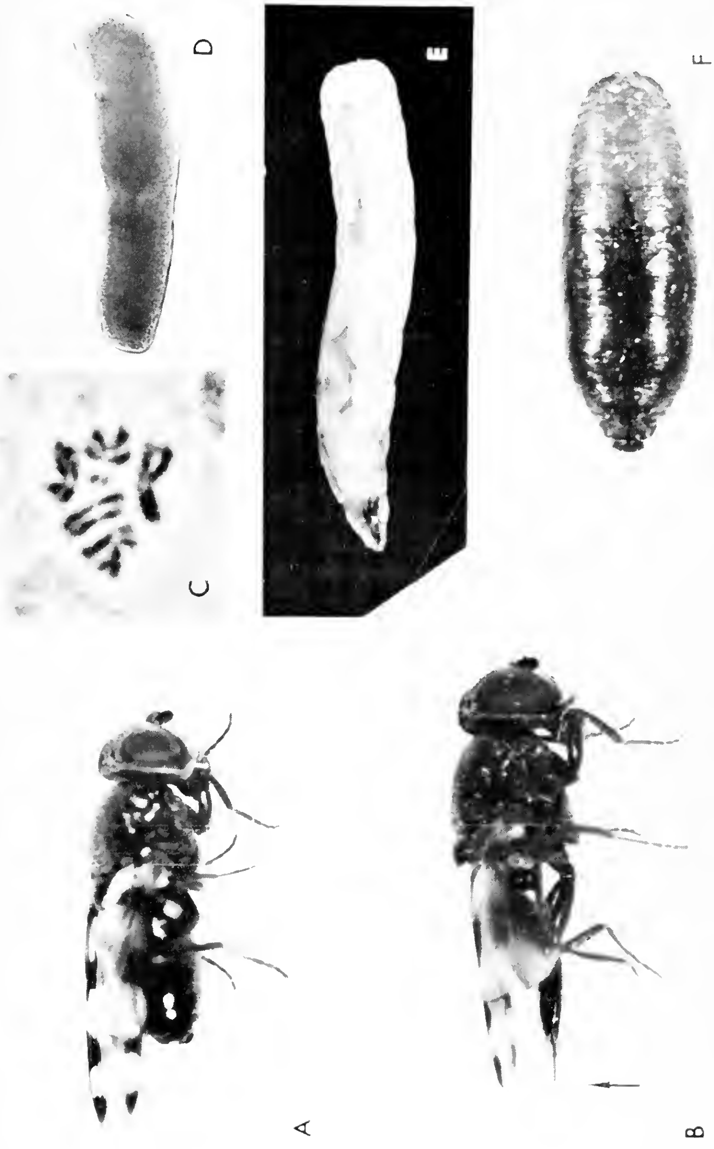

Figure I. Life Cycle of Euxesta quaternaria. A. Adult male. B. Adult female, showing the ovipositor (arrow). C. Metaphase chromosomes (2n=12). 5000X.D. Egg. 70X.E. Third instar larva. F. Pupa.

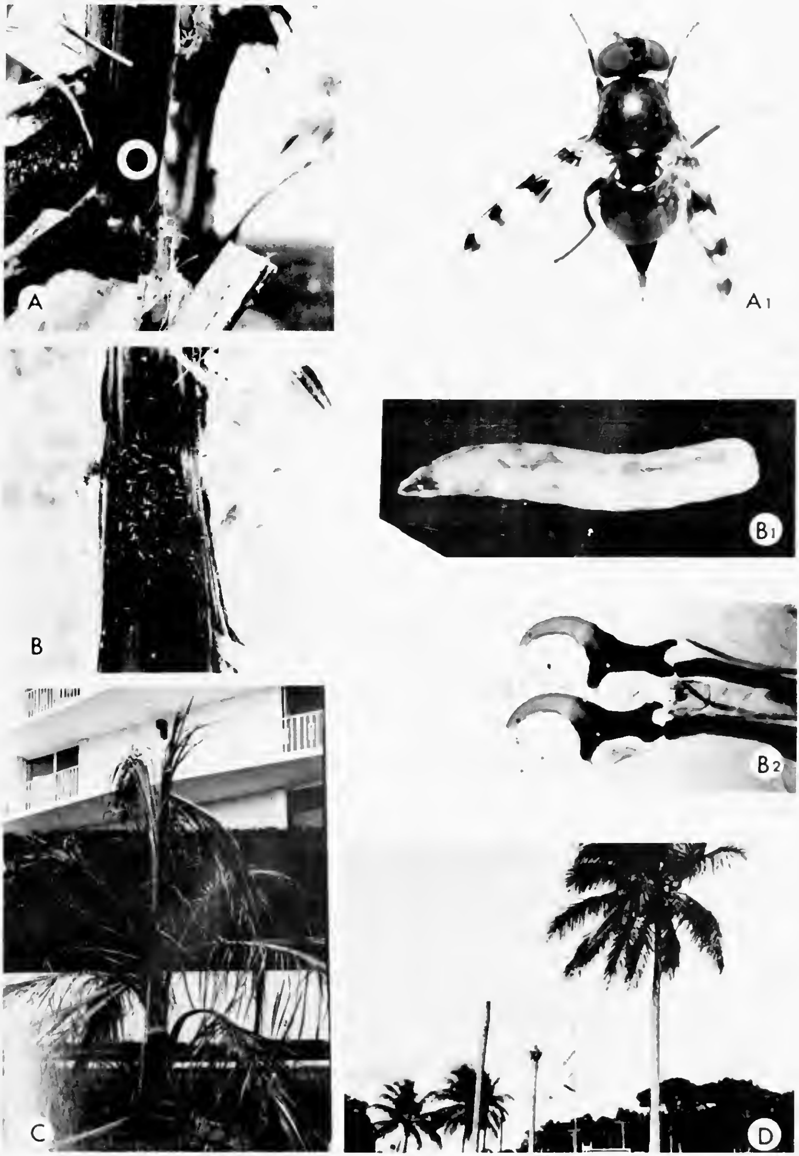

Figure II. Damage to the Coconut Tree by E. quaternaria. A. Adult laying eggs on soft parts of the stem. (In the circle). A1. Female fly. (Notice the ovipositor). B. Larvae (magnified view in B1) feeding on the apical region of palm tree. Enlarged mouth hooks are shown in Fig. B2. C. A young coconut palm tree severely damaged by lethal yellowing and/or by these insects. D. Earlier stages (foreground) of infestation of lethal yellowing disease on mature trees and its final stages (dead trees).

is made up of 3 abdominal segments (Fig. I. B). Females have conspicuous yellow color on the dorsum of the abdomen. In nature, adults are found frequently on the trunks of palm trees. The adults were observed throughout the year, in the early morning or late afternoon, sitting on the sunny side of the trunks. The adults were peculiar in their wing-waving behavior. They move slowly, and constantly wave their dark-banded wings in a to-and-fro motion similar to that of many species of Tephritidae. This wing-waving is probably related to their courtship behavior. Both sexes are found to behave in this manner. This wing-waving behavior was noticed also in the laboratory (Fig. II. A_1).

It was found that *E. quaternaria* has 12 chromosomes (2=12) including one pair of microchromosomes (Fig. I. C). Their polytene chromosomes are ectopically paired as predicted since the metaphase chromosomes have many heterochromatic segments in their genome.

On the basis of the present data available, it is concluded that the life cycle of *E. quaternaria* is associated with palm trees as one of the host plants. The present study indicates that *E. quaternaria* can be reared in the laboratory conditions, therefore it may be possible to establish a direct cause-relationship between the insects and such diseases as "lethal yellowing," by obtaining more data on the biology and ecology of these flies.

ACKNOWLEDGMENTS

We wish to thank Dr. B.A. Foote, Department of Biological Sciences, Kent State University, Kent, Ohio and Mr. George C. Steyskal, U.S. Department of Agriculture, Washington, D.C. for their valuable suggestions and assistance in the identification of the flies in this study. We are grateful to Dr. Robert C. Graves, Bowling Green State University, for his helpful comments on the study and for critically reading the manuscript.

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NEW SPECIES OF *LORETA* AND *ICAIA* (HOMOPTERA: CICADELLIDAE) FROM BOLIVIA AND PERU[1]

Dwight M. DeLong[2]

ABSTRACT: Three species of *Loreta, L. fiski* n.sp. (Peru), *L. Albopunctata* n.sp. (Bolivia), *L. vista* n.sp. (Bolivia) and a species of *Icaia, I. montana* n.sp. (Bolivia), are described.

The genus *Loreta* was described by Linnavuori (1959). New species were described by Linnavuori and DeLong (1978, 1979). The genus *Icaia* was described by Linnavuori (1973). Linnavuori and DeLong (1976) described a Peruvian species. Three new species of *Loreta* and a new Bolivian species of *Icaia* are described in this paper. All types are in the DeLong collection, Ohio State University.

Loreta fiski n.sp.
(Figs. 1-5)

Length of male 3.8 mm. Female unknown. Crown produced, angled, 3/4 as long at middle as wide between eyes at base. Color: crown mostly orange except a v-shaped white spot at apex, a slightly larger angled white spot each side between apex and eye, and a white elongate band extending along eyes and across base, except for a slight interruption at middle; all white markings margined with black. Pronotum mostly grayish brown, a median narrow white band between eyes at base and a rather large roundish grayish spot at middle of pronotum behind each eye. Scutellum orange, 2 median white spots at base, a small white spot in each basal angle and a small median white spot each side and at apex. Forewings greyish white subhyaline, veins dark brown, with a few irregular brownish spots on clavus. Claval area with numerous cross veins.

Male genital plates (fig. 2) 2 times as long as wide at middle, apices narrowed, rounded. Style (fig. 5) with apophysis curved laterally and pointed. Aedeagus with 2 blade-like structures arising at base and extending laterocaudally (fig. 1). Aedeagal shaft rather small, L-shaped laterally (fig. 3), apex bluntly pointed. Pygofer narrowed, rounded apically (fig. 4).

Holotype male: Tingo Maria, Peru 19-VI-1982 at light, Frank Fisk coll. Paratypes: 2 ♂ Bolivia, Santa Cruz 21-IX-1980 Donald Foster coll.

L. fiski differs from all described species of *Loreta* by having 2 blade-like structures arising at base of aedeagus and extending beyond the narrow angled aedeagal shaft.

I take pleasure in naming this leafhopper for the collector, Frank Fisk.

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Loreta albopunctata n.sp.
(Figs. 6-10)

Length of male 3.5 mm, female 4 mm. Crown bluntly angled, more than 2/3 as long at middle as wide between eyes at base. Color: crown whitish, with 2 large squarish proximal brown spots between eyes. Pronotum mostly brownish or dark gray with a whitish area behind each eye and along apical margin. Scutellum white with a brown spot in each basal angle. Forewings brownish, subhyaline with large white spots at apex of claval veins on commissure and on middle of costa. Brown spots on costa and veins margined with darker brown.

Female 7th sternum with posterior margin broadly, concavely rounded.

Male genital plates 2 times as long as wide at middle (fig. 9), apex slightly narrowed, rounded. Style elongate (fig. 8) apical 5th narrowed, rounded. Aedeagus with apical 4th consisting of a process curved dorsally (fig. 7), a long slender process arises at base and extends latero-dorsally. Pygofer rounded apically with a çurved hook (fig. 10) extending caudally on ventro-caudal margin. Pygofer bearing macrosetae on dorsocaudal margin.

Holotype male: Bolivia, Santa Cruz 1-VI-1980, Donald Foster coll. Paratypes: 1 ♀ same data except 21-IX-1980.

L. albopunctata is related to *L. obtecta* Linnavuori (1959, p. 134) and can be separated from it by the more narrowed, curved portion of the aedeagus, in lateral view.

Loreta vista n.sp.
(Figs. 11-15)

Length of male 3.5 mm. Female unknown. Crown bluntly angled, as long at middle as wide between eyes at base. Color: crown white with broad, transverse orange band between anterior portions of eyes. A slight orange ring around white apex. Pronotum dark brownish gray with paler area on each lateral margin. Scutellum white, tinted with orange, with black basal angles. Forewings pale grayish, subhyaline, with a few darker spots on clavus, veins mostly brown.

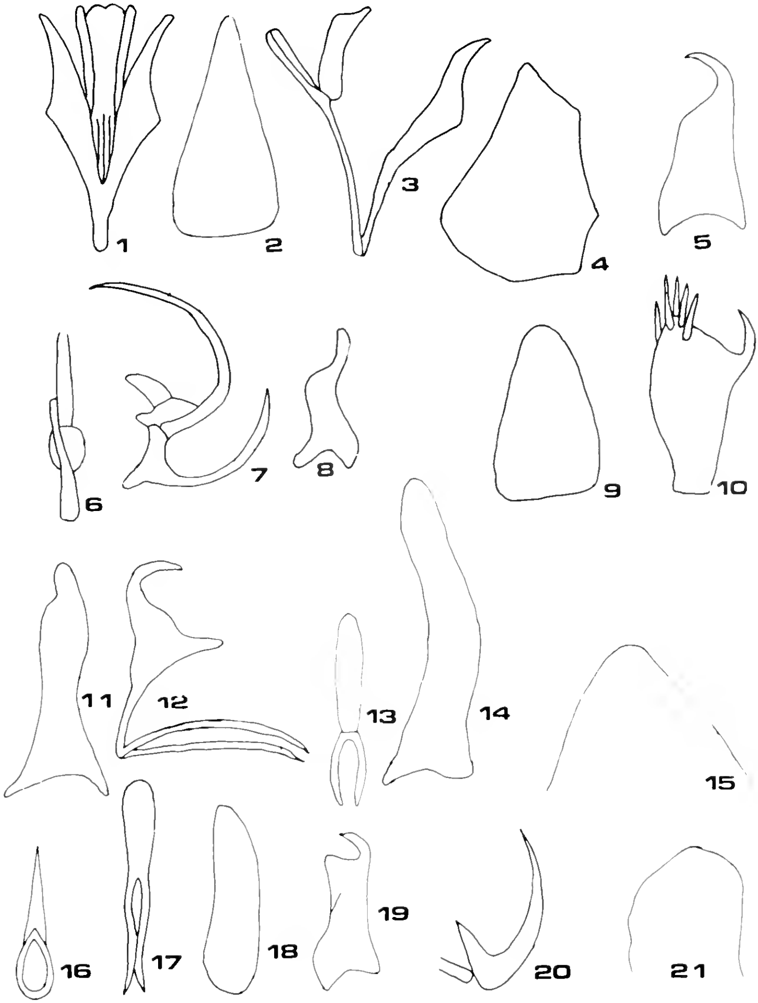
Male genital plates 4 times as long as wide at middle (fig. 14), apices rounded. Style elongate with bluntly rounded apophysis extending caudally (fig. 11). Aedeagus with slender basal portion, broadened at middle dorsoventrally (fig. 12), apical portion narrowed, curved ventrally; with 2 slender processes, 3/4 length of shaft (fig. 12), arising at base of shaft and extending ventrally. Pygofer rounded apically (fig. 15).

Holotype male: Bolivia, Buena Vista 21-V-1980, Donald Foster coll.

L. vista is related to *L. ornaticeps* Linnavuori (1959, p. 155) from which it can be separated by the more broadened (dorsoventrally) central portion of the aedeagus and by the 2 long slender processes arising from its base.

Icaia montana n.sp.
(Figs. 16-21)

Length of male 3.5 mm. Female unknown. Crown bluntly angled, a little wider between eyes at base than long at middle, margin bluntly angled with face. Color: crown pale yellowish with a small black spot at apex, a broad transverse black band, broadened at middle, extending betweeen eyes. Pronotum variable in color, yellowish with disc black and black vermiculate spots on basal half, or almost entirely black. Scutellum black. Forewings black, heavily sclerotized, rugose, extending to 8th tergite.



Figs. 1-5. *Loreta fiski* n.sp. 1. aedeagus ventrally, 2. plate ventrally, 3. aedeagus laterally, 4. pygofer laterally, 5. style ventrally. **Figs. 6-10.** *L. albopunctata* n.sp. 6. aedeagus ventrally, 7. aedeagus laterally, 8. style ventrally, 9. plate ventrally, 10. pygofer laterally. **Figs. 11-15.** *L. vista* n.sp. 11. style ventrally, 12. aedeagus laterally, 13. aedeagus ventrally, 14. plate ventrally, 15. pygofer laterally, apical portion. **Figs. 16-21.** *Icaia montana* n.sp. 16. aedeagus ventrally, 17. connective ventrally, 18. plate ventrally, 19. style ventrally, 20. aedeagus laterally, 21. pygofer laterally, apical portion.

Male genital plates elongate, 4 times as long as wide at middle (fig. 18). Style narrow, elongate (fig. 19), with finger-like apophysis curving laterally. Aedeagus large at base, curving dorsally (fig. 20) and tapered to a slender pointed apex. Connective long and narrow with the basal portion divided and the 2 portions contiguous on basal fourth (fig. 17) Pyrofer rounded apically (fig. 21).

Holotype male: Bolivia, Cochabamba, 20-V-1980. Paratypes 1 ♂ same data as holotype; 1 ♂ 12-V-1981. All specimens collected by Donald L. Foster.

I. montana is related to *I. appendiculata* Linnavuori and DeLong (1967. p. 32) and can be separated from it by the simple curved and tapered aedeagus without apical processes.

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RECENT DEVELOPMENTS IN THE GENETICS OF INSECT DISEASE VECTORS. W. Steiner et al, Eds. 1982. Stipes Publ. 665 pp. $26.00.

A collection of 30 papers from a 1981 symposium aimed at methods of stopping insects that vector parasites.

NEUROHEMAL ORGANS OF ARTHROPODS: THEIR DEVELOPMENT, EVOLUTION, STRUCTURES, AND FUNCTIONS. A. Gupta, Ed. 1983. Chas. C. Thomas, Pub. 629 pp. $74.50.

Twenty contributions, including 13 on Insecta, updating available information on the development, evolution, structure and functions of the neurohemal organs of arthropods.

ADVANCES IN GENETICS, DEVELOPMENT, AND EVOLUTION OF *DROSOPHILA*. S. Lakovaara, Ed. 1982. Plenum Press. 470 pp. $57.50.

This volume offers 37 papers on current research on *Drosophila,* from the morphological to the molecular.

STYGNOCORIS RUSTICUS: NEW RECORDS IN EASTERN NORTH AMERICA, WITH A REVIEW OF ITS DISTRIBUTION (HEMIPTERA-HETEROPTERA: LYGAEIDAE)[1]

A.G. Wheeler, Jr.[2]

ABSTRACT: New state records for *Stygnocoris rusticus* (Fallén), a Palearctic rhyparochromine lygaeid, are given for Michigan, Vermont, West Virginia, and Wisconsin; Prince Edward Island is a new provincial record for Canada. Additional records are provided for Connecticut, Maine, New York, Pennsylvania and Ontario. The known occurrence in the eastern United States and southern Canada is noted and mapped. *S. rusticus* may have been introduced with ballast brought ashore from ships, but it is more likely that it entered much later, perhaps with soil, seeds, or other such material.

Stygnocoris rusticus (Fallén), a common Palearctic rhyparochromine lygaeid, was first reported from North America ("New York") by Heidemann (1908). In eastern North America the known distribution, primarily northern, includes Nova Scotia, Quebec (Montreal area north to Quebec and Tadoussac), Ontario (Ottawa and Ventnor), Maine (eastern coast), Connecticut (Canaan, Storrs), New York (Adirondacks region), and Illinois (Belvidere in extreme north). *S. rusticus* also has been recorded from British Columbia and Washington and thus is one of several Holarctic heteropterans known from northeastern North America and the Pacific Northwest. The lygaeid catalogue (Slater 1964) should be consulted for references to distribution records (except Connecticut — see Sweet 1964). A subsequent record likely to be overlooked is North East (Erie Co.), Pennsylvania, where *S. rusticus* was listed from vineyards as an "incidental species" without collection data (Jubb et al. 1979); a series of specimens was taken in pitfall traps from 28 July to early Sept. 1972 (deposited in the Pennsylvania Dept. of Agric. collection).

In detailed investigations on the rhyparochromine fauna of New England, Sweet (1964) characterized *S. rusticus* as a late-maturing, univoltine species that overwinters in the egg stage. He suggested that the obligate egg diapause may have favored its introduction with man's commerce, probably in ballast dumped from ships sailing from Europe. Sweet found that *S. rusticus* is more common in northern areas (northwestern Connecticut and northward), preferring mesic open fields dominated by tall forbs. It is one of the few rhyparochromines that ascends plants; in early fall it leaves the ground layer, where its diet consists of fallen seeds, to feed on the ripening seed heads of composites like tansy, *Tanacetum vulgare* L., and

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yarrow, *Achillea millefolium* L. (Sweet 1964, Beique and Robert 1964). Sweet also noted that *S. rusticus* is atypical among Rhyparochrominae by exhibiting frequent brachyptery in temporary habitats.

Sweet (1964) suggested that the range of *S. rusticus* in eastern North America might remain nearly boreal, with its southward spread "... limited by the capacity of this insect to survive such a long summer nonreproductive period and then to oviposit vigorously in autumn." Herein, I provide an updated distribution in the eastern U.S. and Canada on the basis of personal collecting and records from museum specimens. *S. rusticus* is recorded for the first time from Michigan, Vermont, West Virginia, Wisconsin, and Prince Edward Island; additional records are given for Connecticut, Maine, New York, Pennsylvania, and Ontario. All new and previously published records are mapped for the U.S. and Ontario, and for most of the localities in southern Quebec (Fig. 1).

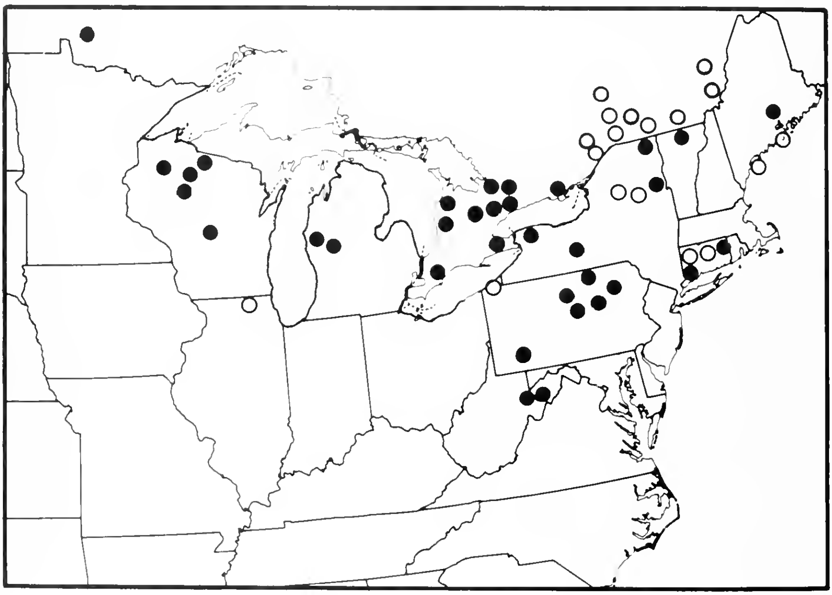

Fig. 1. New records (solid circles) and previously published records (open circles) for *Stygnocoris rusticus* in eastern North America; records for northern Quebec, Nova Scotia, and Prince Edward Island are not shown.

The following data extend the known distribution of *Stygnocoris rusticus* in eastern North America. Voucher material from personal collecting in Pennsylvania and West Virginia (and Genesee Co. and

Ludlowville, NY) is deposited in the collection of the Pennsylvania Department of Agriculture (PDA). Records from Connecticut were obtained from J.A. Slater, University of Connecticut, Storrs (UC); Wisconsin records, from B.J. Harrington, University of Wisconsin-Madison (UW-M). All Ontario records (except for Huron Co.) are based on material in the Canadian National Collection, Ottawa (CNC). Other data were obtained from the following collections: American Museum of Natural History, New York (AMNH); Cornell University, Ithaca, NY (CU); National Museum of Natural History, Washington, DC (USNM); and Royal Ontario Museum, Toronto (ROM).

CANADA. ONTARIO: Dalston, 6 Sept. 1961, Kelton & Brumpton; Eramosa, 5 Sept. 1961, Kelton & Brumpton; Grand Bend, 6 Sept. 1954, C.D.F. Miller; Grimsby, 24 Aug. 1961, Kelton & Brumpton; Huron Co., nr. Silver Cr., Seaforth Hwy. 8, 28 July 1976, D. & W. Maddison (ROM); Kincardine, 7-8 Sept. 1961, Kelton & Brumpton; Oakland, 2 Aug. 1961, J. Brumpton; Orangeville, 24 July 1962, Kelton & Thorpe; Prince Edward Co., 9 Aug. 1925, J.F. Brimley; Sioux Narrows, 8 Aug. 1960, Kelton & Whitney; Smithville, 24 Aug. 1961, Kelton & Brumpton; Thornhill, 15 Aug. 1961, L.A. Kelton; Violet Hill, 5 Sept. 1961, Kelton & Brumpton; Woodford, 6 Sept. 1961, L.A. Kelton.

PRINCE EDWARD ISLAND: Cavendish, 14 Aug. 1959, J.A. Slater (UC), and 13-19 Aug. 1976, L.A. Kelton (CNC).

UNITED STATES. CONNECTICUT: *Fairfield Co.*, Titicus Hamlet, Ridgefield, 2 Sept. 1970, F.P. Maroney; *Windham Co.*, Eastford, 7 July 1976, J.A. Slater (UC).

MAINE: *Penobscot Co.*, Orono, Aug. 1924, I.H. Blake (USNM).

MICHIGAN. *Mason Co.*, 1 Sept. 1947; *Mecosta Co.*, Mecosta, 17 July 1955, R. Dreisbach (USNM).

NEW YORK: *Clinton Co.*, Merrill, 24-26 Sept. 1914, W.D. Appel (USNM); *Genesee Co.*, Bergen Swamp Wildlife Sanctuary, 4 Sept. 1982, AGW; *Tompkins Co.*, Ithaca, 4 Sept. 1968, AGW (CU), and nr. Ludlowville, 4 Aug. 1979, AGW; *Warren Co.*, Warrensburg, 29 Aug. 1959, J.A. Slater (UC).

PENNSYLVANIA. *Centre Co.*, Scotia Barrens, 18 Aug. 1977 and 30 Aug. 1982, AGW; *Clinton Co., Tamarack,*22 Aug. 1977, AGW;*Luzerne Co.*, Dallas, 12 Aug. 1977, AGW; *Montour Co.*, Danville, 23 Aug. 1929 (USNM); *Tioga Co.*, nr. Liberty, 3 Sept. 1982, AGW; *Westmoreland Co.*, nr. Latrobe, 18 Aug. 1982, AGW.

VERMONT. *Orleans Co.*, East Charleston, 24 Aug. 1967 (AMNH).

WEST VIRGINIA. *Tucker Co.*, nr. Blackwater Falls State Park, 15 Aug. 1982, AGW, and Dolly Sods, 14 Aug. 1982, AGW.

WISCONSIN. *Price Co.*, Intersection rts. 8 & 13, 21 Aug. 1982, B.J. Harrington; *Sawyer Co.*, Radisson, 23 Aug. 1982, B.J. Harrington, and 4 mi. E. Stone Lake, Rt. 70, 23 Aug. 1982, B.J. Harrington; *Taylor Co.*, 2 mi. S. Price Co. line, co. rd. C, 21 Aug. 1982, B.J. Harrington, and 2 mi. E. rt. 13 on co. rd M, 21 Aug. 1982, B.J. Harrington; *Vilas Co.*, Arbor Vitae, 21 Aug. 1982, B.J. Harrington; *Wood Co.*, 19 Aug. 1977, K. Thorpe.

All specimens in Pennsylvania and West Virginia were collected by sweeping the seed heads of yarrow or by tapping the heads over a small tray; the collection at Bergen Swamp in New York was made from tansy. Mating pairs were common on these composites. *S. rusticus* was taken mainly during August and early September, and most of the museum specimens examined had been collected from late July to September. The general collector who relies upon sweeping is not apt to encounter this rhyparochromine except in late summer when adults leave the ground layer to feed on ripening seeds.

I often collected *S. rusticus* on yarrow growing along roadsides. In Connecticut, Sweet (1964) reported that larger populations were found in mesic open fields than along roadside edges.

S. rusticus also was abundant in several areas well removed from its known North American distribution. The "Barrens" region of Centre Co., Pennsylvania, lying 100-200 ft. (30-61 m) above the rest of Nittany Valley, is characterized by sandy soil of low fertility. The iron ore industry that flourished in the 19th century and the associated production of charcoal with its frequent fires destroyed the original vegetation; thus, the flora differs strikingly from that of the surrounding area. Scrub oak, *Quercus ilicifolia* Wang., dominates the Barrens. Other characteristic species are aspens, *Populus* spp.; pitch pine, *Pinus rigida* Mill.; and blueberries, *Vaccinium* spp. (Westerfeld 1959). *S. rusticus* also was taken near the tamarack bogs in northern Clinton Co., Pennsylvania; in Bergen Swamp in Genesee Co., New York; and at nearly 4,000 ft. (1,219 m) on Dolly Sods in the Monongahela National Forest, Tucker Co., West Virginia. Dolly Sods is a wilderness area consisting largely of unbroken forest on the steep frontal knobs of the Alleghenies.

The abundance of *S. rusticus* in these areas probably reflects a continuing southward spread of populations rather than a natural Holarctic distribution. As Sweet (1964) noted, the introduced status of *S. rusticus* is supported by its early collection on and near the Atlantic Coast and the rather "immature" pattern of distribution (see Lindroth 1957). *S. rusticus* and the introduced *S. sabulosus* (Schilling) also are the only Western Hemisphere representatives of the otherwise Old World tribe Stygnocorini (Slater 1974; see also Slater et al. 1977). The known distribution in western North America does not point to a trans-Beringian origin; it is not known from Alaska or across northern Canada. *S. rusticus* should be considered an immigrant element in the North American fauna, probably the result of separate introductions to the Atlantic Coast and Pacific Northwest. Although a ballast origin is possible, this lygaeid was detected well after the main ballast period, suggesting an introduction with soil, seeds, packing material around nursery stock, or other products of man's commerce.

ACKNOWLEDGMENTS

I am grateful to B.J. Harrington (UW-M) and J.A. Slater (UC) for allowing me to use their unpublished records of *Stygnocoris rusticus;* to T.J. Henry (Systematic Entomology Laboratory, USDA, c/o U.S. National Museum, Washington, DC) for recording label data from specimens in the CNC and USNM and L.A. Kelton (Biosystematics Research Institute, Agriculture Canada, Ottawa) for allowing access to the CNC; to R.T. Schuh (AMNH) for recording data from specimens under his care; and to M.F. O'Brien (University of Michigan, Ann Arbor) for checking the Univ. Mich. collection for possible specimens of *S. rusticus*. E.R. Hoebeke (CU) and K. Valley (PDA) kindly reviewed the manuscript.

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Westerfeld, W.F. 1959. Flora of Centre and Huntingdon counties with related historical, geological, and physiographic features. Pa. State Univ. Agric. Exp. Stn. Bull. 647, 35 pp.

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INSECT NEUROHORMONES. M. Raabe. 1982. Plenum Press. 352 pp. $42.50.

Neurohormones and their source sites, release modes, and physiological roles are examined in this volume on insect endocrinology.

NEW ZEALAND BUTTERFLIES: IDENTIFICATION AND NATURAL HISTORY. G. Gibbs, 1980. W. Collins Pub. 207 pp. $45.00. Available from ISBS, Box 1632, Beaverton, OR 97075.

A conspectus of information on most aspects of butterfly life, aranged systematically, and an identification guide through use of identification keys, illustrations, and maps. Every species known to breed in New Zealand is described and illustrated in color.

NEW RECORDS OF NORTH AMERICAN ODONATA[1]

Sidney W. Dunkle[2]

ABSTRACT: New records, including 28 state records, 11 range extensions, and 12 flight date extensions are given for 36 species of Nearctic Odonata. *Aeshna multicolor* Hagen is deleted from the Missouri fauna. Behavioral and habitat notes are given for *Arigomphus maxwelli* (Ferguson) and *Aeshna mutata* Hagen.

This paper includes geographical and temporal information on Nearctic Odonata accumulated by the author since 1975. Data obtained prior to that year are given in Dunkle (1975). The Anisoptera records listed below are in the same sequence as in Needham and Westfall (1955). One or more substantiating specimens are placed in the Florida State Collection of Arthropods (FSCA) at Gainesville, and specimens were collected by the author (SWD), unless otherwise noted.

Hagenius brevistylus Selys. VERMONT, Essex Co., outlet Dennis Pond, 17 July 1982, 6 ♂♂. New VT record. Also listed for VT in Carle (1982).

Octogomphus specularis Hagen. CALIFORNIA, Fresno Co., Fancher Creek, 8 April 1977, 1 ♀ exuviae. New early date.

Arigomphus maxwelli (Ferguson). MISSISSIPPI, Sharkey Co., Blue Lake and Barge Lake, 20-21 May 1981, and a large pond on MS 16, 15 km SE Rolling Fork, 22 May 1981. New MS record. Blue Lake and Barge Lake are inter-connected, swampy, muddy sloughs. Here, a number of ♂♂ and 2 teneral ♀♀ were collected. The mature ♂♂ perched in small sunlit areas in the swamp on the mud at the edge of the water, on logs near shore, or occasionally on leaves low over the water. They avoided open shoreline and logs in open water, and I did not find them in small forest sunspots. They were present at the water beginning about 1000, and definitely dwindled in number after 1330. They usually perched with their abdomens held horizontally, but sometimes raised their abdomens 45 degrees, probably to decrease body temperature. Two exuviae were found 2-10 cm above the water on logs. At the pond on Route 16, which had open shores, several ♂♂ were present about 1000, but seemed to be driven away by males of the larger *Arigomphus submedianus* Williamson which arrived in greater numbers later in the morning. *A. submedianus* was not present at Blue Lake or Barge Lake. One *A. maxwelli* oviposited while hovering 10 cm up, by tapping the tip of the abdomen to the water along the shoreline while facing the bank. At another locality, in Arkansas, 2 ♂♂ perched on a semi-shaded duckweed (*Lemna* sp.) mat in a slow small river.

A. villosipes (Selys). MISSOURI, Shannon Co., Lewis Lake 3 km N of Winona, 8 June 1981, 1 ♂. New for MO and western range extension.

Gomphus consanguis Selys. GEORGIA, Walker Co., E fork of East Armuchee Creek, SE of Villanow, 14 June 1979, 1 ♂ 1 ♀, SWD Collection. New for GA and southern range extension.

G. rogersi Gloyd. GEORGIA, Lumpkin Co., Hidden Lake 15 km NW of Dahlonega, 18 June 1979, 1 ♂ 1 ♀, SWD Collection. Gilmer Co., Big Turniptown Creek at GA 5, 13 April 1980, 3 larvae (Louton, 1982). New GA records and southern range extension.

G. graslinellus Walsh. TEXAS, Real Co., Nueces River at Barksdale, 15 March 1978, 1 ♂ 1 ♀ reared, SWD Collection. Southwestern range extension.

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[2]Bureau of Entomology, Division of Plant Industry, Box 1269, Gainesville, Florida 32602.

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G. apomyius Donnelly. MISSISSIPPI, Lauderdale Co., Chickasawhay River at U.S. 80, 1.7 km E of Chunky, 17 May 1981, 1 ♀, SWD Collection. New late date.

G. parvidens Currie. GEORGIA, Richmond Co., Sandy Run at U.S. 1, 16 May 1982, 2 ♂♂ 1♀. New GA record.

Stylogomphus albistylus (Hagen). ALABAMA, Tuscaloosa Co., Cooley Creek, 14 May 1939, collector unknown, 1 ♀. VERMONT, Essex Co., outlet McConnell Pond at VT 105, 14-15 July 1982, 5 ♂♂ 2 ♀♀. New early date and VT record.

Stylurus amnicola (Walsh). GEORGIA, Houston Co., Ocmulgee River at GA 96, 21 June 1982, 5 ♂♂ 1 ♀. New GA record and southeastern range extension.

Boyeria grafiana Williamson. GEORGIA, Lumpkin Co., Dick's Creek 5.7 km N of U.S. 19, 31 Aug 1975, 1 ♂. White Co., Hiwassee River at GA 75, 2 Aug. 1981, 4 ♂♂, collected by J. Daigle and in his collection. VERMONT, Essex Co., outlet Wheeler Pond at VT 102, 16 July 1982, 2 ♂♂. New VT and GA records, the latter a southern range extension. Also listed for VT in Carle (1982).

Anax longipes Hagen. MISSOURI, Oregon Co., pond 0.3 km W of MO 19 on Mark Twain National Forest Road 3174, 7 June 1981, 1 ♂ exuviae. One mature ♂ also seen. New MO record.

Aeshna mutata Hagen. MISSOURI, same data as *Anax longipes*, 7 ♂♂. New MO record and western range extension. According to Needham and Westfall (1955), the very similar species *A. multicolor* Hagen ranges E to Nebraska, Kansas, and Texas, but their record for MO was apparently based on the "Upper Missouri" in Hagen (1861). Thus *A. multicolor* should be deleted from the MO fauna.

The MO habitat for *Anax longipes* and *Aeshna mutata* as well as *Lestes eurinus* Say was a small man-made pond, about 20 X 70 m. The abundance of these uncommon odonates at this pond was no doubt due to its lack of fish, although larval newts were common. Up to 3 ♂♂ *A. mutata* at a time patrolled the pond, especially in the shade, until 2016 at a height of 15-25 cm. They rested in the trees after patrolling for periods of about 15 min. The patrol flights were leisurely, erratic, and mostly well out from shore, with the abdomen slightly raised and the wings beating only a little below the horizontal plane. From 1937-2030, females were ovipositing in the underwater parts of the flower stems of water-shield (*Brasenia* sp.), almost entirely in the middle of the pond.

A. persephone Donnelly. ARIZONA, Cochise Co., Cave Creek at John Hand Dam W of Portal, 23 Oct 1976, 4 ♂♂ 1 ♀, SWD Collection. New late date. These specimens were taken in cool weather as they flew closely along the shoreline at times when the sun had been shining for periods of at least 5 min.

A. umbrosa umbrosa Walker. GEORGIA, Fannin Co., Edmunson Fish Rearing Pond N of Hawk Mountain, 27 Oct. 1951, 2 ♂♂, collected by W.H. Cross. Hall Co., Owens Farm near Gainesville, 2 April 1979, 15 larvae, collected by M.J. Westfall. Towns Co., Bald Mountain Park, 1 Sept. 1975, 1 ♂. These new GA records are at the southern edge of the species range.

A. walkeri Kennedy. CALIFORNIA, Madera Co., small tributary to Kerckhoff Reservoir, 13 June 1977, 2 exuviae, SWD Collection. Fresno Co., Sycamore Creek at Pine Flat Reservoir, 9 Nov. 1976, 5 ♂♂, SWD Collection. New range of dates.

Macromia margarita Westfall. NORTH CAROLINA, Macon Co., Cullasaja River 6.7 km W of Highlands on U.S. 64, 5 Aug. 1981, 1 ♂ 1♀, SWD Collection, J. Daigle Collection. New late date.

Neurocordulia virginiensis Davis. ARKANSAS, Montgomery Co., Ouachita River at U.S. 270, 28 May 1981, 1 ♀. New for AR.

N. yamaskanensis (Provancher). NORTH CAROLINA, Macon Co., Little Tennessee River at Iotla, 24 June 1982, 1 ♂. New NC record.

Epitheca costalis (Selys). ILLINOIS, Gallatin Co., Pounds Hollow Lake, 11 June 1981, 2 ♂♂, 1 ovipositing ♀, SWD Collection. MISSOURI, Wayne Co., Markham Springs, June 1981, 5 ♂♂. New IL and MO records, the former a northern range extension. These specimens were tentatively determined as *E. costalis* by K.J. Tennessen and the author. However, *E. costalis* is nearly identical morphologically with *E. spinigera* (Selys) of IL and northward, and *E. petechialis* (Muttkowski) of Kansas and westward. These 3 species and the enigmatic *E. williamsoni* (Muttkowski) urgently need critical study. At the IL locality, *E. cynosura* (Say) was flying mixed in with *E. costalis* on sex patrols.

E. petechialis (Muttkowski). TEXAS, Val Verde Co., Sycamore Creek at U.S. 90, 14 March 1978, 1 teneral ♀. New early date.

Somatochlora elongata (Scudder) GEORGIA, White Co., Chattahoochee River at Robertstown, 25 May 1979, 1 reared ♀, SWD Collection. VERMONT, Essex Co., outlet McConnell Pond at VT 105, 15 July 1982, 3 ♂♂. Also listed for VT in Carle (1982). New VT and GA records, the latter a slight southern range extension.

S. georgiana Walker. MISSISSIPPI, Jackson Co., Big Cedar Creek at S-63, 29 June 1968, 1 ♀, collected by W.F. Mauffray and W. Walters. Wayne Co., stream 5 km E of Buccatunna, 11 Aug. 1977, 1 ♂, SWD Collection. New MS records.

S. minor Calvert. VERMONT, same data as *S. elongata,* 1 ♂. New VT record.

S. walshii (Scudder). VERMONT, same data as *S. elongata,* 1 ♂ 1♀. Also listed for VT in Carle (1982). New VT records.

S. williamsoni Walker. VERMONT, Essex Co., outlet Spectacle Pond, 14 July 1982, 3 ♂♂. Also listed for VT in Carle (1982). New VT records.

Ladona deplanata Rambur. MISSOURI, Oregon Co., McCormack Lake, 7 June 1981, 1 ♂ 1 ♀, SWD Collection. Wayne Co., Upalika Pond 11.7 km E of Ellsinore, 9 June 1981, 1 ♂. New MO records.

Libellula forensis Hagen. CALIFORNIA, Fresno Co., Lost Lake, 25 April 1977, 1 ♂, SWD Collection. New early date.

Sympetrum rubicundulum (Say). GEORGIA, Rabun Co., pond W of Moccasin Creek State Park, 29 Aug. 1978, 15 ♂♂. White Co., Dukes Creek at GA 75, 18 June 1979, 1 ♂. New GA records and southern range extension.

Erythemis collocata (Hagen). CALIFORNIA, Fresno Co., Lost Lake, 25 April 1977, 1 mature ♂. New early date.

Archilestes californica MacLachlan. CALIFORNIA, Fresno Co., Sycamore Creek at Pine Flat Reservoir, 9 Nov. 1976, 7 ♂♂ 1 ♀. New late date.

Lestes eurinus Say. VIRGINIA, Highland Co., Locust Spring beaver pond, 4 July 1981, 1 ♂, SWD Collection. Giles Co., Mt. Lake Biological Station, 17-22 July 1978, 14 ♂♂ 5 ♀♀, collected by F.C. Johnson. New VA records.

L. rectangularis Say. GEORGIA, White Co., Helen, 26 March 1979, 4 ♂♂. New early date.

Enallagma hageni (Walsh). VIRGINIA, Highland Co., Locust Spring Beaver Ponds, 4 July 1981, 9 ♂♂ 3 ♀♀. Giles Co., Mt. Lake Biological Station, 17-22 July 1978, 2 ♂♂, collected by F.C. Johnson. New VA records.

Nehalennia gracilis Morse. GEORGIA, White Co., spring ponds at Dukes Creek and GA 75, 25 May 1979, 1 ♂. New GA record.

ACKNOWLEDGMENTS

I thank Minter Westfall and Jerrell Daigle for permission to include some of their records, and Minter Westfall, George Bick, Juanda Bick, and Leonora Gloyd for reading the manuscript.

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NEW RECORD FOR *IXODES TEXANUS* (ACARINA: IXODIDAE) BANKS IN MISSISSIPPI, WITH A NEW HOST RECORD[1,2]

Jerome Goddard[3], B.R. Norment[3]

ABSTRACT: Nymphs of *Ixodes texanus* were collected in Marshall County, Mississippi from raccoon, rabbit and mice. This collection represents a new state record and the white-footed mouse is a new host record for the nymph.

Ixodes texanus Banks, the raccoon tick, is an important parasite of raccoons in the eastern United States and is known from at least 30 states (Clifford et al, 1960; Darsie and Anastos, 1957; Keirans and Clifford, 1978). Hosts include raccoon, ground squirrel, gray squirrel, pine squirrel, weasel, marten, chipmunk, mink, opossum, rabbit, gray fox, woodchuck, and domestic dog (Clifford et al, 1960; Cooley and Kohls, 1945; Cooney and Hays, 1972; Cooney and Burgdorfer, 1974).

In a study of tick and rickettsial infections of mammals in northern Mississippi, 21 nymphs of *I. texanus* were collected: 14 from two raccoons, *Procyon lotor;* 4 from two cottontail rabbits, *Silvilagus floridanus;* and 3 from a white-footed mouse, *Peromyscus leucopus* (Stricklin, 1975).

The presence of this tick in Mississippi has never been reported but was predicted in light of the results of surveys conducted in other Southern states (Cooney and Hays, 1972; Lancaster, 1973).

Raccoon and rabbits have been previously reported as hosts for *I. texanus,* but the white-footed mouse represents a new host record for the nymph of this species. With the exception of 2 specimens which are in the MSU collection, all specimens are deposited in the Rocky Mountain Laboratories Collection.

New Records

Marshall Co., Wall Doxey State Park, 7-III-1975, L.S. Stricklin, raccoon, 11 nymphs, 23-III-1975, L.S. Stricklin, raccoon, 3 nymphs; 20-V-1975, L.S. Stricklin, cottontail rabbit, 2 nymphs; 13-VIII-1975, L.S. Stricklin, cottontail rabbit, 2 nymphs; 12-IV-1975, L.S. Stricklin, white-footed mouse, 3 nymphs.

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[2]Publication No. *5405* of the Mississippi Agricultural and Forestry Experiment Station.

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BOOKS RECEIVED AND BRIEFLY NOTED (Continued)

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This book records the proceedings of the International Conference on Insect Cells, Sapporo, Japan, August, 1982. Subject matter is same as in INSECT ULTRASTRUCTURE.

INSECT ULTRASTRUCTURE, Vol. 1. R.C. King & H. Akai, Eds. 1982. Plenum Press. 485 pp. $55.00.

Up to date reviews on selected aspects of the ultrastructure of gametes, of developing cells, and of the development, differentiation, and functioning of specialized tissues and organs. From the proceedings, International Conference on Insect Cells.

NEW RECORD OF MAYFLY *BAETISCA RUBESCENS* (PROVANCHER) FOR WEST VIRGINIA (EPHEMEROPTERA: BAETISCIDAE)[1]

Donald C. Tarter, Daniel K. Pettry[2]

ABSTRACT: A new distribution record for *Baetisca rubescens* (Provancher) is reported for West Virginia. Seven mature nymphs were collected from Red Creek, Tucker County, West Virginia. Prior to this collection, *B. rubescens* has been reported only in the northeastern region of North America from New Hampshire to Quebec.

Baetisca rubescens (Provancher) is reported for the first time in West Virginia. Seven mature nymphs were collected on 1 October 1976 from Red Creek, Tucker County, West Virginia. Pescador and Berner (1981) provided excellent characters to separate the nymphs from the closely related *B. berneri* Tarter and Kirchner and *B. carolina* Traver.

Prior to this state record, four species of *Baetisca* have been reported from West Virginia: (1) *B. carolina* (Monongalia County) (Needham et al., 1935); (2) *B. callosa* Traver (Greenbrier, Mineral and Preston counties) (Needham et al., 1935; Faulkner and Tarter, 1977); (3) *B. bajkovi* Neave (= *B. lacustris* McDunnough) (Lewis, Lincoln, Pleasants and Wayne counties) (Faulkner and Tarter, 1977); and (4) *B. berneri* (Mingo County) Tarter and Kirchner, 1978). However, Pescador and Berner (1981), after making a careful study of paratypes of *B. callosa* from West Virginia, concluded that the species is not recognizable. Their examination of young nymphs of several species has shown that specimens which could be identified as *B. callosa* were collected along with more mature, easily recognizable older nymphs. Efforts are being made to collect and rear specimens from the type locality to help solve the taxonomic problem.

The closely related *B. berneri, B. carolina,* and *B. rubescens* occur in the cool mountain streams of the Appalachians. *Baetisca carolina* is found in Georgia, North and South Carolina, Tennessee, Virginia, and West Virginia, while *B. berneri* is known from Pennsylvania, Tennessee, Virginia and West Virginia (Needham et al., 1935; Pescador and Berner, 1981). *Baetisca rubescens* has been collected only in the northeastern region of North America from New Hampshire to Quebec. Pescador and Berner (1981) suggested these species represent a group that was either pushed or trapped in the streams of the Appalachians during Pleistocene glaciation. The collection of nymphs from Red Creek, a cool mountain stream in West

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Virginia, helps to bridge the gap from the disjunctive species *B. rubescens* to the sister species *B. berneri* and *B. carolina.*

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Over 260 arthropod species were recorded in a survey of potential pests and their enemies. 115 fine color photographs provide a ready field guide to identification.

VARIABLE PLANTS AND HERBIVORES IN NATURAL AND MANAGED SYSTEMS. R. Denno & M. McClure, Eds. 1983. Academic Press, 717 pp.

Understanding the dynamics of plant-herbivore relationships and applying this knowledge in agriculture and silviculture are the themes of this volume.

WINDBORNE PESTS AND DISEASES: METEROLOGY OF AIRBORNE ORGANISMS. D.E. Pedgley. 1982. Halsted Press: John Wiley & Sons. 250 pp. $59.95

This book describes and explains the influence of the atmosphere on the wind-borne movement of small organisms, and how they get into and out of the atmosphere. It is a book for biologists, entomologists and ecologists, by a meteorologist.

A MUTILLID MIMIC OF AN ANT (HYMENOPTERA: MUTILLIDAE AND FORMICIDAE)[1]

George C. Wheeler[2]

ABSTRACT: The female of the Central American mutillid *Pappognatha myrmiciformis* mimics the major worker of the common Neotropical ant *Camponotus sericeiventris.* It is hypothesized that the mimicry is aggressive and may enable the mimic to oviposit on the brood of the model.

"*Camponotus (Myrmepomis) sericeiventris,* owing to its size, wide distribution and dense covering of silver or golden pubescence, is one of the handsomest and most conspicuous ants of the American tropics" (W.M Wheeler 1931: 86), and one might add, considering the defensive capabilities of a populous colony of large *Camponotus* species, a likely model for mimics. Dr. Wheeler continued (p. 87): "Some years ago Dr. J. Bequaert gave me several peculiar Cerambycid beetles which he had taken June 4, 1924, on tree trunks at Prieta, Honduras, in company with workers of *C. sericeiventris rex* var. *semirex.* The beetles so closely resemble the ants that they may be regarded as highly mimetic."

In 1897 Cameron described (p. 378) a new species of mutillid *Sphaerophthalma myrmiciformis* from a female collected at Bugaba, Panama, and commented that "this species bears a great resemblance to the not uncommon Central-American ant *Camponotus sericeiventris,* amongst specimens of which it was placed in the box when received by me; but I know not if they are found together in nature."

In 1939 Mickel transferred the mutillid species (p. 336) to his new genus (p. 330) *Pappognatha* and adds the following records (all females) from Costa Rica: Zent; "Las Mercedes, bei San Jose. . . on blossoms of Tuga;" Irazu.

Dr. Karl V. Krombein has kindly supplied me with copies of all significant literature of *P. myrmiciformis,* i.e., the two papers mentioned above. In his covering letter (19 January 1983) he stated: "*Pappognatha* has a long, and presumably potent, sting so probably the mimicry should not be ascribed to a requirement for protection by the wasp. We have in the USNM a specimen of *P. speciosa* Mickel reared from the euglossine bee, *Euglossa brullei* Lepeletier, and that is the only host record known to me."

While collecting a sample of *Camponotus sericeiventris* (Guérin) on Barro Colorado Island in Panama, I noticed a specimen running with a

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peculiar gait. Fortunately I realized just in time that it was a mutillid. Had it been motionless I might have been severely stung as a result of its close resemblance in life to major workers of the ant. This close resemblance is somewhat less evident in Fig. 1, because the color of the golden pubescence of both species does not show in a black-and-white photograph, while the spots on the gaster of the mutillid do show. Mickel stated that *P. myrmiciformis* "differs from other species in the genus in being [almost] entirely pale golden tomentose. . . The yellow, integumental spots on the [gaster] are. . . almost obscured by the pale, golden, tomentose pubescence."

Mimicry is obvious but what purpose does it serve? Certainly not defense, for mutillid females are armed with long powerful stings. But the ant is not defenseless: the major worker of large species of *Camponotus* can easily cut the tough skin of human fingertips. Mutillids are known to be external parasitoids on the larvae and pupae of bees and wasps. Why not ants? Certainly the mature larvae and pupae of the females of this ant are larger than *P. myrmiciformis.*

I would therefore hypothesize that this is an example of aggressive mimicry; the close resemblance may enable the female of *Pappognatha myrmiciformis* to enter the nest of *Camponotus sericeiventris* and deposit her eggs on the brood of the latter; if detected she is quite capable of defending herself.

Fig. 1. Photograph by Jeanette Wheeler comparing the dried specimens of the mutillid (left) *Pappognatha myrmiciformis* (Barro Colorado Is., Panama; coll. G.C. Wheeler; 22-VII-1924; det. C.E. Mickel) and a major worker of the ant (right) *Camponotus sericeiventris* (Changuinola District, Bocas del Toro, Panama; coll. G.C. Wheeler: 2-VIII-1924).

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AN AGGREGATION OF *CHALYBION CALIFORNICUM* (HYMENOPTERA: SPHECIDAE) IN A BELL[1]

Kenneth Schoenly[2], Diane M. Calabrese[3]

ABSTRACT: Wasps of the species *Chalybion californicum* aggregated in a bell. Initial contact with the bell was probably fortuitous, but later contact may have been mediated by a pheromone.

During the summers of 1980 and 1981 (from about June through August) a population of *Chalybion californicum* (Sphecidae) aggregated in a bell (15 cm. diameter, 25 cm. high) on the porch of a house in the upper Rio Grande valley in El Paso, Texas The bell hung on the west-facing exposure of the building 6 feet off the ground. Aggregations of 50-100 individuals were noted. We also observed the wasps aggregating in knot holes in the rafters and support posts under the porch.

Aggregations of *C. californicum* are common (Bohart and Menke 1963). Large groups have been found on the undersurface of overhanging rocks (Rau 1928) and on rafters (Rau 1938). This is the first report of an aggregation on a metal structure.

The gregarious behavior of the wasps within and around the bell closely approximates that described by Ward (1972) for the species in Indiana. *C. californicum* she studied roosted among shingles, under an overhanging rock and on rafters. She found that most of the wasps roosted before sunset — beginning about 2 hours before sunset. After dark the wasps were not disturbed if a light was focused on them. Similarly, the wasps we observed roosted before dusk and were undisturbed by beams of light. Ward (1972) proposed that the initial choice of a roost by *C. californicum* may be "based on temperature" (higher temperatures selected), and that return to the roost on successive nights may be mediated by a pheromone.

The presence of wasps in the rafters and support posts of the porch from which the bell hung, as well as in the bell, indicates that initial contact with the bell may have been fortuitious. However, once the bell was located, perhaps its warmer temperature (or a pheromore) caused the wasps to return on successive nights.

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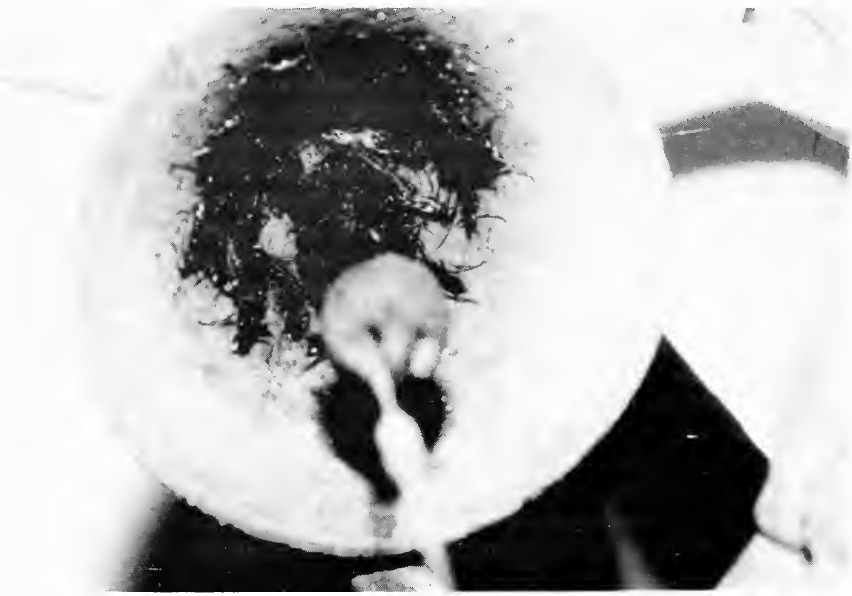

Figure 1. An aggregation of *Chalybion californicum* in a bell.

ACKNOWLEDGMENT

We are grateful to A.S. Menke, of the Systematic Entomology Laboratory, USDA, who identified the wasp specimens for us.

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INSECTS VISITING FLOWERS OF WILD RED RASPBERRY IN SPRUCE-FIR FORESTED AREAS OF EASTERN MAINE[1]

Richard W. Hansen, Eben A. Osgood[2]

ABSTRACT: Flower-visiting insects were collected from wild red raspberry (*Rubus idaeus* L.) flowers in spruce-fir forested areas of eastern Maine in 1981. Collections included 5 insect orders and 49 families. At least 38 species of Syrphidae, including 2 new species, and 47 species of Apoidea were represented. The most commonly collected visitors were *Dialictus* spp. bees and Syrphidae. Native Apoidea are probably the primary pollinators of *R. idaeus* in Maine, though some of the more pubescent Coleoptera and Diptera, particularly the syrphids probably have a pollinating function.

Red raspberry, *Rubus idaeus* L.[3], is a common shrub in Maine, growing in a variety of well-exposed situations. It is especially common in cuttings or natural openings in forested areas. It produces biennial canes that reach 2 m in height, from a perennial rootstock (Fernald 1950); only the second year canes produce flowers. Raspberry flowers are borne singly or in small clusters on the terminal portions of the floricane. The flowers are about 1 cm in diameter, with numerous stamens and pistils, creamy-white petals, and conspicuous bristly sepals. The fleshy fruit is typically red in color.

Although the reproductive methods of the genus *Rubus* are not fully understood, it appears that raspberry flowers are largely self-sterile, and insect pollination is necessary for normal fruit development (Jensen and Hall 1979, McGregor 1976). Honeybees are the dominant pollinators of raspberries in agricultural situations (McGregor 1976) and because of the copious production of nectar and pollen, raspberry bloom is considered to be prime bee forage (Howes 1946). Besides the economic value of commercial raspberries in fruit and honey production, wild raspberries, such as *R. idaeus,* provide important wildlife food (Gill and Healy 1974).

Honeybees, *Apis mellifera* L., are rare or absent throughout Maine's spruce-fir forest, so other insects are necessary for pollination and fruit set of wild raspberry. Raspberry flowers are accessible to many types of insect visitors (Faegri and van der Pijl 1971), and this factor, coupled with the high level of nectar and pollen production and wide distribution of *R. idaeus,* should ensure that a varied insect fauna visits the bloom.

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[3]Several varieties of *R. idaeus* L. can be found in Miane; var. *strigosus* (Michx.) Maxim. is probably the variety encountered in this study (Fay Hyland, pers. comm., Fernald 1950).

This work is part of a larger study to determine the effects of spraying with Sevin-4-oil® on insect pollinators and fruit set in a spruce-fir forest (Hansen *et al.* 1982). The objectives of this portion of the study were to document the insect fauna that visits wild red raspberry flowers and to identify the most important species of pollinators. The species of important pollinators could then be compared with those collected in sprayed and unsprayed areas, by use of Malaise traps or by some other method, prior to and following spraying. Assuming that the effect of the spray on insect pollinators was sufficiently great, this type of information may provide evidence that would directly associate lower fruit set with mortality of specific insect pollinator species or groups. Information on other insect visitors would also suggest additional insect species or groups that could be studied in future work on the relationship between insecticide use and fruit set of *R. idaeus.*

MATERIALS AND METHODS

Large stands of flowering *Rubus idaeus* were selected for study throughout Township 36 M.D., Washington Co., Maine. Insects observed visiting flowers were collected with a sweep net or aspirator. Small insects were collected by placing flowers in a killing jar. Collections were made on sunny days from June 4 to June 26, the peak 1981 bloom period. Insects were collected for 1 to 2 hours in the morning and again in the afternoon.

R. idaeus stands were situated along roadsides and in forest openings. The forest overstory was predominantly red spruce, *Picea rubens* Sarg. and balsam fir, *Abies balsamea* (L.) Mill.; other softwood and various hardwood species occurred infrequently. Understory vegetation was sparse under the dense coniferous overstory and consisted primarily of blueberry, *Vaccinium* spp., bunchberry, *Cornus canadensis* L., wild lily-of-the-valley, *Maianthemum canadense* Desf., and several ferns and mosses.

Collected insects, except the Macrolepidoptera, were pinned for identification. Some specimens of Syrphiae are at the U.S. National Museum. All other specimens have been deposited in the collection of the Department of Entomology, University of Maine at Orono.

RESULTS AND DISCUSSION

Five orders and 49 families were represented in the collections. At least 38 species of Syrphidae, including two new species, and 47 species of Apoidea were collected.

Though the study was not designed to give quantitative results, the most numerous *R. idaeus* flower visitors were *Dialictus* spp. (Halictidae) and the various species of Syrphidae. Other common groups were the Cerambycidae,

INSECTS COLLECTED ON FLOWERS OF *RUBUS IDAEUS* L. IN A SPRUCE-FIR FOREST, WASHINGTON CO., MAINE

Hemiptera (nymphs)
- Miridae
- Pentatomidae

Coleoptera
- Scarabaeidae
  - *Trichiotinus affinis* (Gory and Percheron)
- Byrrhidae
- Ptilodactylidae
- Elateridae
- Lampyridae
  - *Photuris pennsylvanica* (De Geer)
- Cantharidae
- Anobiidae
- Byturidae
  - *Byturus rubi* Barber
- Lagriidae
- Mordellidae
- Cerambycidae
  - *Anastranglia sanguinea* (Le Conte)
  - *Clytus ruricola* (Olivier)
  - *Cosmosalia chrysocoma* (Kirby)
  - *Evodinus monticola monticola* (Randall)
  - *Judolia montivagans montivagans* (Couper)
  - *Neoalosterna capitata* (Newman)
  - *Pidonia ruficollis* (Say)
  - *Strangalepta abbreviata* (Swederus)
- Curculionidae

Lepidoptera
- Microlepidoptera
- Macrolepidoptera
- Lycaenidae
- Papilionidae
  - *Papilio glaucus* L.
- Nymphalidae
  - *Nyphalis antiopa* (L.)
  - *Vanessa atalanta* (L.)

Diptera
- Tipulidae
- Chironomidae
- Simuliidae
- Asilidae
- Bombyliidae
  - *Hemipenthes* sp.
  - *Lepidophora* sp.
- Empididae
- Dolichopodidae
- Syrphidae
  - *Blera confusa* Johnson
  - *Carposcalis obscurum* (Say)
  - *Cartosyrphus pallipes* Leow
  - *Cartosyrphus* n. sp.
  - *Chalcosyrphus libo* (Walker)
  - *Chrysotoxum fasciolatum* (De Geer)
  - *Eristalis obscurus* Leow
  - *Epistrophe emarginata* (Say)
  - *E. xanthostoma* (Williston)
  - *Heringia (Neocnemdon) coxalis* (Curran)
  - *Heringia* sp.
  - *Leucozna lucorum* (L.)
  - *Mallota posticata* (Fabricius)
  - *Melangyna lasiophthalma* (Zetterstedt)
  - *Metasyrphus perplexus* Osborn
  - *Microdon tristis* (Leow)
  - *Orthonevra pulchella* (Williston)
  - *Parasyrphus genualis* (Williston)
  - *P. semiinterruptus* (Fluke)
  - *Parasyrphus* n.sp.
  - *Sericomyia chrysotoxoides* Macquart
  - *S. lata (*Coquillett)
  - *S. militaris* (Walker)
  - *Sphaerophoria contingua* (Macquart)
  - *S. longipilosa* Knutson
  - *S. novaengliae* Johnson
  - *Sphegina rufiventris* Leow
  - *Syritta pipiens* (L.)
  - *Syrphus rectus* Osten Sacken
  - *S. ribesii* (L.)
  - *S. torvus* Osten Sacken
  - *Temnostoma alternans* Leow
  - *T. barberi* Curran
  - *T. vespiforme* (L.)
  - *Taxomerus geminatus* (Say)
  - *T. marginatus* (Say)
  - *Volucella bombylans* (L.)
  - *Xylota annulifera* Bigot
  - *X. quadrimaculata* Leow

Conopidae
Lauxaniidae
Anthomyiidae
Muscidae
Calliphoridae
Sarcophagidae
Tachinidae
Hymenoptera
Tenthredinidae
Braconidae
Ichneumonidae
Pteromalidae
Chalcididae
Gasteruptiidae
Gasteruption kirbii kirbii (Westbrook)
Chrysididae
Formicidae (workers)
Vespidae
Dolichovespula arenaria (Fabricius)
Eumenidae
Ancistrocerus sp.
Eumenes crucifer Provancher
Euodynerus sp.
Stenodynerus sp.
Symmorphus sp.
Pompilidae
Sphecidae
Ammophila azteca Cameron
A. evansi Menke
A. mediata Cresson
Crossocerus sp.
Ectemnius arcuatus (Say)
Ectemnius atriceps (Cresson)
E. borealis (Zetterstedt)
E. continuus (Fabricius)
E. dives (Lepeletier & Brulle)
E. lapidarius (Panzer)
E. ruficornis (Zetterstedt)
E. stirpicola (Packard)
Lestica sp.
Apoidea
Colletidae
Hylaeus basalis (Smith)
H. ellipticus (Kirby)
H. modestus modestus Say
H. verticallis (Cresson)
Halictidae
Augochlora pura pura (Say)
Augochlorella striata (Provancher)
Dialictus cressonii (Robertson)
D. disabanci Knerer & Atwood
D. laevissimus (Smith)
D. versans (Lovell)
D. viridatus (Lovell)
Dialictus spp.
Evylaeus divergens (Lovell)
E. foxii (Robertson)
E. quebecensis (Crawford)
E. rufitarsis (Zetterstedt)
Halictus confusus confusus Smith
Lasioglossum athabascense (Sandhouse)
L. coriaceum (Smith)
L. forbesii (Robertson)
Andrenidae
Andrena cressonii Robertson
A. dunningi Cockerell
A. lata Viereck
A. miranda Smith
A. nasonii Robertson
A. nigrihirta (Ashmead)
A. regularis Malloch
A. thaspii Graenicher
A. vicina Smith
A. wheeleri Graenicher
Megachilidae
Hoplitis albifrons (Kirby)
H. cylindrica (Cresson)
H. producta producta (Cresson)
Megachle frigida frigida Smith
M. melanophoea melanophoea Smith
M. mendica mendica Cresson
M. mucida Cresson
M. relativa Cresson
Osmia albiventris Cresson
Osmia atriventris Cresson
O. bucephala bucephala Cresson
O. proxima Cresson
O. tersula Cockerell
Anthophoridae
Ceratina calcarata Robertson
Ceratina spp.
Nomada cressonii cressonii Robertson
N. depressa Cresson
N. pygmaea Cresson
N. sayi Robertson
Apidae
Apis mellifera L.
Bombus ternarius Say
B. terricola terricola Kirby
B. vagans vagans Smith

Scarabaeidae, represented by one species, *Trichiotinus affinis* (Gory and Percheron), Empididae, Sphecidae, Colletidae, and Andrenidae. The frequently collected adults of *Byturus rubi* Barber (Byturidae) fed on *R. idaeus* flowers and flower buds; these insects can cause enough floral damage to affect raspberry yield (Slate *et al.* 1947).

Many insect groups collected on *R. idaeus* flowers are potential pollinators. The various species of native Apoidea are probably responsible for much of the *R. idaeus* pollination in Maine because of their behavioral and morphological adaptations for pollen transport. The stigmas and anthers of a raspberry flower mature over several days, and repeated pollinator visits are required for maximum fruit set (McGregor 1976). The foraging behavior of bees is, therefore, important to ensure pollination.

The floral morphology of *R. idaeus* ensures that insect visitors with pubescent ventral surfaces can also bring about significant pollen transfer (Faegri and van der Pijl 1971). Thus, other common floral visitors such as *T. affinis,* several cerambycids, and number of syrphid species may also be responsible for *R. idaeus* pollination.

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THE BIOLOGY OF *TRICHADENOTECNUM ALEXANDERAE* SOMMERMAN (PSOCOPTERA: PSOCIDAE): I. HABITAT, LIFE STAGES AND EVENTS[1]

B.W. Betz[2]

ABSTRACT: Populations of *Trichadenotecnum alexanderae* Sommerman are localized within apparently suitable habitat. Only 1 egg is laid during an ovipositional event. Eggs are encrusted with the contents of the gut mixed with debris collected by tapping the terminalia on the substrate. This mixture camouflages an egg once it is laid. Only a few silk strands are deposited on each egg. Eclosion and ecdysis are similar to other psocomorph Psocoptera. There are 6 nymphal stages.

Sommerman (1948) described both sexes of *Trichadenotecnum alexanderae* from North Plainfield, New Jersey, where 302 males and 425 females were collected on 27 and 29 July, 1 August, and 28 September 1947. Of all the collections she examined from other localities (Connecticut, District of Columbia, Illinois, Maine, Maryland, Massachusetts, New Jersey, New York, North Carolina, and Pennsylvania), only one from Union, New Jersey, collected on 4 June 1937, contained males, and in fact consisted of males only.

Field and laboratory investigations over a 3 year period convinced me that a complex of 4 sibling species is involved: *T. alexanderae* which is biparental (=euphrasic), but in the laboratory was found to be capable of facultative parthenogensis (thelytoky) for only 1 generation, and 3 obligatorily parthenogenetic species, *T. castum, T. merum,* and *T. innuptum*, which I have described (Betz 1983a). These species occur sympatrically.

The habitat of *T. alexanderae* and also aspects of its life history observed in laboratory cultures are discussed in this paper, which is part of a series (cf. Betz 1983b, c, d) reporting these investigations.

PROCEDURE

Field and laboratory observations (and cultures) were made in 1977-9 from Illinois populations located at Moraine View State Park, McLean County (hereafter called Lake Dawson); along the Sangamon River at Lake of the Woods, Champaign County; and along the Salt Fork River at Champaign County Forest Preserve District — Homer Lake (hereafter

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called Salt Fork).

Several breeding pairs were used to start each culture and their identity was verified morphologically. The parent females were mated in the laboratory to assure the identity of the offspring. The bark used in the cultures came from the vicinity of the parent population and the bark was examined for eggs prior to use.

The cultures were kept in cotton-stoppered test tubes, supplied *ad libitum* with food (pleurococcine algae on bark), and were kept over a saturated potassium chloride (KC1) solution in closed, glass desiccator jars to maintain a relative humidity of 80 ± 5%. The temperature regimen for rearing was 23.3°: 18.0°C light: dark, the photoperiod was 15h: 9h light: dark, and illumination was 4300 lumens/m^2.

RESULTS AND DISCUSSIONS

Habitat. Most populations are found in rather open forest where the relative humidity is high and pleuorococcine algae occur on the substrate (usually tree trunks). But for some unknown reason the populations at the study areas, and at the other 11 localities where I have collected this species (Illinois, Indiana, Kentucky, Maryland, Michigan, New Hampshire, New Jersey, Ohio, and West Virginia), occur in limited patches in larger areas of what appears to be equally suitable substrate. This may be related to differences in food distribution (Broadhead and Wapshere 1966, New 1970), in microhabitat, or the comparative stability of bark over a foliage habitat, making dispersal relatively unimportant (New 1969). Because pleurococcine algae are plants and are consumed by this species, it is probably safe to say that there *is* a host plant association involved. Statements to the contrary made about other bark-dwelling species (New 1970) were at least partly in reference to "macro" substrate, i.e., conifers, broadleaved trees, etc.

Migration to nearby tree trunks offering favorable habitat apparently occurs infrequently, even though this is a macropterous species. Similar behavior has been reported in *Cuneopalpus cyanops* (Rostock) by New (1968). Most species of bark-dwelling psocids do not fly readily (New 1969, 1971, personal observation) and generally are lacking in collections of airborne Psocoptera (Thornton 1964, Thornton and Harrell 1965, New 1969, 1975). Individuals of *T. alexanderae* in cultures becoming overcrowded or depleted of their food supply show neither a noticable increase in activity nor a greater tendency toward flight, quite unlike some species in other families (cf. Sommerman 1943b, Mockford 1962, Turner 1974). Even movement on a tree trunk may be limited. On two occasions (at Lake Dawson and Salt Fork on 18 June and 27 July 1978, respectively) when I collected about 15 adults, their proximity in the aspirator led to a mating.

Hence, the patchy population distribution pattern probably is not due to an aggregating response by the individuals (cf. Mockford 1957, Heilbronn 1975).

Oviposition. Oviposition by 7 females from the study areas (6 mated, 1 not) was observed to be about the same. About 30-45 minutes before an egg was deposited, a female repeatedly pressed the tip of her abdomen to the substrate or probed at random for about 30 seconds, with an interval of a few seconds to 5 minutes between probes. One female dragged the tip of her abdomen along the substrate about 3 mm several times. While probing, algae and debris adhered to the ventral surfaces of a female's terminalia. When probing ceased, her abdomen returned to the normal resting position. An egg usually would be laid where her terminalia had last touched the substrate.

A female normally remained motionless about 2-3 minutes before oviposition, except for pulsing and spasmodic abdominal contractions of a few seconds duration, at about half-minute intervals. One female rubbed her hind femora along the sides of her abdomen after an abdomen spasm, possibly moving an egg into position for extrusion.

Next, an opaque, dark fluid was discharged on her terminalia and was manipulated rapidly between the epiproct, paraprocts, and valvulae for about 3-5 seconds. Then with one spasm, about one-third of an egg appeared, coated by dark fluid. About 5 seconds later another spasm exposed another third of the egg. Both egg and dark fluid were supported by the dorsal surface of the egg guide of her subgenital plate, an immobile, bracket-like structure.

Once an egg was about two-thirds exposed, it also was manipulated rapidly for about 3-5 seconds. Then she quickly pressed the tip of her abdomen down on the substrate, thereby elevating the anterior part of her body and causing here forewings to part slightly. A female paused for less than 1 second in this position, then vibrated her body from side to side. Before a female withdrew her abdomen, she slightly flexed her terminalia and dragged the tip of her abdomen about 1 mm, thus not disturbing the placement of an egg on the substrate. Depositing an egg on the substrate required about 3-5 seconds. Absorption of the dark fluid by the bark appeared to solidify an encrustation. This ovipositional behavior resembles that of *Peripsocus quadrifasciatus* (Harris) (cf. Eertmoed 1966) because an egg emerges before a female's abdomen is applied to the substrate, rather than vice versa as with *Caecilius manteri* (cf. Sommerman 1943a).

The dark fluid of an encrustation originates in the gut, as proposed by Pearman (1928a). The composition of fluid and feces are similar in *T. alexanderae,* both containing algae and debris, and thus appear to differ only in their degree of hydration. Females of *T. alexanderae* in the stage of oviposition produce fewer feces than males of the same age, so their use in encrustations may explain this.

After a female withdrew her abdomen, she fastened several strands of silk from her labium to the egg and the surrounding substrate. She normally circumscribed the egg with silk in a roughly stellate pattern and then walked partially around it. Depositing silk took about 5-10 seconds. Each egg had about the same amount of silk whether or not eggs were present nearby. Once silk was laid down, oviposition was complete and a female walked about 5-10 mm and usually began feeding. Silk strands can keep an egg on the bark should its encrustation become dislodged.

Silk strands are produced by females that have just oviposited, by those which have yet to oviposit, and by nymphs (presumably female). Adult males do not produce silk. Females in the stage of oviposition, but not actually ovipositing, were not seen to produce silk.

Only one egg is laid during an ovipositional event. For another to be laid, the entire procedure must be repeated. Eggs are sometimes laid next to others previously laid, and cultures with a great number of eggs sometimes have clusters of two or three eggs produced in this way, giving the false impression that the eggs were deposited in succession.

Appearance of Eggs. Eggs of *T. alexanderae* are ovoid in shape and are laid with their longitudinal axes parallel to the substrate. For the first few days after oviposition, the chorion is iridescent with a grayish-white background, but later the eggs become a lusterless yellow.

Most eggs are covered completely by a hardened secretion, encrusted with algae and debris, which camouflages them on the bark. The encrustation is shaped during oviposition by the ventral surface of the epiproct and the medial surfaces of the paraprocts. Figure 1 depicts the appearance and size of a normally-shaped egg encrustation. If less dark fluid is produced during an oviposition, the egg is encrusted but the encrustation is not shaped. Some eggs are naked because they are laid without any fluid. The amount of encrusted material around an egg does not seem to affect the amount of silk subsequently attached to it.

In two separate ovipositions, the female probed with her abdomen in an area on the bark, then moved or was chased away to a differently-colored substrate on which an egg was laid. The color of these encrustations did not match their substrates. The bark debris that had been collected on the terminalia at the intended ovipositional site must have become mixed with the encrusting fluid when this was discharged, thereby causing a mismatch between the encrustation and the substrate of the actual site.

The site for oviposition apparently is selected before a female stops moving, probably because any further movement may cause a mismatch between the debris on her terminalia and the substrate, minimizing the

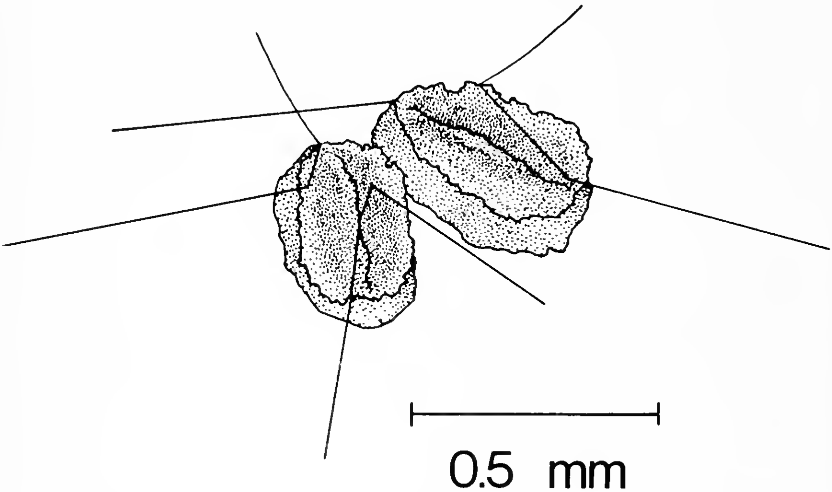

Figure 1. Encrusted eggs of *Trichadenotecnum alexanderae* with silk strands (Salt Fork culture).

effectiveness of the camouflaging encrustation. Also, further movement may result in the selection of a site ill-suited in some other way for oviposition.

Eclosion. Eclosion is similar to that of other species of psocomorph Psocoptera (cf. Pearman 1928b, Sommerman 1943a, b, c, 1944, Mockford 1957, Eertomoed 1966, Dunham 1972, Garcis Aldrete 1973). The hatching described is that of an egg from Lake of the Woods culture.

Hatching began as the top of the egg opened flapwise at its anterior end and was forced up by the head of the upright pronymph. The head emerged first, and while the pronymph had its ventral surface facing the substrate it underwent ecdysis. As molting proceeded, the nymph remained almost perpendicular to the substrate, its legs being freed before its antennae. The nymph then arched posteriorly, slowly freeing its antennae. The legs moved slightly when freed, but more actively once the antennae were freed. The nymph then fell forward, and when its legs contacted the egg it slowly crawled ahead. Emergence was completed in about 20 minutes. The nymph was cream-colored with dark purple ommatidia.

All pronymphal exuviae are grayish-white and are left about halfway out of an egg. Hatched but undisturbed eggs (N=136) retain the hatching flap and pronymphal exuviae.

Nymphal stages. Exuviae from 10 isolated individuals from Lake of the Woods culture indicated there are 6 nymphal stages, and all except the first resemble adults in overall coloration. Fecal material and debris passively accumulate on nymphs of all ages, presumably because of a secretion by glandular hairs, causing most older nymphs to become camouflaged on the bark.

Ecdysis. Ecdysis is the same as that described for other species of psocomorph Psocoptera (Pearman 1928b, Sommerman 1943a, b, c, 1944, Eertmoed 1966, Dunham 1972). The following is a description of a molt from last stage nymph to adult female from Salt Fork culture.

The first sign that the nymph was about to molt was its walking with stiff appendages. It then stopped moving, about 1 minute later its antennae began to pulse at about 2 beats per second. About 20 seconds after its antennae began to beat, a pulse began in synchrony, extending from the top of the frons to the bottom of the clypeus. Then the posterior portion of its abdomen began to pulse about once every 5 seconds and the size of the nymph increased.

The dorsum of the nymph's thorax gradually split open medially and the adult emerged through this lengthening split. Excluding appendages, the thorax, head, and then abdomen emerged. The anterior end of the adult's abdomen began to withdraw from the nymphal cuticle once its head began to emerge.

Once the thorax of the adult emerged from the old cuticle, the appendages were freed in the following order: mouthparts, wings, forelegs, midlegs, hindlegs, antennae. A foreleg pulled an antenna out of the old cuticle. When an appendage was freed it quivered for about 15 seconds.

Once the appendages were out the adult was held to the old cuticle only at the posterior end of its abdomen, and was almost perpendicular to the substrate. The abdomen was freed when the adult dropped forward and crawled ahead. Once emerged, the epiproct was flexed ventrally and the paraprocts and valvulae were flexed medially in spasms for about 15 seconds.

The molt was completed in about 7.5 minutes, from the moment the nymph stopped moving to the time the abdomen of the adult became detached from the nymphal exuviae.

Directly after molting the adult was unable to stand, but could move on its coxae. The wings were curled away from the body and the forewings were pale yellow, and it took about 12 hours for the shape and color pattern to mature.

Neither nymphs nor adults of *T. alexanderae* eat their exuviae, as some psocid species do that are mycophagous or lichenophagous (cf. Sommerman 1943b, c, 1944, Mockford 1957).

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BOOK REVIEW AND BRIEF EDITORIAL COMMENT

HOW TO WRITE AND PUBLISH A SCIENTIFIC PAPER. Robert A. Day. 2nd. Ed. 1983. ISI Press. 181 pp. $11.95 pbk. Available from Ent. Soc. of Amer., Box 4104, Hyattsville, MD 80781. (E.S.A. members $9.95).

I have just finished reading and even studying this very instructive, interesting, and valuable small book on the subject of scientific writing and publishing.

After first defining what is a scientific paper, the author proceeds to provide detailed instructions on how to prepare the title, to list the authors and addresses, to prepare the abstract, to write the introduction, the materials and methods section, the results, the discussion, to cite acknowledgments, to prepare literature cited, to design effective tables, to prepare effective illustrations, and to type and submit the manuscript. Also included are chapters on the review and publishing processes, the use and misuse of English, and several other pertinent subjects.

This is a very direct and concise presentation of all the essential factors in the subject field. Throughout, the author illustrates his many points with copious, pertinent, and often humorous examples of good and poor scientific writing.

I do not recall having read any other book that addresses this subject as completely and as interestingly as this small volume. As an editor, I picked up a number of points of real value, several of which I plan to incorporate into future ENTOMOLOGICAL NEWS editorial procedures in continuing efforts to constantly improve the quality of scientific papers in this journal.

I strongly recommend that all authors and would-be authors of scientific papers secure and carefully study this valuable reference before submitting any future paper to the editor of any scientific journal including, of course, ENTOMOLOGICAL NEWS.

Howard Boyd

BOOKS RECEIVED AND BRIEFLY NOTED (Continued)

BARK BEETLES IN NORTH AMERICAN CONIFERS. J. Mitton & K. Sturgeon, Eds. 1982. Univ. Texas Press. 527 pp. $30.00, $17.50 pbk.

Ten papers on bark beetle communities: on evolution, systematics, life cycles, pheromones, symbionts, host resistance and forest management.

TRICHOPTERA OF THE AREA PLATENSE (Argentina) O. Flint. 1982. *In* Biologia Acuatica No. 2. Instituto de Limnologia, La Plata, Argentina. 70 pp. $8.00.

Descriptions and keys for identification of 31 species in 11 genera and 6 families. Larvae and pupae are included in supra-generical identification keys.

BOOKS RECEIVED AND BRIEFLY NOTED (Continued)

FLIES OF THE NEARCTIC REGION. Vol. V, Pt. 13, No. 3. J. Hall & N. Evenhuis. 1982. $36.96; Vol. VIII, Pt. 2, No. 1. G. Griffiths. 1982 $56.32. Schweizerbart'sche Verlagsbuchhandlung (Nagele u. Obermiller). Available in USA from Lubrecht & Cramer, RDF 1, Box 227, Monticello, NY 12791.

Two more numbers in this continuing series. V: 13:3 is on Bombyliidae. VIII: 2: 1 is on Anthomyiidae.

THE DOLICHOPODIDAE OF NEBRASKA. F. Harmston & W. Rapp. 1983. *In* Novitates Arthropodae 1 (4). J-B Pub. 75 pp.

Annotated listing of species and localities, with maps, of members of this Diptera family collected during mosquito surveys in Nebraska.

THE MARSH FLIES OF CALIFORNIA (Diptera: Sciomyzidae). T. Fisher & R. Orth. 1983. Univ. Calif. Press. 117 pp. $20.00 pbk.

Taxonomy, biology and distribution of 49 species in 13 genera known in California, plus 8 species from neighboring states, and 4 forms of *Dictya montana.*

BUMBLE BEES AND CUCKOO BUMBLE BEES OF CALIFORNIA (Hymenoptera: Apidae). D. & L. Dunning. 1983. Univ. Calif. Press. 79 pp. $19.00 pbk.

24 species of *Bombus* and of *Psithyrus* are treated, including keys to and diagnosis of genera and species.

COMMON INSECT AND MITE GALLS OF THE PACIFIC NORTHWEST. H. Larew and J. Capizzi. 1983. Oregon State Univ. Press. 80 pp. $4.95 pbk.

A small, popular guide to provide brief answers to some common questions people ask about galls and to describe some found in the Pacific northwest.

A CATALOG OF THE DIPTERA OF AMERICA NORTH OF MEXICO. A. Stone et al. 1983 reprint of 1965 publication. ARS, USDA. Smithsonian. $29.95.

Catalog of over 16,000 species, plus index, bibliography, and section of periodicals.

CATALOGUE OF THE ORTHOPTERA OF SPAIN. L. Herrera. 1982. Dr. W. Junk BV Pub. 162 pp. $37.00.

As title indicates, a catalog of the Orthoptera of Spain.

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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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FOR SALE: *Journal of Medical Entomology*, Vols. 5 (1968) to 16 (1979) complete. Make offer. D. Hilton, Bishop's University, Lennoxville, P.Q. J1M 1Z7 Canada.

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(Continued on inside of back cover)

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IMMATURE STAGES AND BIOLOGY OF *TETRAGLOSSA PALPALIS* CHAMPION (COLEOPTERA: PTILODACTYLIDAE)[1]

Paul J. Spangler[2]

ABSTRACT: The adult of the monotypic ptilodactylid *Tetraglossa palpalis* Champion, its distinctive labial palpus, and the male genitalia are illustrated. The larva, pupa, and habitat niches are described and illustrated; surface sculpture of the larva is illustrated by scanning electron micrographs. Notes on larval food and pupation are included.

Many inhabitants of lotic habitats do not fly often, if at all, and are restricted to their respective habitat niches; also, those that do fly (with some exceptions) seem not to be commonly attracted to blacklights. Although the number of specimens collected in lotic habitats is lower than the number of specimens obtained from lentic habitats in the equivalent expended time, the extra effort to obtain material from lotic habitats usually is well worth the effort. During the month of May 1981 I conducted fieldwork in the states of Chiapas, Mexico, Oaxaca, and Veracruz in Mexico. Because my companions, Dr. Joaquin Bueno and Dr. Oliver S. Flint, Jr., were trichoperists, most of my collecting efforts were directed toward obtaining dryopoid and other stream inhabiting Coleoptera. My collecting efforts in the lotic habitats were divided among examining "leaf packs"; water-logged and rotting twigs, limbs, and logs; rocks in riffles; and examination of roots and other vegetation caught under overhanging banks of streams. My efforts to collect Coleoptera occurring in streams resulted in the collection of adults and immature stages of some interesting taxa.

Among the interesting insects found was a common ptilodactylid larva which resembles larvae of members of the genera *Anchytarsus* and *Anchycteis.* However, by rearing a last-instar larva through to the adult stage I was able to establish that the larva was an immature stage of *Tetraglossa palpalis* Champion (1897) which occurs widely through much of Mexico and Central America and represents the monotypic genus *Tetraglossa.* A review of the literature revealed that Bertrand (1972) included a dorsal view of the ninth abdominal segment of a larva of *T. palpalis* and included the genus in a key to larvae of the genera of Ptilodactylidae. Because the immature stages of *T. palpalis* have not been fully described previously and the pupa was unknown, descriptions of the larva and pupa follow.

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[1]Received March 24, 1983. Accepted May 27, 1983.

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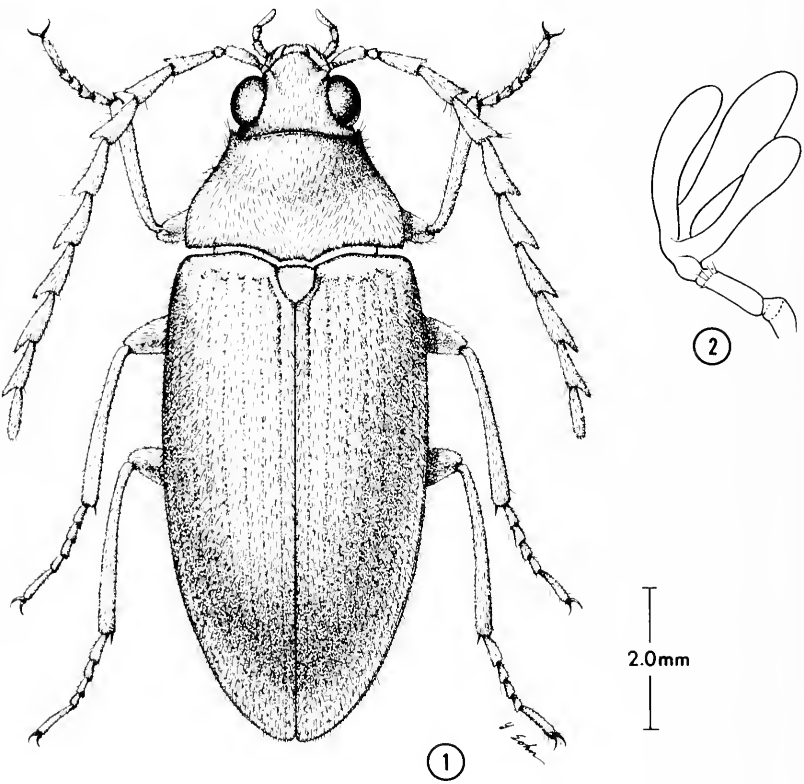
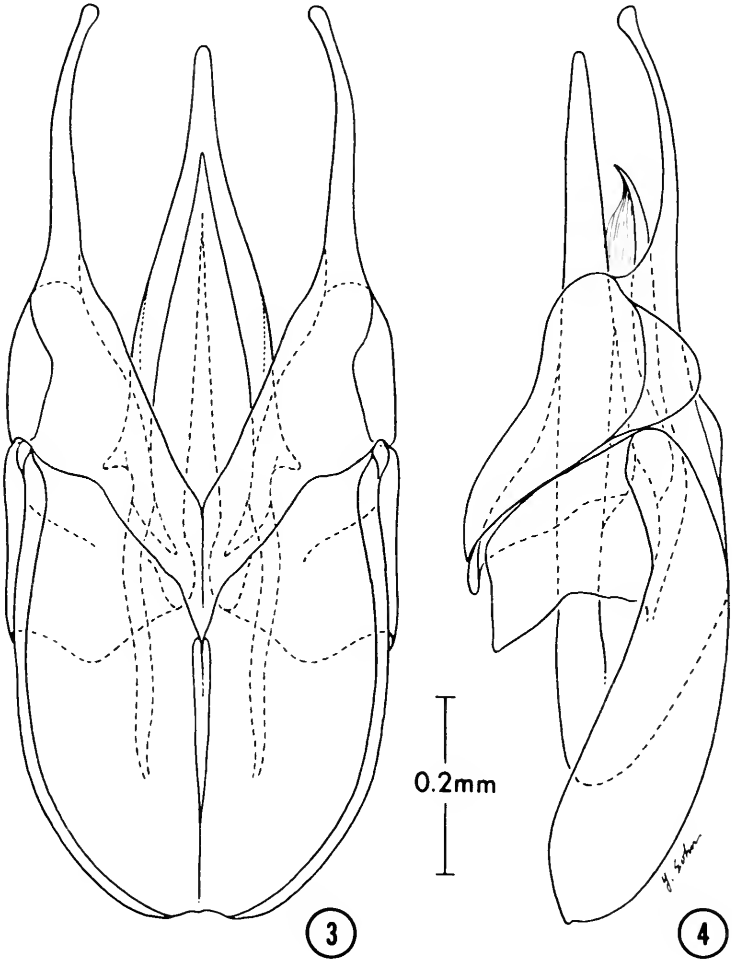
Tetraglossa palpalis

The adult of this species was adequately described by Champion (1897); illustrations of the adult, labium, labial palpus, maxilla, and maxillary palpus were included in that publication. Because Champion's illustrations are very small and somewhat schematic, illustrations in greater detail of the adult male, including habitus (Fig. 1), labial palpus (Fig. 2), and genitalia (Figs. 3 & 4), are included in this paper.



Figs. 1-2. *Tetraglossa palpalis* Champion, male adult: 1, Habitus; 2, Labial palpus.



Figs. 3-4. *Tetraglossa palpalis* Champion, male genitalia: 3, Dorsal view; 4, Lateral view.

Larva
Figures 5-15

Description: Length 17.8 mm; width of prothorax 2.1 mm. Body (Figs. 5, 6, 7) semicylindrical, moderately flattened ventrally. Color testaceous to castaneous dorsally; lighter testaceous ventrally except legs creamy yellow.

Head: Slightly wider than long (1.4:1.6mm) (Fig. 8). Ecdysial cleavage line forked near base; frontal arms diverge and extend in sinuous lines to bases of antennae. Frons sagittate. Cuticle appearing smooth except for numerous, moderately coarse punctures and 1 long seta behind each frontal arm at about basal third; 6 long setae adjacent to stemmata; 3 long setae on each anterolateral angle of clypeus near bases of antennae. Labrum with 6 long setae across anterior surface and small tufts of setae on anterolateral angles. Stemmata single; large, strongly convex; on each side of head directly behind bases of antennae; with distinct black pigment beneath lens. Antenna long, cylindrical; of 3 antennal segments; first segment longest; second segment about four-fifths as long as first; third segment minute. Clypeus broad, feebly arcuate. Labrum narrower than clypeus; finely, densely punctate; and feebly emarginate anteriorly. Mandible tridentate apically; mesal surface sulcate; anterior and posterior margins each with a tuft of long golden setae at about midlength. Maxilla and labium as illustrated (Fig. 9). Submentum divided longitudinally into 3 sclerites.

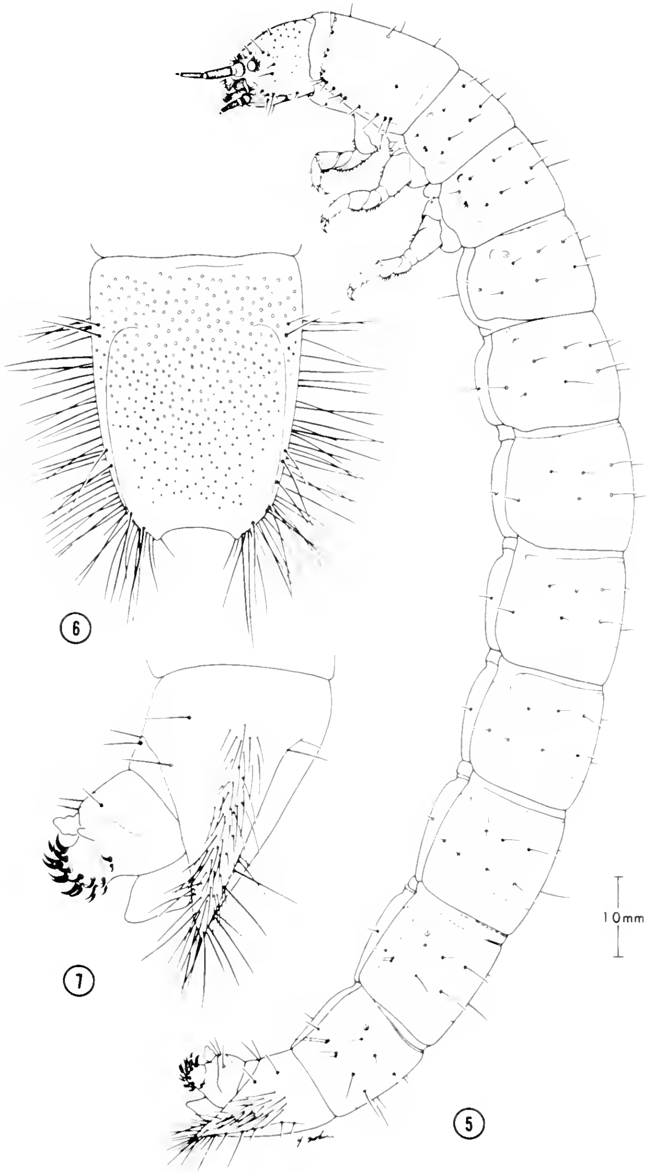
Thorax: Prothorax almost twice as long as mesothorax; bearing 3 long setae in a longitudinal row between midline and lateral margins and several more long setae along lateral margins. Mesothorax with 1 large spiracle anterolaterally; with 2 long setae in a longitudinal row between midline and lateral margins plus several more (6 or 7) on each lateral margin and a second longitudinal row of 3 long setae laterally in line with spiracle; 2 setae on mesal side of spiracle and 1 seta at about posterior third; cuticular punctures coarser and denser across apical margin. Metathorax similar to mesothorax but without spiracles. Hind margins of thoracic and abdominal segments strigate. Legs four-segmented, short and stout; second and third segments ventrally with row of dense, robust, spines along anterior and posterior (inner and outer) margins (Fig. 10). Last segment (tibiotarsus) terminates in a single robust claw.

Abdomen: Of 9 segments; segments 1-8 similar to metathorax in punctation but long setae are in 2 rows between biforous spiracle (Fig. 11) and midline; 2 long setae posterior to spiracle and 2 long setae arising together from posterolateral angle of each segment. Tergum of last abdominal segment compressed dorsoventrally (Fig. 6); discal area moderately convex; lateral margins strongly keeled; side beneath keel on each side with longitudinal rows of long hairlike setae; posterolateral angles obtuse, subspinose; apex broadly and moderately deeply emarginate. Ventral surface of last abdominal segment bearing a pair of large, robust, prehensile appendages each of which bears a pair of large, stout, curved, lateral hooks and 8-22 similar hooks on posteroventral surface (Fig. 7). Gills, 6; 1 large conical dorsal gill above and between appendages; a single small lateroventral gill below lateral pair of hooks; and a pair of moderately large ventral gills between appendages. Two pairs of long setae between and slightly posterior to ventral gills and a single long seta posterior to lateroventral gill.

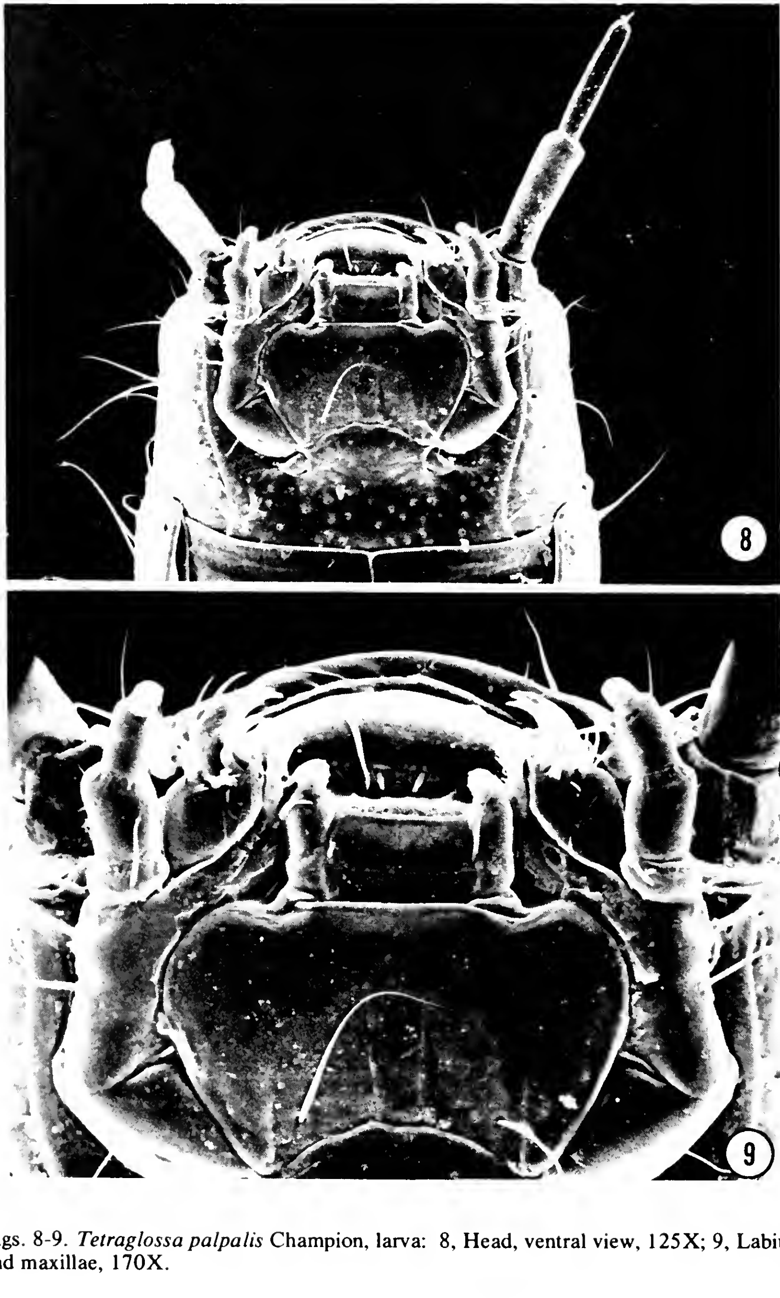
Surface sculpture of larva: Examination of the larval head capsule (Fig. 12) with the SEM revealed that most of, if not all, the punctures bear a cluster of minute slender setae arising from a common base (Figs. 13, 14). It is unknown whether those setae perform a sensory function; however, the apex of the last antennal segment is surrounded by sensilla (Fig. 15).

Variations: The number of curved hooks on the prehensile appendages on the last abdominal segment vary considerably. The hooks on the smaller, earlier instars varied from 8 to 13 hooks on each appendage; the hooks on the large, last-instar larvae varied from 15 to 22 on each appendage.

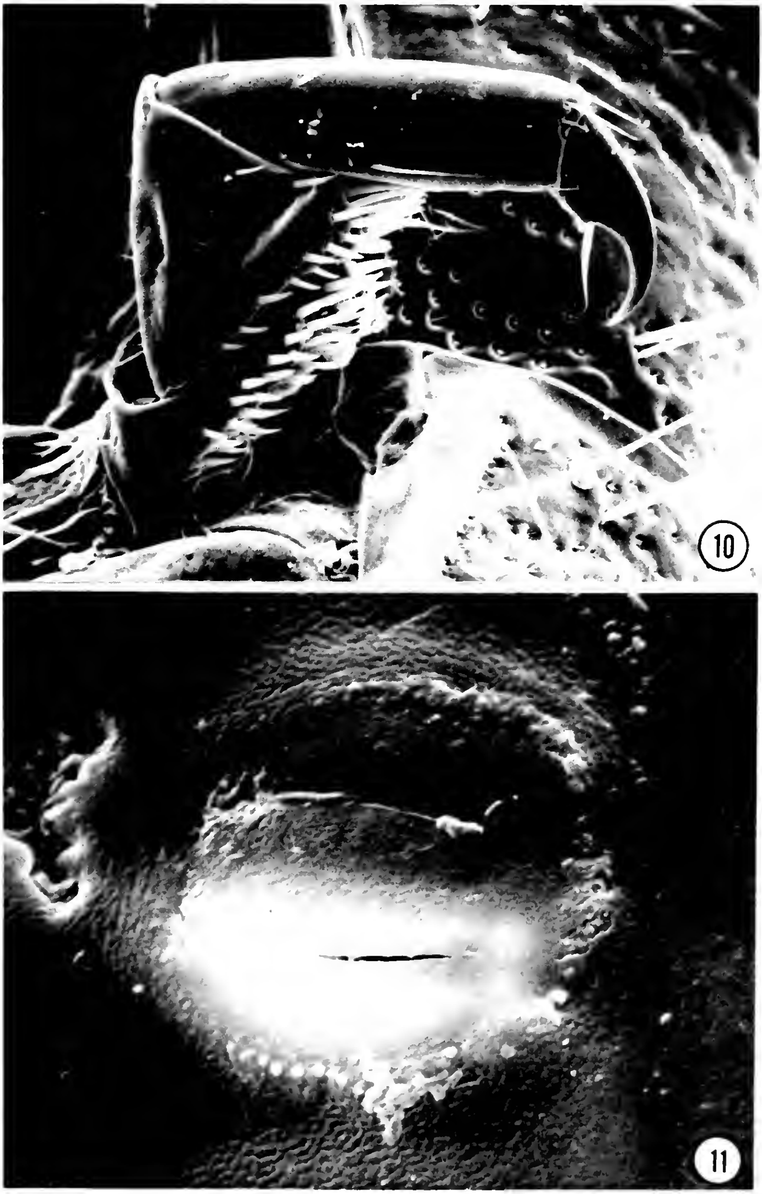
Food: Examination of the gut contents showed that the larvae were feeding on the plant material on which they were found.



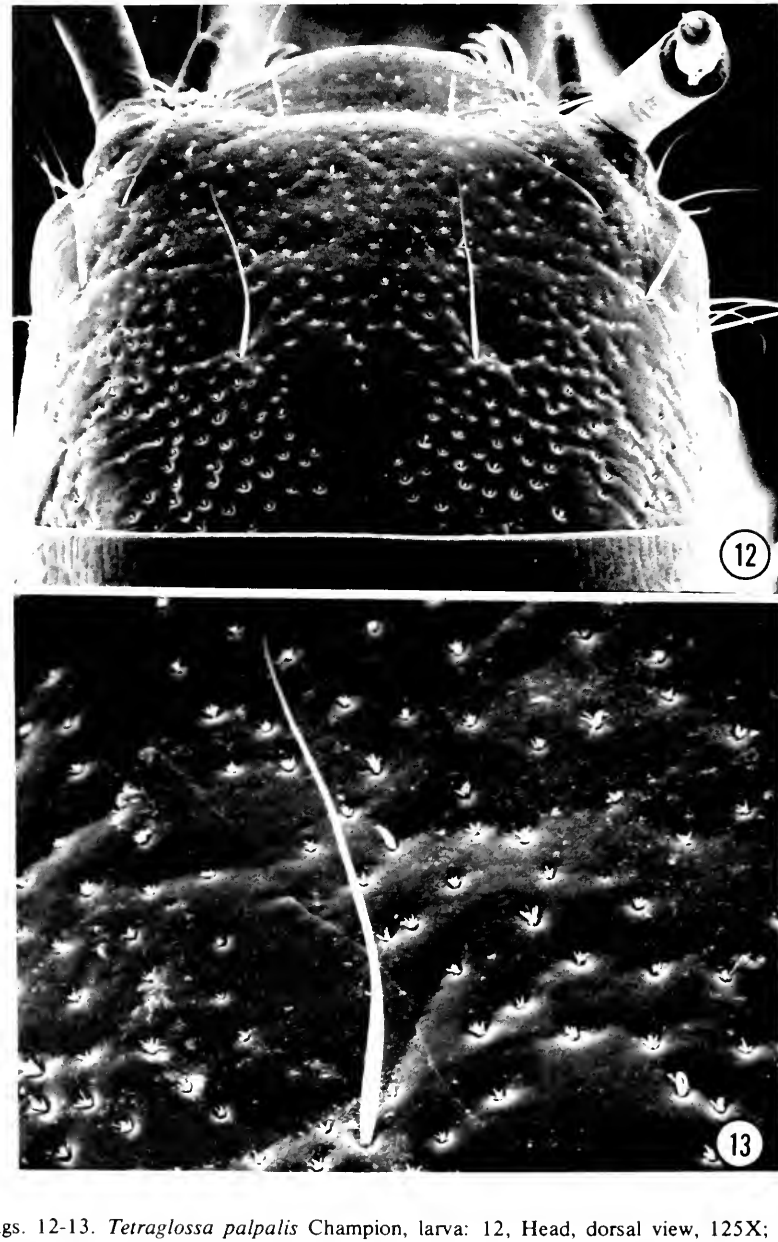
Figs. 5-7. *Tetraglossa palpalis* Champion, larva: 5, Habitus, lateral view; 6, Last abdominal segment, dorsal view; 7, Last abdominal segment, lateral view.



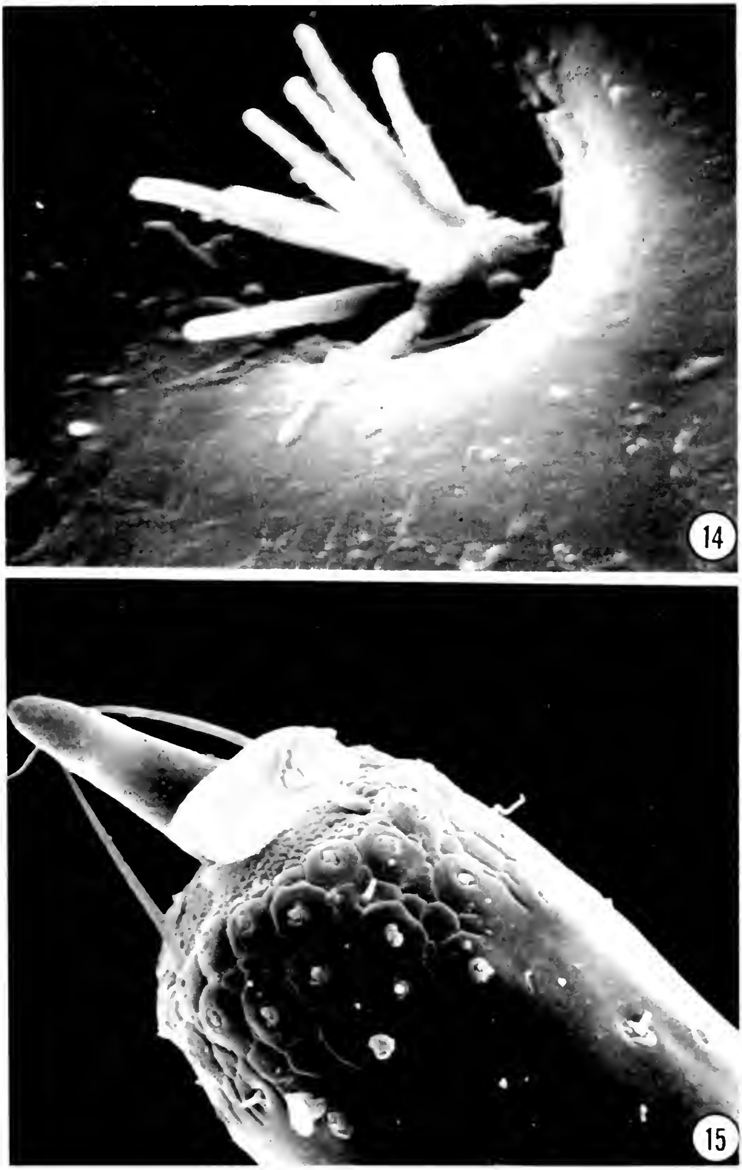
Figs. 8-9. *Tetraglossa palpalis* Champion, larva: 8, Head, ventral view, 125X; 9, Labium and maxillae, 170X.



Figs. 10-11. *Tetraglossa palpalis* Champion, larva: 10, Front leg, 225X; 11, Spiracle, 2650X.



Figs. 12-13. *Tetraglossa palpalis* Champion, larva: 12, Head, dorsal view, 125X; 13, Sculpture on head, 360X.



Figs. 14-15. *Tetraglossa palpalis* Champion, larva: 14, Setae in punctures on head, 1000X; 15, Sensilla on antennal apex, 3000X.

Pupa
Figures 16-19

Description: Length (including cerci) 12.0 mm. Color white with pronotal styli, cuticular setae, spiracles, gin-traps, sclerite on first abdominal tergum, and cerci testaceous. Short cuticular setae on areas as described.

Head: With moderately dense cuticular setae on dorsum, denser at inner apical corner of each eye. Antennae directed posteriorly, lying along side of pronotum (Fig. 16). Maxillary and labial palpi extended posteroventrally. Ultimate labial palpal segment trifurcate in male, unbranched in female.

Thorax: Pronotum with moderately dense cuticular setae and 4 robust styli; 1 strongly angular stylus on each anterolateral angle and 1 arcuate stylus on each posterolateral angle. Mesonotum and metanotum and their respective wing pads with sparse cuticular setae only. Front, middle, and hind femora extend outward at right angles from body-axis and lie beneath elytral wing pads. All legs with tibiae folded against femora; all tarsi turned backward parallel with body axis.

Abdomen: Tergum of abdominal segment 1 with small subrectangular sclerite at apicomedial margin; terga of remaining abdominal segments with sparse cuticular setae. First through seventh abdominal segments each with a pair of spiracles; 1 spiracle on each anterolateral corner of each segment; those spiracles on segment 1 small, poorly developed. Gin-traps, 4; present between first through fifth abdominal segments (Figs. 17, 18). Cerci elongate, blunt apically (Fig. 19).

Pupation: On May 15, 1981, while collecting about 25 km northeast of Catemaco, Veracruz, Mexico, I found a sapling which had fallen into the Rio Palma; many leaves and twigs had drifted against the sapling and formed a dense leaf pack. The leaf pack was about one-third of a meter thick, two meters long and one-half meter wide (Fig. 20). By carefully pulling this leaf pack apart I uncovered 60 larvae, 1 pupa, and 3 adults of *T. palpalis*. Numerous large, apparently last-instar larvae were found in poorly defined pupal cells. The pupal cells were simply oval depressions about 25 X 18 mm, were usually in moist leaves 3 to 4 cm above the waterline, and appeared to have been formed by the respective larvae chewing the leaves and compacting them by wriggling movements. Some earlier instar larvae were found randomly throughout the leaf pack; several larvae in cavities under loose bark of rotting branches in the leaf pack, and numerous larvae inside hollow twigs in the leaf pack. One pupa eclosed a half hour after it was collected. Three last-instar larvae found in pupal cells were kept alive for rearing to obtain pupae for preservation and illustration, to establish the length of the pupal stage, and to verify the presumed identity. The three larvae pupated and one of the pupae eclosed 4 days after pupation; that adult and the two remaining pupae were then preserved.

Habitat: Larvae, pupae, and freshly eclosed adults were present in almost all lotic habitats examined—large rivers, small streams, small cascades, and seeps. In all of the habitats where specimens of *Tetraglossa palpalis* were found, two factors were always present—clean running water and accumulations of vegetation in various stages of decomposition.

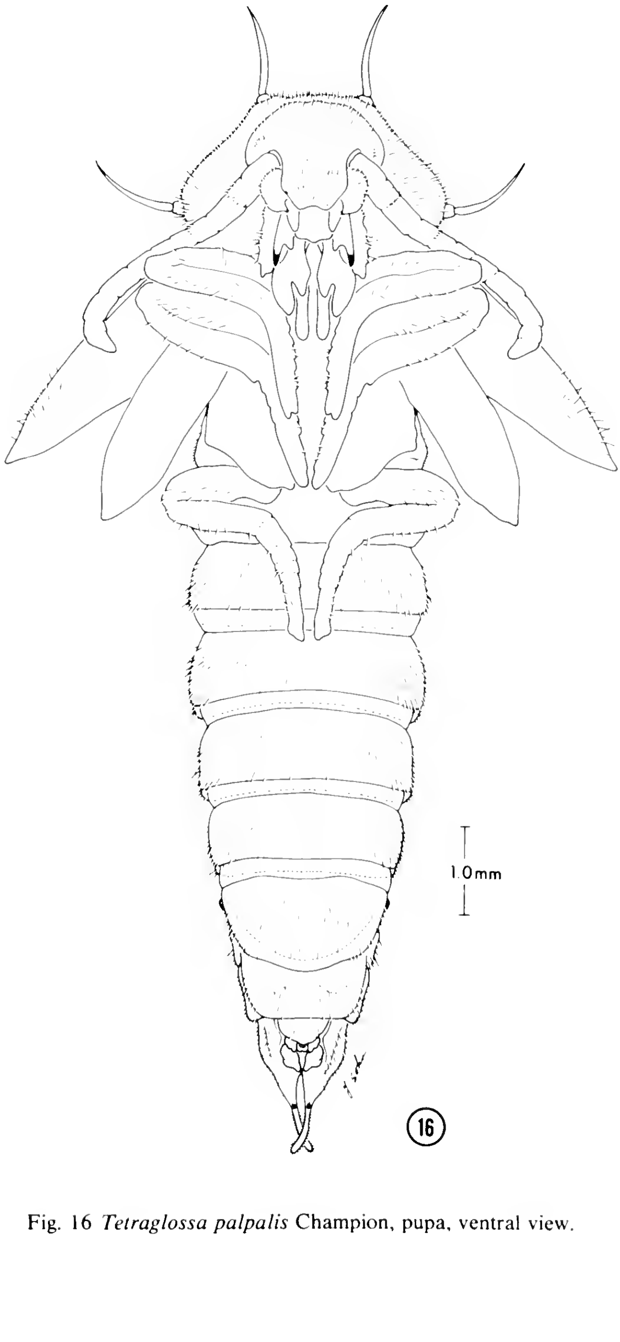
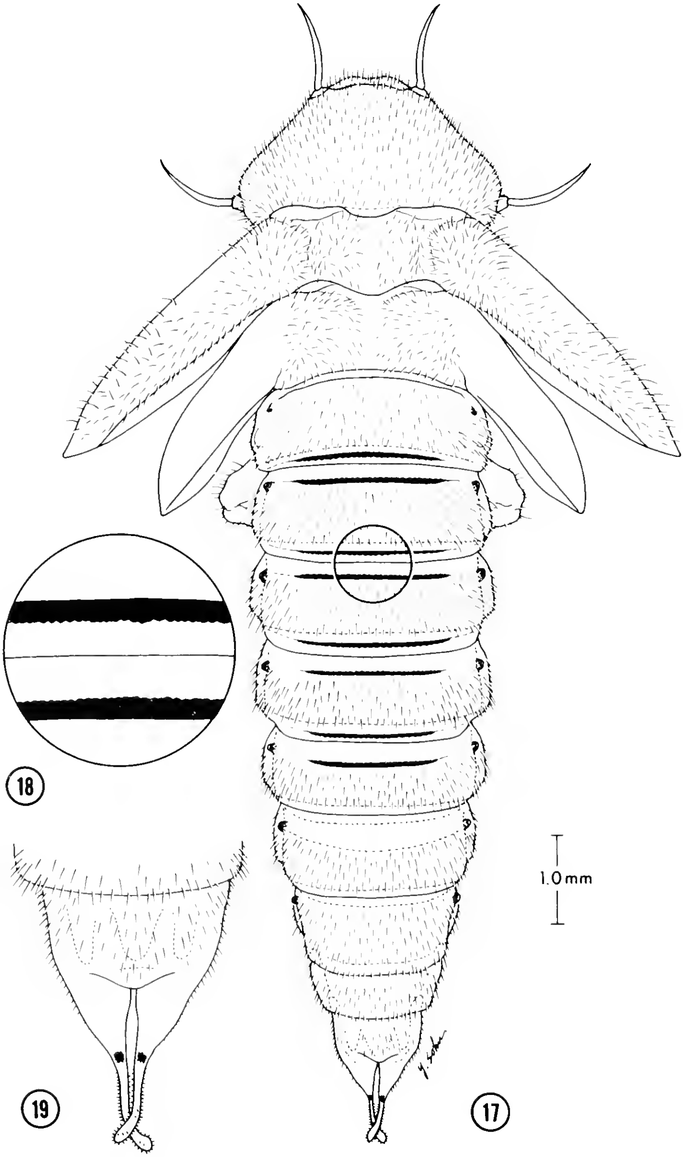
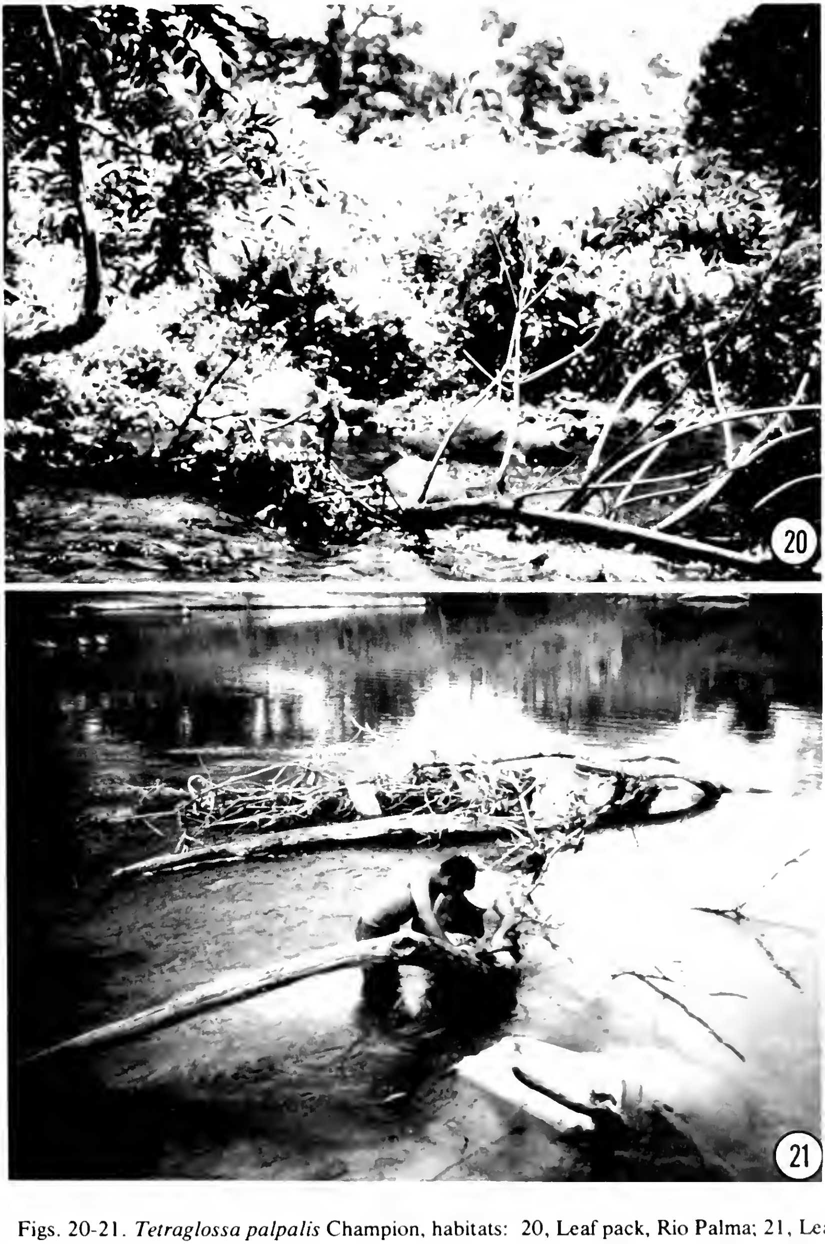


Fig. 16 *Tetraglossa palpalis* Champion, pupa, ventral view.



Figs. 17-19. *Tetraglossa palpalis* Champion, pupa: 17, Dorsal view; 18, Gin-traps, enlarged; 19, Cerci.



Figs. 20-21. *Tetraglossa palpalis* Champion, habitats: 20, Leaf pack, Rio Palma; 21, Leaf pack, Rio Tulija.

Figs. 22-23. *Tetraglossa palpalis* Champion, habitats: 22, Mat of roots from seep; 23, Picking specimens from roots.

Specimens were especially abundant in leaf packs (Figs. 20, 21) and among rootlets. On seeps, specimens were found by pulling the mats of roots loose from the substrate, placing the roots on a cloth and then carefully sorting through the plant material (Figs. 22, 23).

In leaf packs lodged against the partly submerged tree in the Rio Tulija, taxa associated with specimens of *T. palpalis* were: Limnichidae (*Eulimnichus* sp.), Lutrochidae (*Lutrochus* sp.), and Elmidae (*Austrolimnius* sp., *Heterelmis* sp., *Microcylloepus* sp., and *Phanocerus* sp.). Other beetles associated with *T. palpalis* in the matted roots (Figs. 22, 23) on the seeps were: Dryopidae (*Elmoparnus* sp.), Elmidae (*Elsianus* sp. and *Heterelmis* sp.), Hydraenidae (*Spanglerina* sp.), and Hydrophilidae (*Oocyclus* sp.).

Specimens examined (all in National Museum of Natural History, Smithsonian Institution). — BELIZE: TOLEDO DISTRICT: Blue Creek Village, 30 June 1981, W. Steiner, 25 larvae; San Antonio (5 km N), Columbia Forest, 26 June 1981, W. Steiner, 1 larva. GUATEMALA: ALTA VERAPAZ: Trece Aguas, April 1906, 1 larva; Trece Aguas, 25, 27, 30 Mar., Schwarz & Barber, 6 adults; Trece Aguas, 7, 16, 22 Apr., Schwarz & Barber, 5 adults. — MEXICO: CHIAPAS: Ocosingo (22 km N), Rio Lacanja, 19 May 1981, P.J. Spangler, 1 larva; Ocosingo, Rio Contento, 20 May 1981, P.J. Spangler, 1 larva; Pacific Coast Cordilleras, L. Hotzon, 800-1000m, 1 adult. OAXACA: Valle Nacional (8 km S), 25 May 1981, P.J. Spangler, 14 larvae; Valle Nacional (8 km S), 25 May 1981, C.M. and O.S. Flint, Jr., 1 larva. SAN LUIS POTOSI: 2 km W. Tlamaya, 8 km N. Xilitla, Sotano de Huitzmolotitla, 29 Jan. 1964, T. Raines and T. Phillips, 1 adult. VERACRUZ: La Palma (above town), Los Tuxtlas area, Rio Palma, 7 May 1981, P.J. Spangler and S. Santiago, 1 larva; La Palma (above town), 15 May 1981, P.J. Spangler, 1 adult, 60 larvae, 1 pupa; Los Tuxtlas area, Rio Maquinas, 13 May 1981, P.J. Spangler, 4 larvae; Palenque (48 km S), Rio Tulija, 17 May 1981, P.J. Spangler, 1 larva; Palenque Ruinas, 10 July 1981, W. Steiner, 1 larva. — PANAMA: CHIRIQUI: Rio Chrirqui Viejo (Volcan), Foster, 1 larva. PANAMA: La Chorrera, 10 May 1912, Aug. Busck, 1 adult.

ACKNOWLEDGMENTS

I thank the following friends who contributed to this article: Joaquin Bueno-Soria who made all the financial and logistical arrangements for the fieldwork during which time most of the biological data reported here were obtained; Silvia and Joaquin Bueno, Carol and Oliver Flint, Hector Velasco, and Roberto Arce for help in collecting the Mexican specimens; and Warren Steiner for collecting specimens from Belize during the Earthwatch Expedition led by D.H. Messersmith; Robin Faitoute for preparation of larvae for SEM photography; Susann Braden for the SEM micrographs; Young Sohn for the art work; and Noreen Connell for typing the manuscript.

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SECOND RECORD OF SOUTH AMERICAN BURROWING BUG, *SCAPTOCORIS CASTANEUS* PERTY (HEMIPTERA: CYDNIDAE) IN THE UNITED STATES[1]

Richard C. Froeschner, Warren E. Steiner, Jr.[2]

ABSTRACT: A second North American population of the neotropial *Scaptocoris castaneus* Perty was found among beach plants on a sand dune in Georgia about 200 miles south of the initial find in South Carolina.

While collecting on Little Cumberland Island, Camden County, Georgia, in September 1982, Steiner discovered five adult specimens of the South American burrowing bug, *Scaptocoris castaneus* Perty; this locality is approximately 200 miles south of Charleston, South Carolina, whence the species was originally reported in North America by Froeschner and Chapman (1963). That paper included a dorsal habitus drawing. Whether this represents a separate introduction into the United States due to dumping of ballast by early sailing ships (see paper cited) or a part of the same introduction reported for Charleston, South Carolina, is not now evident. Further collecting along the coasts of South Carolina and Georgia is needed to determine if the two populations are continuous.

Three of the Georgia specimens of *S. castaneus* (28 September 1982) were found among the roots of European beachgrass (*Ammophila arenaria* (L.) Link) and sea-oats (*Uniola paniculata* L.) on a primary ocean beach dune; bugs were exposed by digging into the top of the slip-face of the dune and were found at depths of 8-15 cm in slightly moist sand. At the same locality on 30 September 1982, two more specimens were taken during the late afternoon on the sand surface of a trail through the dunes. These cydnids bear a remarkabe similarity to some scarabaeid and tenebrionid beetles which also inhabit dune sand; the globular, rugose body, bladelike front tibiae and stout hind legs with reduced tarsi, and long setae on legs and venter are seen in many unrelated taxa which have evolved a psammophilous way of life.

ACKNOWLEDGMENTS

Thanks are due the Little Cumberland Island Association for granting permission to collect insects on the island, and to Rebecca Bell and William A. Dix for valuable field assistance.

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NOTES ON *BRACHYDEUTERA* LOEW (DIPTERA: EPHYDRIDAE) FROM NORTH AMERICA[1]

Wayne N. Mathis[2]

ABSTRACT: The type series of *Brachydeutera argentata* (Walker) and its junior synonym, *B. dimidiata* Loew, are reviewed, to include lectotype designations for both. *B. argentata* is now known to occur only in eastern North America, and in southeastern United States its' distribution overlaps that of *B. neotropica*. A few paratypes of *B. neotropica* were discovered to be misidentified, thus altering slightly the distribution of that species. A revised key and illustrations of North American species of *Brachydeutera* are presented.

As part of a research project on the genus *Brachydeutera* Loew from the Oriental, Australian, and Oceanian regions (Mathis and Ghorpade, in preparation), we needed to know the identity of *B. argentata,* which had been reported from these regions in addition to North America (eastern United States) and the Palearctic Region (Canary Islands, eastward through the Mediterranean and Middle Eastern countries to Japan) (Wirth, 1964). Clarification of the status of *B. argentata* has resulted in this publication, which also includes illustrations of the male terminalia and a key to the three species known from the Western Hemisphere.

Walker (1853) described *argentata,* but in the genus *Notiphila.* Less than a decade later, Loew (1862) erected the genus *Brachydeutera* for *B. dimidiata,* a species that he newly described in the same paper. The specimens Walker and Loew studied are from North America, "United States" and "Wasington [D.C.]" respectively. Becker (1896) recognized that Walker and Loew were dealing with the same species and cited *B. argentata* as the widespread, holarctic species, with *B. dimidiata* as the junior synonym. Not until Wirth's revision (1964) of *Brachydeutera* was the status of *B. argentata* changed. Wirth's studies, particularly of the male terminalia, indicated that several species were included under *B. argentata* of authors. For the most part Wirth (1964) described these species, although he still followed his predecessors in recognizing *B. argentata* as a widespread, holarctic species. My studies have revealed that specimens of *"B. argentata"* from the Old World represent another species, for which *B. ibari* Ninomiya (1929) appears to be an available name. Details concerning the latter species will be presented elsewhere (Mathis and Ghorpade, in preparation).

In quoting information on labels, I have cited data as they appear, with clarifying or interpretive remarks in brackets. A double set of quotation

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marks is used to distinguish data occurring on one label from those on another.

Key to North American species of *Brachydeutera* Loew

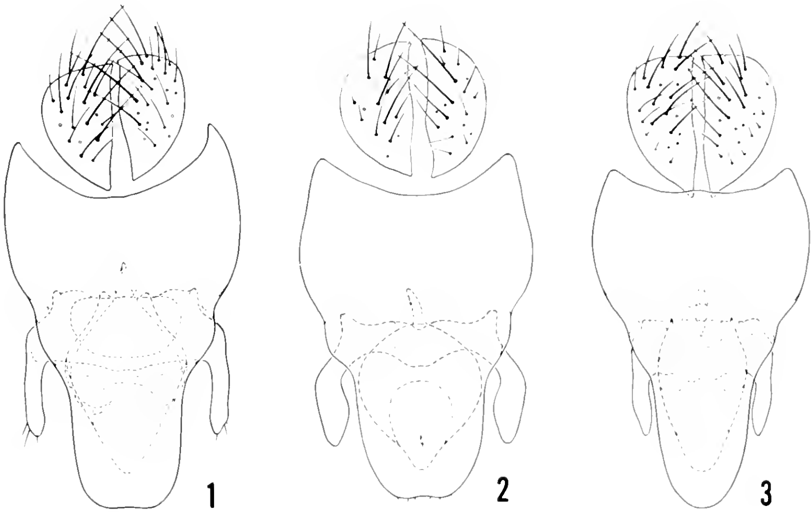
1. Facial carina low, bluntly rounded, especially ventrally; male terminalia as in Figs. 3, 6 (Texas to California, south into Mexico) .... *B. sturtevanti* Wirth
   Facial carina high, sharply defined, especially ventrally 2
2. Merger of fused surstyli with epandrium, in lateral view, indicated by an angulate emargination (Fig. 5); gonite spatulate apically (Fig. 5) (Florida to Texas, southward throughout most of the Neotropics) .... *B. neotropica* Wirth
   Merger of fused surstyli with epandrium, in lateral view, broadly rounded (Fig. 4); gonite digitiform apically, narrowly rounded (Fig. 4) (eastern North America; Michigan to Maine, south to Texas and Florida .... *B. argentata* (Walker)

Brachydeutera argentata (Walker)
(Figs. 1, 4)

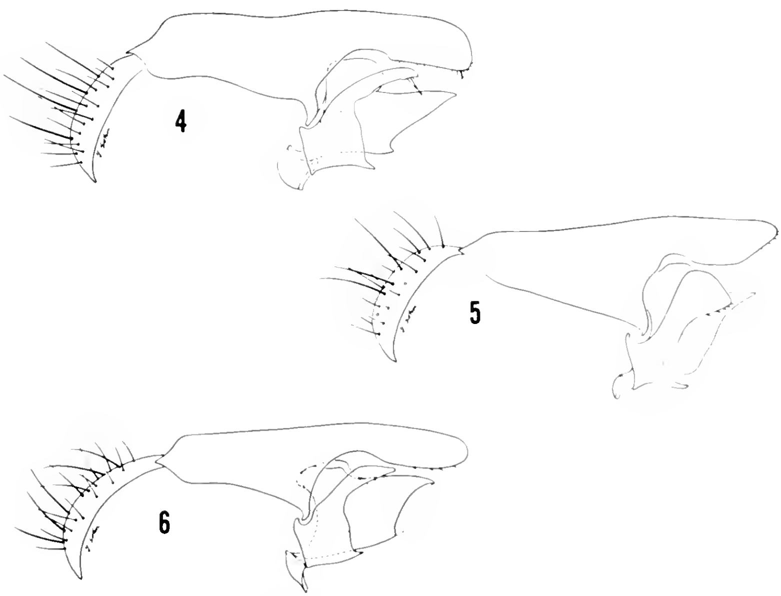
Notiphila argentata Walker, 1853: 407.
Brachydeutera dimidiata Loew, 1862: 163 [synonymy according to Becker, 1896: 201].
Brachydeutera argentata: Becker, 1896: 201; Wirth, 1964: 5 [revision].
Brachydeutera neotropica Wirth, 1964: 8 [paratype series partially misidentifed, see remarks section below].

Primary Type Material. — Lectotype specimen of *Notiphila argentata* (herein designated), in the British Museum (Natural History), is labeled "Notiphila type argentata Walk. [name handwritten on a disk with a green sub-border]" " N. America. Ex coll. Saunders. 68.4 [handwritten]" " VB [?, handwritten on underside of label]" " argentata [folded, handwritten]" " 68.4." " LECTOTYPE Notiphila dimidiata Walker By W.N. Mathis [name and designator handwritten; black sub-border]." The Lectotype is double mounted (pin in paper rectangle) and is in poor condition (wings, abdomen, and two legs missing). It is not clearly evident whether Walker described this species from a single specimen or a series, hence the lectotype designation.

Lectotype female of *B. dimidiata* (herein designated), in the Museum of Comparative Zoology, is labeled "D.C. [Washington, D.C.]" " Osten Sacken Coll."" LECTOTYPE ♀ Brachydeutera dimidiata Loew by W.N. Mathis [sex, name, and designator handwritten; black sub-border]." The lectotype is double mounted (minuten nadel in polyporus rectangular block), is in fair condition (the abdomen is twisted, some setae broken or misoriented). Loew, in the original description, gave only the female sex symbol, but mentioned "specimens" in the description and gave measurements as a range. Evidently he had before him a syntypic series. As no specimen was designated specifically as the holotype, I am designating



Figs. 1-3. Male terminalia, posterior view. Fig. 1. *Brachydeutera argentata.* Fig. 2. *B. neotropica.* Fig. 3. *B. sturtevanti.*



Figs. 4-6. Male terminalia. lateral view. Fig. 4. *Brachydeutera argentata.* Fig. 5. *B. neotropica.* Fig. 6. *B. sturtevanti.*

the lectotype here. The series,all from Osten Sacken's collection, is at the MCZ and includes two males and three females. Only one male and one female specimen bear a "D.C." label. As only the latter female agrees with the sex Loew indicated and the type locality of "Washington," it was selected as the lectotype.

Remarks. — The three species of *Brachydeutera* occurring in North America are closely related and belong to the same species group, the *argentata* group. The close relationship among them is particularly evident in their very similar appearance. Externally, for example, I can accurately distinguish only *B. sturtevanti,* and must rely on characters of the male terminalia for separation of the other species. Fortunately these characters are marked and clear (see figures and key). Accurate identification are presently available only for males.

After making dissections and studying characters of the male terminalia of the type series of *B. neotropica,* it became evident that the paratypes of that species from North Carolina and some of them from Florida were misidentified. They are representatives of *B. argentata.* This discovery alters the cited distribution of *B. neotropica* (Wirth, 1964), which is corrected as follows: Southeastern United States (Florida to Texas, southward through Mexico and Central America to most of South America. In southeastern United States, the distributions of *B. argentata* and *B. neotropica* overlap, especially in Florida, and characters of the male terminalia must be used in making species indentifications.

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NEW HYDROPTILIDAE (TRICHOPTERA) FROM ALABAMA AND SOUTH CAROLINA[1]

Robert W. Kelley[3], Steven C. Harris[4]

ABSTRACT: Four new species of micro-caddisflies are described from blackwater streams of Alabama and South Carolina. Two species are assigned to the genus *Oxyethira* and one each to the genera *Neotrichia* and *Hydroptila*. Each is illustrated and compared to similar species within their respective genera.

In recent years, it has become increasingly clear that the southeastern United States supports a great diversity of micro-caddisflies. This diversity is a result of a southerly range extension of largely boreal species and a northerly range extension of Central American species, as well as the occurrence of many endemic species. Most of the species of Hydroptilidae endemic to the Southeast are associated with blackwater, sandy-bottom streams of the Coastal Plain. Included are such species as *Orthotrichia curta* and *O. dentata* from Florida (Kingsolver and Ross, 1961), *Ochrotrichia provosti* from Florida (Blickle, 1961), *Hydroptila wakulla* from Florida (Denning, 1947), *H. lloganae* and *H. molsonae* from Florida (Blickle, 1961), *Oxyethira glasa* from Louisiana to South Carolina (Ross, 1941), *O. lumosa* from Florida to South Carolina (Ross, 1948), *O. novasota* from Texas to South Carolina (Ross, 1944), *O. maya* and *O. setosa* from Georgia to Florida (Denning, 1947), *O. dunbartonensis* from South Carolina (Kelley, 1981), and *O. elerobi* and *O. sininsigne* from Louisiana to South Carolina (Kelley, 1981). To these we add four new species from the same type of habitat. They belong to the genera *Neotrichia, Hydroptila,* and *Oxyethira.* All four species appear to be locally abundant and may be expected to be found elsewhere in the southeast.

Type specimens are deposited in the United States Museum of Natural History (USNM) at the Smithsonian Institution, Washington, DC, the Illinois Natural History Survey (INHS), and the author's personal collections (RWK;SCH).

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Neotrichia alabamensis n. sp.
(Fig. 1)

In most respects, this species resembles *riegeli* Ross. It differs primarily in the inferior appendages, which are more elongate as in *falca* Ross, the three pair of processes enclosing the aedeagus, and the conformation of the spines of the aedeagus.

Male: Antennae 18-segmented. Length 1.8 mm. Venter VII lacking apicomesal process. Segment VIII not modified. Segment IX with elongate antero-lateral apodemes and blunt, rounded posterolateral processes. Inferior appendages proximally separated and diverging, each bearing a basal seta; bracteoles lightly sclerotized, with sinuous ventral margin. Tergum X membranous dorsally, produced ventrally into three pairs of acute processes which enclose aedeagus; bilobed processes subtending tergum. Aedeagus with two subdistal spines, one of which is strongly curved; titillator present.

Female: Unknown.

Etymology: Latin: "of Alabama."

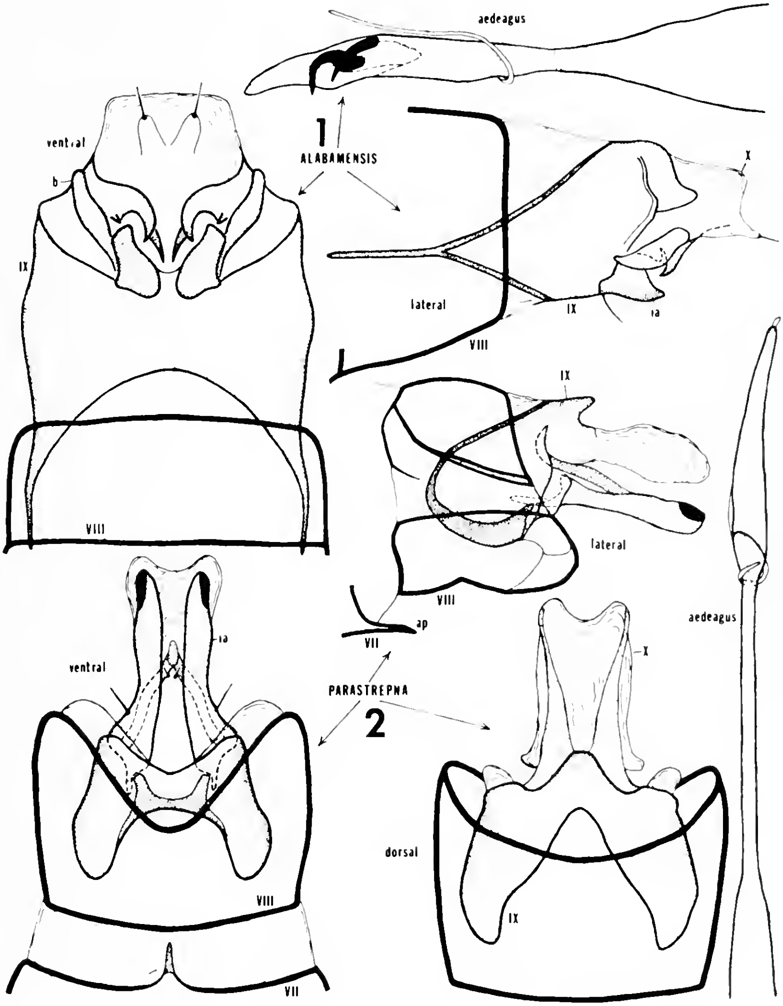
Holotype, male: ALABAMA, Mobile County, Indian Grave Creek near junction with Cedar Creek, 4 miles east of Citronelle, 29 Sept. 1981, Harris, O'Neil, and McCullough (USNM).

Paratypes: ALABAMA, Mobile County, Puppy Creek at Co. Rd. 217, 7 miles southwest of Citronelle, 25 June 1981, 1 ♂. Harris, O'Neil, and McCullough (SCH); Puppy Creek as above, but 5 Aug. 1982, 1 ♂, Harris and O'Neil (SCH); Puppy Creek as above, but 20 Sept. 1982, 1 ♂, Harris and O'Neil (SCH); Big Creek at Hwy. 63, 25 June 1982, 1 ♂, Harris and O'Neil (SCH); Cedar Creek, 6 miles east of Citronelle, 4 Aug. 1982, 1 ♂, Harris (SCH); Cedar Creek as above, 20 Sept. 1982, 2 ♂, Harris and O'Neil (SCH); Escatawpa River, 7 miles west of Citronelle, 5 Aug. 1982, 2 ♂, Harris and O'Neil (SCH); Bennett Creek, 6 miles west of Citronelle, 5 Aug. 1982, 3 ♂, Harris and O'Neil (SCH); Chickasaw Creek, 2 miles north of Oak Grove, 24 June 1982, 1 ♂, Harris and O'Neil (SCH); Baldwin County, Little Rvier at Hwy. 59, 11 May 1982, 1 ♂, Harris (SCH); Pine Log Creek at Hwy. 59, 11 May 1982, 3 ♂, Harris (USNM); Washington County, Pond Creek at Co. Rd. 9, 13 May 1982, 1 ♂, Harris (USNM); Okwakee Creek at Co. Rd. 9, 13 May 1982, 1 ♂, Harris (USNM); Monroe County, Little River at Little River State Park, 11 May 1982, 1 ♂, Harris (USNM); Choctaw County, Middle Tallawampa Creek at Co. Rd. 23, 16 May 1982, 4 ♂, Harris (RWK); Tallawampa Creek at Co. Rd. 23, 16 May 1982, 1 ♂, Harris (INHS); Butler County, Pigeon Creek at Hwy. 110, 4 Sept. 1982, 1 ♂, Harris (INHS); Perry County, Oakmulgee Creek at Co. Rd. 30, 15 June 1981, 1 ♂, Harris (INHS); Oakmulgee Creek at Hwy. 219, 20 Sept. 1981, 1 ♂, Harris and O'Neil (INHS); Tuscaloosa County, Tyro Creek, 4 miles southeast of Berry, 15 June 1982, 1 ♂, Harris and O'Neil (INHS); Escambia County, Little Escambia Creek at Hwy. 31, 6 Aug. 1982, 1 ♂, Harris and O'Neil (INHS).

Hydroptila parastrepha **n. sp.**
(Fig. 2)

This species can be placed in the *consimilis* group and is closely related to *strepha* Ross. It can be distinguished from the latter on the basis of the inferior appendages which are distally broad, each bearing a darkly pigmented spot on the apex. The sclerotized plate supporting the aedeagus is distinctly pointed distally, unlike the rounded conformation in *strepha.*

Male: Antennae 29-segmented. Length 3.5 mm. Apicomesal process of Venter VII short. Dorsum IX with mid-dorsal projection; blunt posterolateral processes; venter deeply



Figs. 1-2. Male genitalia - Segments VII-X and aedeagus. 1, *Neotrichia alabamensis* n. sp. 2, *Hydroptila parastrepha* n. sp.

excised anteriorly with a pair of posteriorly directed apodemes articulating with inferior appendages. Inferior appendages lacking mesal connection; with narrow anterior projections; broadening distally with black spot at apex. Tergum X largely membranous with lightly sclerotized lateral bands; sclerotized lateral rods enclose aedeagus and fuse ventrad of that structure. Aedeagus with broadened distal portion from which ejaculatory duct protrudes at tip; titillator short.

Female: Unknown.

Holotype, male: ALABAMA, Mobile County, Puppy Creek at Co. Rd. 217, 7 miles southwest of Citronelle, 9 Nov. 1981, Harris (USNM).

Paratypes: Same, but 12 May 1982, 1 ♂ (SCH); Mobile County, Cedar Creek, 12 May 1982, 1 ♂, Harris (RWK).

Oxyethira lumipollex **n. sp.**
(Fig. 3)

It appears that this species is part of the *forcipata* group, being most closely related to *setosa* Denning. There are many characters which render it distinct, including the shape of segment VIII with its two lateral spines and the tapering distal process of the aedeagus.

Male: Antennae 31-segmented. Length 2.9 mm. Venter VII with apicomesal process. Segment VIII short; dorsum roundly excised; pleuron excised dorsolaterally and bearing two spines, one at innermost point of excision and another at tip of lateral finger-like process. Venter IX reaching to posterior end of segment VII; dorsum IX reduced to thin strip. Inferior appendages apparently lacking. Subgenital processes convergent, with blackened tips. Aedeagus wtih ventral sclerotized process tapering to a point; titillator encircling aedeagus one time.

Female: Unknown.

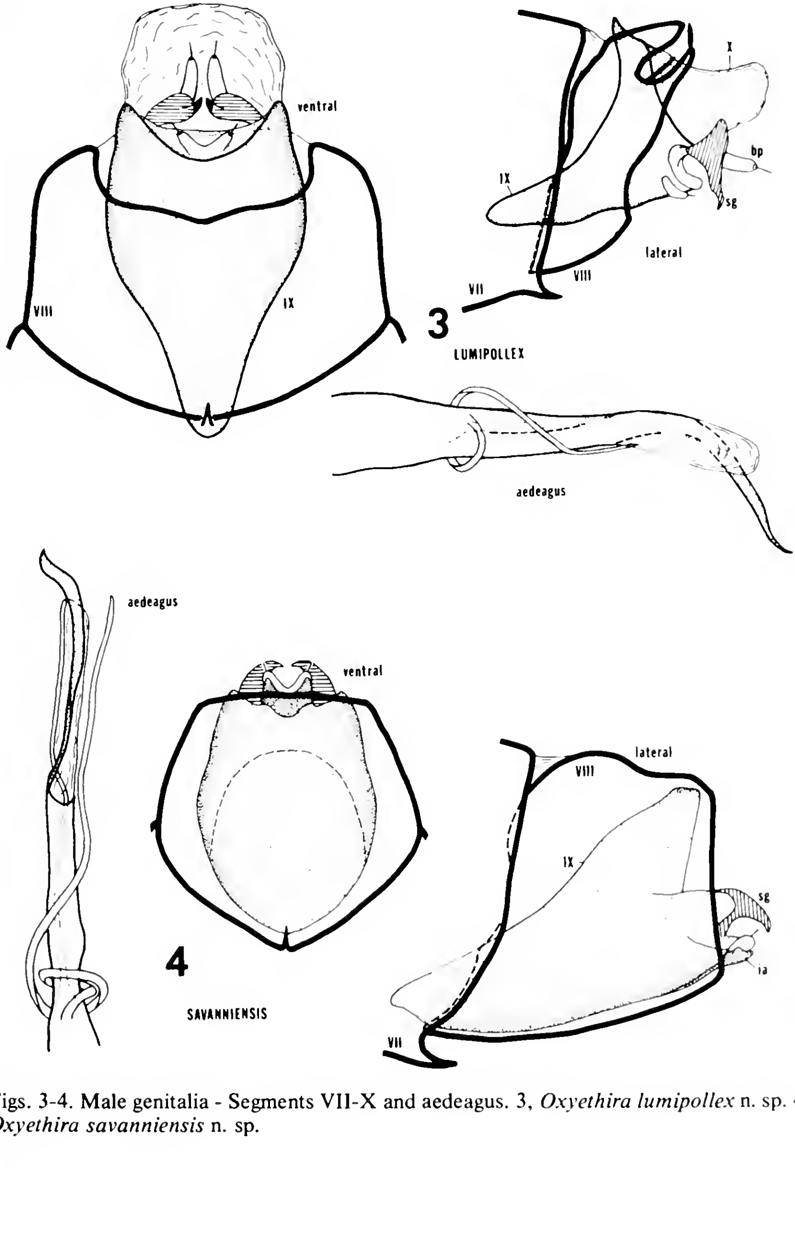
Entymology: Latin: "thorn-thumb."

Holotype, male: ALABAMA, Mobile County, Bennett Creek, 6 miles west of Citronelle, 30 Sept. 1981, Harris, O'Neill, and McCullough (USNM).

Paratypes: Same as above, 1 ♂; same as above, but 5 Aug. 1982, 1 ♂, Harris and O'Neil (USNM); Escatawpa River, 7 miles west of Citronelle, 31 March 1982, 2 ♂, Mettee and O'Neil (RWK); Escatawpa River same as above, but 20 Sept. 1982, 1 ♂, Harris and O'Neil (INHS); Beaver Pond Branch, 1.5 miles west of Citronelle, 5 Aug. 1982, 1 ♂, Harris and O'Neil (INHS); Washington County, Bates Creek at Hwy. 43, Aug. 1982, 1 ♂, Harris and O'Neil (INHS); Choctaw County, Tallawampa Creek at Co. Rd. 23, 16 May 1982, 1 ♂, Harris (SCH); Bogueloosa Creek at Co. Hwy. 9 near Toxey, 16 May 1982, 10 ♂, Harris (SCH); Perry County, Oakmulgee Creek at Hwy. 219, 4 Apr. 1982, 1 ♂, Harris and O'Neil (SCH).

Oxyethira savanniensis **n. sp.**
(Fig. 4)

This species belongs to the *grisea* group. It is similar to *novasota* Ross, *grisea* Betten, and *rivicola* Blickle and Morse in the heavily sclerotized, M-shaped inferior appendages. However, the broad dorsum IX and complete, non-excised, posterior margin of segment VIII are reminiscent of *lumosa*. The combination of characters mentioned above along with the elongate process of the aedeagus render it distinct.



Figs. 3-4. Male genitalia - Segments VII-X and aedeagus. 3, *Oxyethira lumipollex* n. sp. 4, *Oxyethira savanniensis* n. sp.

Male: Antennae 29-segmented. Length 24 mm. Venter VII with apicomesal process. Segment VIII cylindrical with posterior margin complete, not excised. Inferior appendages heavily sclerotized and M-shape. Subgential processes pointed and convergent. Aedeagus with long distal process beginning at midlength and widening distally; titillator encircling aedeagus twice.

Female: Unknown.

Etymology: Referring to the type locality inthe Savannah River Basin.

Holotype, male: SOUTH CAROLINA, Aiken County, Savannah River Plant, Upper Three Runs Creek at SRP 8-1, 29 March 1976, Herlong and Prichard (USNM).

Paratypes: ALABAMA, Mobile County, Puppy Creek at Co. Rd. 217, 25 June 1982, 1 ♂, Harris and O'Neil (USNM); Puppy Creek same as above, but 12 May 1982, 4 ♂ (RWK); Puppy Creek same as above, but 20 Sept. 1982, 3 ♂, Harris (RWK); Escatawpa River, 7 miles west of Citronelle, 5 Aug. 1982. 2 ♂, Harris and O'Neil (USNM); Nobodies Creek near junction with Escatawpa River, 8.5 miles southwest of Citronelle, 13 May 1982, 4 ♂, Harris (USNM); Bennett Creek, 6 miles west of Citronelle, 20 Sept. 1982, 1 ♂, Harris (USNM); Chickasaw Creek, 2 miles north of Oak Grove, 24 June 1982, 1 ♂, Harris and O'Neil (INHS); Beaver Pond Branch, 1.5 miles west of Citronelle, 5 Aug. 1982, 1 ♂, Harris and O'Neil (INHS); Cedar Creek, 6 miles east of Citronelle, 4 Aug. 1982, 2 ♂, Harris and O'Neil (INHS); Indian Grave Creek near junction Cedar Creek, 4 Aug. 1982, 1 ♂, Harris and O'Neil (INHS); Baldwin County, Turkey Creek at Hwy. 59, 11 May 1982, 2 ♂, Harris (INHS); Farris Creek at Hwy. 59, 11 May 1982, 25 ♂, Harris (INHS); Hall Creek at Hwy. 59, 11 May 1982, 5 ♂, Harris (SCH); Washington County, Okwakee Creek at Co. Rd. 9, 13 May 1982, 3 ♂, Harris (SCH); Bates Creek at Hwy. 43, 4 Aug. 1982, 2 ♂, Harris and O'Neil (SCH); Escambia County, Blackwater Creek at Co. Rd. 4, 12 June 1982, 1 ♂, Harris (SCH).

ACKNOWLEDGMENTS

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A NEW SPECIES OF *UNERUS* FROM HONDURAS (HOMOPTERA: CICADELLIDAE)[1,2]

Paul H. Freytag[3]

ABSTRACT: A deltocephaline leafhopper *Unerus gilvus* n. sp. is described from Honduras, and compared with *U. colonus* (Uhler) and *U. fessulus* (Van Duzee).

Linnavouri (1959) revised the deltocephaline leafhoppers of the genus *Unerus* DeLong and included two subgenera, *Unerus* with three species and *Mattogrossus* with one species. Linnavouri and DeLong (1978) added *fessulus* (Van Duzee) to the subgenus *Unerus*. I add one additional species from Honduras to this same subgenus.

Unerus gilvus **n. sp.**
(Figures 3, 4, and 10-14)

Length of male 3.9-4.0 mm., female 4.1 mm.

Resembling *fessulus* (Van Duzee) (redescription in Linnavouri and DeLong 1978: 228) but with apical spots on crown.

Generally pale ochraceous, with faintly indicated pattern on frontoclypeus, crown with two pairs of spots, larger pair behind ocelli and a smaller apical pair between ocelli. Face with pair of dark spots between the ends of frontoclypeal sutures and eyes.

Male genitalia: Pygofer similar to *colonus* (Uhler) but posterior process (Fig. 14) not greatly expanded at base and more sharply pointed at apex. Genital plates (Fig. 13) triangular with lateral margin short with a few macrosetae (usually four). Style (Fig. 12) with apex small, claw-like, base robust. Aedeagus (Figs. 10 & 11) long, slender, evenly curved dorsad, gonapore subapical, apex bifed, sharply pointed, and a pair of extremely short, lateral processes half distance to base.

Female seventh sternum similar to *colonus*, except median projection shorter and wider.

Holotype male, Honduras, El Zamorano, Nov.-Dec., 1970, George F. Freytag, blacklight trap; allotype female, same data except July 22 and 29, 1970, both deposited in the collection of the California Academy of Science. Paratypes: one male, same data as holotype, deposited in the Ohio State University Collection; and one male, same data, except Oct.-Nov., in the University of Kentucky Collection.

Notes: The male of *fessulus* is unknown but the color markings of the head are similar to this new species, except for the lack of the apical spots on the crown. I believe *fessulus* is a distinct species, not as Linnavuori and DeLong speculated that it would be a synonym of *colonus*.

The head and male genitalia of *colonus* (Figs. 1, 2 and 5-9) are illustrated for comparison with *gilvus*. The major difference between this

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[2]The investigation reported in this paper (83-7-70) is in connection with a project of the Kentucky Agricultural Experiment Station and is published with approval of the Director.

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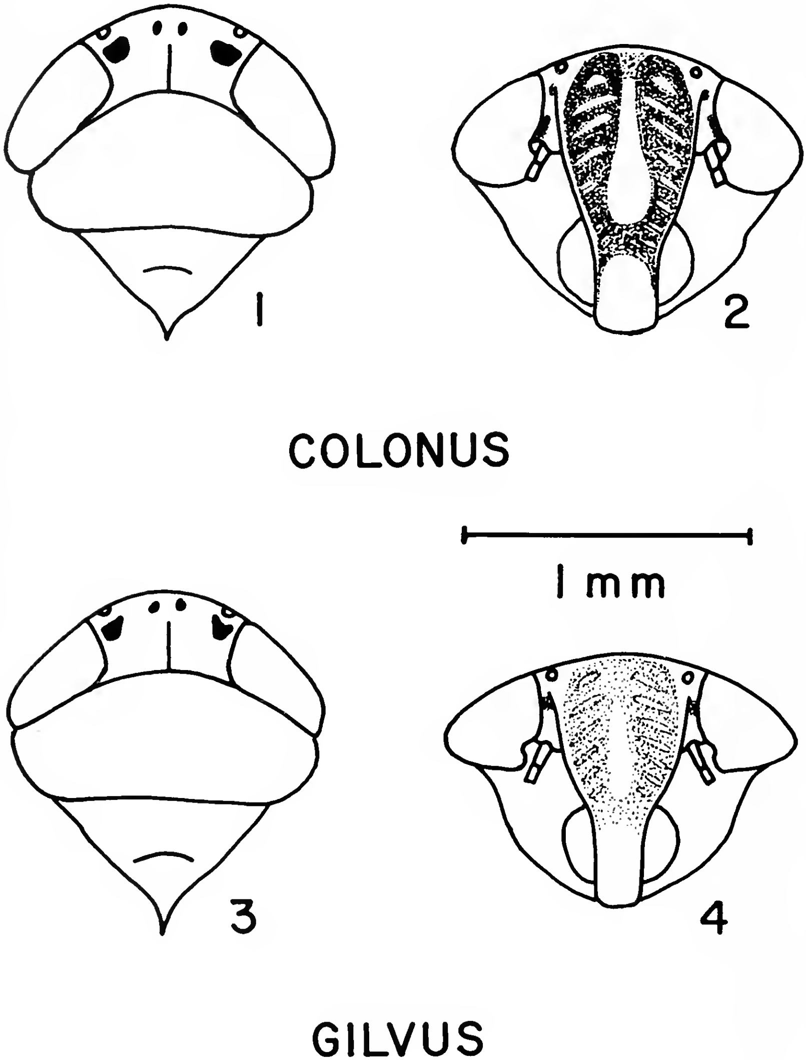
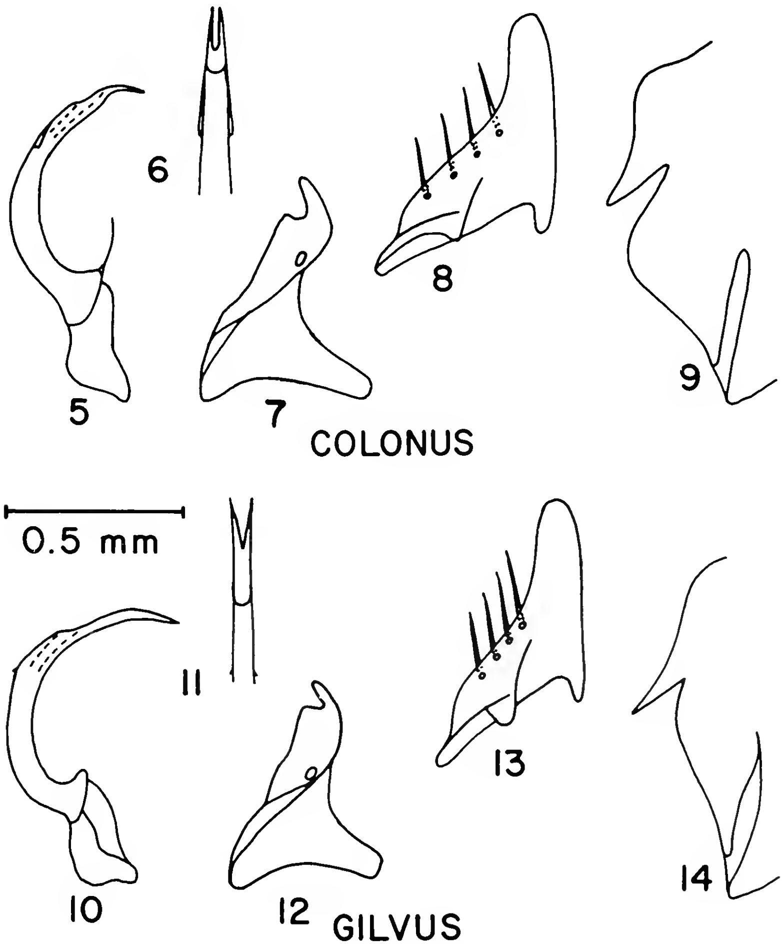


Figs. 1-2. Male *U. colonus* (Uhler). 1, head, pronotum and scutellum (dorsal aspect). 2, head (anterior aspect). Figs. 3-4. Male *U. gilvus* n. sp. 3, head, pronotum and scutellum (dorsal aspect). 4, head (anterior aspect). All drawn to the same scale.



Figs. 5-9. Male genitalia of *U. colonus* (Uhler). 5, aedeagus and connective (lateral aspect). 6, apex of aedeagus (ventral aspect). 7, style (dorsal aspect). 8, genital plate (dorsal aspect). 9, posterior margin of pyrofer (lateral aspect). Figs. 10-14. Male genitalia of *U. gilvus* n. sp. 10, aedeagus and connective (lateral aspect). 11, apex of aedeagus (ventral aspect). 12, style (dorsal aspect). 13, genital plate (dorsal aspect). 14, posterior margin of pyrofer (lateral aspect). All drawn to the same scale.

new species and *colonus* is the lack of a distinct dark pattern on the frontoclypeus, as in *colonus,* and the male aedeagus with very small medial processes, not the wing-like subapical processes as in *colonus.*

The known distributions are: *colonus* from the United States, West Indies, Panama, and most of South America, *fessulus* only from Jamaica, and *gilvus* only from Honduras. The other two species in this subgenus are both known only from Argentina.

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SOCIETY MEETING OF OCTOBER 19, 1983

Professor Dewey Caron, Chairman of the Department of Entomology and Applied Ecology at the University of Delaware, was the featured speaker at the American Entomological Society's first regular meeting of the 1983-84 year. Thirteen members and nine guests were treated to Dr. Caron's very informative talk on the "Status of the Killer Bee."

Although the "killer bee" is morphologically almost identical to the normal European honey bee, behaviorly it is distinct and is considered to be a separate race of *Apis mellifera.* These bees are no more venomous than their European kin, but they are considerably more aggressive and will attack *en masse* with the slightest provocation. The race originated in the sub-Sahara of Africa and was introduced to Brazil in 1957. They accidently escaped, quickly established themselves, and have now displaced commercial colonies and many native bee species throughout tropical and part of temperate South America. Currently they are advancing across Central America at the rate of 200 to 300 miles per year. They are expected to arrive in the southern United States in about 1990 and eventually to infest much of the southern and coastal United States.

The implications of this imminent arrival are hard to assess but they may be great. Bee-keeping for the hobbyist may become impossible as it has in much of South America. Culture techniques will have to change. The current 40 or so deaths per year due to bee stings may well increase. Furthermore, there is likely to be an effect on the one-third of the American diet estimated to be derived from bee pollinated crops.

Although it had been theorized that the aggressive traits of the killer bee would be diluted by mating with local bee populations, Dr. Caron's research in Panama indicates that "Africanization" occurs by displacement without hybridization. Thus it seems unlikely that their unwanted traits will be reduced by the docile local honey bees.

In notes of local entomological interest, Roger Fuester predicted that the southern New Jersey and Delaware populations of the gypsy moth would not collapse until 1985 or 1986. Other members noted the apparent abundance of earwigs, aphids, and preying mantids this fall.

Harold B. White
Corresponding Secretary

THE TICKS OF SOUTH DAKOTA: AN ANNOTATED CHECKLIST (ACARI: IXODOIDEA)[1,2]

Emmett R. Easton[3]

ABSTRACT: Collection data are reported for 16 species of ticks from South Dakota. Nine species, *Argas cooleyi* Kohls & Hoogstraal, *Ornithodorus concanensis* Cooley & Kohls, *Otobius megnini* (Duges), *Dermacentor andersoni* Stiles, *Haemaphysalis chordeilis* (Packard), *H. leporispalustris* (Packard), *Ixodes eastoni* Keirans & Clifford, *I. kingi* Bishopp and *I. spinipalpis* Hadwen & Nuttall are restricted in distribution to the western portion of the state, west of the Missouri River. Six species, *Ornithodoros kelleyi* Cooley & Kohls, *Dermacentor albipictus* (Packard), *D. variabilis* (Say), *Ixodes sculptus* Neumann, *I. muris* Bishopp & Smith and *Rhipicephalus sanquineus* Latreille are more widely distributed, while *I. cookei* Packard is restricted in distribution to the eastern edge of the state.

Ticks have long been recognized as important transmitters of various disease agents to both man and animals. Saliba et al. (1966) described an outbreak of tularemia among native Americans on the Rosebud and Pine Ridge Indian Reservations of southwestern South Dakota that was associated with *Dermacentor variabilis.* Cases of Rocky Mountain spotted fever in man, associated with *D. variabilis,* regularly occur each year, more often in eastern South Dakota, and the virus of Colorado tick fever associated with *D. andersoni* is probably transmitted to man each year in the Black Hills of the western portion of the State. Powassan virus, a proven human disease agent, has been isolated from the blood of small mammals and ticks, *I. spinipalpis* and *D. andersoni* from Spearfish Canyon in the northern Black Hills (Keirans and Clifford 1983).

Non-human etiological agents of disease have also been isolated from ticks in this state. Several isolations of the soft tick viruses Sapphire II and Six Gun City have been recovered from *Argas cooleyi* collected from the Badlands and the Wind Cave National Parks of southwestern South Dakota (C.E. Yunker, pers. comm.).

The relationship to disease of these 16 species of ticks and their distribution, as provided in this list, will become more important as this geographical area is shared with an ever expanding tourist population. Currently many vacationers from the 50 United States as well as the

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provinces of Canada find the Black Hills area and the Badlands National Park pleasant areas to visit. Unless otherwise indicated by the name of the collector, the tick records included here were made by the author and most are on file at the Rocky Mountain Laboratories (USPHS), Hamilton, Montana. Entomologists and other persons concerned with ticks should be advised that the RML tick collection was transferred to The Smithsonian Institutions's new facility at Silver Hill, Maryland in August of 1983 (J.E. Keirans, pers. comm.).

Family Argasidae Canestrini

Genus *Argas* Latreille

Argas cooleyi Kohls & Hoogstraal, Ex. nesting sites of cliff swallows, *Petrochelidon pyrrhonota* from the following locations: on face of cliff, 20 Aug. 1977, Wind Cave Canyon, Wind Cave Nat'l Pk., Custer Co.; nesting sites under small bridge, 24 Aug. 1977, Badland Nat'l Pk. n. of Interior, Jackson, Co.; nests in metal road culvert, 30 June 1980, e. side of Cuny Table near Rockford in Northern Shannon Co.; 19 July 1980, 18 mi se. of Scenic, Pennington Co.

First published record in state was by Wilson (1978) from *P. pyrrhonota* nesting sites in a road culvert near Wanblee on the Pine Ridge Indian Reserv., Washabaugh Co.

Genus *Ornithodoros* C.L. Koch

Ornithodoros concanensis Cooley & Kohls. Ex. nesting site of *P. pyrrhonota* on face of cliff, 20 Aug. 1977, Wind Cave Canyon in Wind Cave Nat'l Pk., Custer Co.; ex. imm. prairie falcons *Falco mexicanus,* 24-25 June 1967, western South Dakota J. Flavin (RML 47651); ex. woman, Aug. 1967. Ft. Pierre, Stanley Co. B. Diamond (RML 48622).

First published record by Wilson (1978) was from cliff swallow nests near Wanblee, Washabaugh Co.

Ornithodoros kelleyi, Cooley & Kohls. Ex. *Myotis lucifugus carissima,* 29 May 1968, Harding Co., J.K. Jones, Jr. (RML 50369); ex. *Myotis s. subulatus,* 20 June 1947, 2 mi. se Wall, Pennington Co., M.L. Johnson (RML 24329); ex. *Myotis lucifugus* in school, Sept. 1979, Mission, Todd Co. (RML 109699).

First published record of this species by Anderson and Jones, Jr. (1971) was from a barn at Ralph in eastern Harding Co.

Genus *Otobius* Banks

Otobius megnini (Duges). Cooley and Kohls (1944) reported the spinose ear tick from the ears of cattle in Haakon and Fall River Counties.

The lack of recent record of *O. megnini* from South Dakota as well as the permanent establishment of the parasite in neighboring states suggests that previous records probably resulted from interstate movement of livestock.

Family Ixodidae Murray

Genus *Dermacentor* Koch

Dermacentor albipictus (Packard). Ex. mountain goat, *Oreamnos americanus,* 22 November 1951, Custer State Park, Custer Co., collector unknown, (RML 30033); ex. elk, *Cervus* *canadensis,* 25 Jan. 1924, Wind Cave Nat'l Pk., Custer Co., collector unknown, (RML 60433); ex. drag, 13 June 1962, Spearfish Canyon, Lawrence Co., R. Kennedy; (RML 38013); ex beneath bale of hay, 4 May 1980, Redig, Harding Co.; ex. cattle, 8 Dec. 1982, Tyndall, Bon Homme Co.

Bishopp and Trembley (1945) first reported this tick from South Dakota, but hosts were not listed. Boddicker and Hugghins (1969) found *D. albipictus* on mule deer, *Odocoileus hemionus* in the Slim Buttes area of Harding Co. and the record from Bon Homme Co. listed above is the first reported occurrence of this species in eastern South Dakota.

Dermacentor andersoni Stiles. Ex. woman, August 1950, Newell, Butte Co., collector unknown, (RML 27865); ex. drag, 18 May 1955, Wind Cave Nat'l Pk. campground, Custer Co. (RML 33268); ex. drag 13 May 1955, 1 mi. w. headquarters, Custer State Pk., Custer Co., Kohls and Jellison, (RML 33260); ex. drag, 14 June 1978, Hells Canyon, Jewell Cave Nat'l Mon., Custer Co.; in sheep pens, 16 May 1955, 12 mi. w. of Edgemont, Fall River Co. (RML 33264); ex. *Eutamias minimus pallidus,* 15 May 1968, 2 mi. s. 3 1/4 mi. from Reva, Harding Co., J.K. Jones, Jr. (RML 50367); ex. drag, 13 June 1978, 12 mi. s. of Reva. Custer Nat. For., Harding Co.; ex. drag, 28 May 1963, near Interior, Jackson Co., J. Bell and G.M. Kohls (RML 38798); ex. drag, 2 May 1982, Spearfish Canyon, Lawrence Co. (RML 115987); ex. drag, 2 May 1980, Bear Butte State Pk., Meade Co.; ex. man, 11 April 1948, Rapid City, Pennington Co., collector unknown (RML 25337); ex. drag, 3 May 1982, Pine Ridge Indian Reservation, Shannon Co. (RML 115990).

Dermacentor variabilis (Say). Ex. drag, 24 May 1977, Oak Lane Girl Scout Camp, 7 mi. s. of Astoria, Brookings Co. (RML 105144); ex. drag, 3 June 1963, Belle Fourche River between Newell and Belle Fourche, Butte Co., G.M. Kohls and J. Bell; ex. drag, 8 May 1981, Bailey's Lake 9 mi. n. of Clark, Clark Co.; ex. drag, 10 May 1977, 2 1/2 mi. NE Watertown, Codington Co.; ex. drag, 20 June 1981, Mitchell, along Big Sioux River, Davison Co.; ex. dog. 22 July 1957, Enemy Swim District, Day Co. (RML 34616); ex. drag, 1 June 1979, 2 miles northwest of Gary, Deuel Co., Kieckhefer and Swartos (RML 109474); ex. drag, 18 May 1955, 11 mi. NW Oelrichs, Fall River Co., G.M. Kohls and W.L. Jellison (RML 33269); ex. drag, 15 May 1980, Damerow road side park, 4 mi. s. of Milbank, Grant Co.; ex. coyote, *Canis latrans,* 5 May 1977, 3 miles northwest of Lucas, Gregory Co., E. Sheldon; ex. drag, 10 May 1977, Lake Poinsett State Pk., Hamlin Co.; ex. drag, 23 May 1979, St. Lawrence Natural Pk., St. Lawrence, Hand Co.; ex. drag, 30 April 1982, Farm Island State Pk., SE of Pierre, Hughes Co., (RML 115992); ex. drag 31 May 1977, Cottonwood Range and Livestock Research Station, 2 mi. E. of Cottonwood, Jackson Co.; ex. drag, 13 May 1980, Lake Whitewood s. of Lake Preston, Kingsbury Co.; ex. *Erethizon dorsatum,* 25 May 1979, Whitewood, Lawrence Co., (RML 109470); ex. drag, 3 June 1978, Newton Hills State Pk., 5 mi. s. of Canton, Lincoln Co.; ex. drag, 21 May 1977, Sica Hollow State Pk., 16 mi. NW of Sisseton, Marshall Co. (RML 105143); ex. drag, 10 July 1979, Bear Butte State Pk., 9 mi. n. of Sturgis, Meade Co. (RML 109490); ex. dog, 2 May 1972, 5 mi. n. of Colman, Moody Co.; ex. man, 28 April 1937, Rapid City, Pennington Co., R.J. Jackson (RML 13167); ex. drag, 30 June 1978, Shadehill Reservoir, Perkins Co.; ex. drag, 20 May 1979, Hartford Beach State Pk., Roberts Co. (RML 109462); ex. drag, 30 April 1982, Pine Ridge Indian Reservation, Shannon Co., J. Casken and E.R. Easton (RML 115989); ex. porpupine, *Erethizon dorsatum,* 9 July 1979, 17 miles n. Midland, Stanley Co., (RML 109491); ex. dog, 3 May 1982, Rosebud Indian Reservation, Todd Co., R. Ballinger (RML 115991); ex. drag, 12 May 1979, Union County State Park,11 mi. s. of Beresford, Union Co., (RML 109460); ex. drag, 24 May 1977, 12 miles ne Dupree, Ziebach Co., G.M. Kohls and J. Bell.

Saliba et al. (1966) reported this species from Todd and Shannon Counties in the western part of the state, but Ulrich and Vaughn (1963) were first to report it from Clay County in southeastern South Dakota.

Genus *Haemaphysalis* Koch

Haemaphysalis chordeilis (Packard). Boddicker and Hugghins (1965) collected this tick from sharptailed grouse, *Pedioecetes phasinaellus,* in either Haakon, Jackson, Mellette or Washabaugh Co. of WC South Dakota.

Haemaphysalis leporispalustris (Packard). Ex. *Sylvilagus audubonii,* 6 Aug. 1980, Martin, Bennett Co., (B. Baran & E.R. Easton); ex. *Sylvilagus floridanus,* 30 May 1980, Spearfish Canyon, s. of Spearfish, Lawrence Co., (E.R. Easton, C.M. Clifford and J.E. Keirans.

Even though Bishopp and Trembley (1945: Fig. 11) show *H. leporispalustris* as occurring nationwide, their collections at that time did not contain material from South Dakota. Turner (1974) evidently was first to report this species from *S. auduboni* near Minnekahta in Fall River Co. Thus far, I have been unable to find the rabbit tick in South Dakota east of the Missouri River.

Genus *Ixodes* Latreille

Ixodes cookei Packard. The only record of this tick available to me is from Banks (1908), who reported *I. cookei* from a small mammal (possibly a woodchuck) from Brookings, Brookings Co.

Ixodes eastoni Keirans & Clifford. Reported originally by Keirans and Clifford (1983) from rodents and insectivores from Lawrence and Pennington Counties of the northern Black Hills as well as from Harding Co., in the northwestern part of the state.

Ixodes kingi Bishopp. Ex. red fox, *vulpes vulpes,* 19 May 1978, 16 Mi. e. of Chamberlain, Brule Co., C. Emmett; ex. *Peromyscus maniculatus,* 17 June 1967, Fall River Co., J.K. Jones, Jr. (RML 48986); ex. *C. latrans,* 12 October 1976, Harding Co., (L. Sheldon); ex. *Mustela frenata,* 29 July 1972, e. of Cottonwood, Jackson Co. (RML 64200); ex. *Mustela nigripes, 23 Oct. 1952, Zeona, 4 mi. n. of Moreau River, Perkins Co. (RML 64214); ex. swift fox, Vulpes velox,* June-Aug. 1978, 14 mi. n. of Ogalala, Shannon Co., J. Sharp.

First reported by Boddicker (1968) from *M. nigripes* in Mellette Co.

Ixodes muris Bishopp & Smith. Ex. *Zapus hudsonius pallidus,* 8 July 1967, LaCreek National Wildlife Ref., 4 mi. s. 8 mi. e., Martin, Bennett Co., J.K. Jones, Jr. (RML 48988); ex. *Microtus p. pennsylvanicus,* 18 June 1965, Hartford Beach State Pk., Roberts Co., J.K. Jones, Jr. (RML 46415).

First reported in this state by Keirans and Clifford (1978) without additional data.

Ixodes sculptus Neumann. Ex. *Spermophilus tridecemlineatus, 27 July 1968, Custer Co. J.K. Jones, Jr. (RML 53745); ex. Cynomys ludovicianus,* April-June 1977, Wind Cave Nat'l Pkg., Custer Co., (J. Hoogland); ex. *S. tridecemlineauts,* 24 March 1977, Buffalo, Harding Co.: ex. *Canis latrans,* 11 Sept. 1976, Harding Co.; ex. longtail weasel *M. frenata,* June 1977, 7 mi. w. of Highmore, Hyde Co.; ex. *S. tridecemlineatus,* 24 July 1972, se of Cottonwood, Jackson Co. (RML 64256).

Cooley and Kohls (1945) record this tick from *S. tridecimlineatus* in Brookings Co., but the earliest report was apparently by Bishopp (1911) (RML 66141).

Ixodes spinipalpis Hadwen & Nuttall. Ex. *Neotoma cinerea,* 26 July 1967, 2 mi. s., 10 mi. w. of Lead, Lawrence Co., J.K. Jones, Jr. (RML 48989); ex. *N. cinerea,* 14 Aug. 1979, Spearfish Canyon, Lawrence Co.; ex. *Peromyscus maniculatus,* 27 Aug. 1968, Wind Cave Canyon, Wind Cave Nat'l Pk., Custer Co., J.K. Jones, Jr. (RML 53746); ex. *P. maniculatus,* 4 Sept. 1983, 1 mi. n., 5 1/2 mi. e. of Hot Springs. Fall River Co., J.K. Jones, Jr. (RML 53768).

McLean et al. (1964) mentioned isolations of Powassan virus from *I. spinipalpis* collected from *Peromyscus* mice in Spearfish Canyon in Lawrence Co.

Genus *Rhipicephalus* Koch

Rhipicephalus sanguineus (Latreille). Ex. dog in home, 21 Apr. 1980, Huron, Beadle Co.
Nelson (1966) was first to report this species in South Dakota on a map of record nationwide. Later Nelson (1968) listed a single record from Madison, Lake Co., according to a U.S. Dept. of Agriculture collection dated 21 April 1962. The lack of additional records of this species in South Dakota indicates that *R. sanguineus* not only cannot overwinter out-of-doors at this latitude, but ticks would have to be accidentally introduced during the short summer season through the movements of pet animals for tick multiplication to occur.

ACKNOWLEDGMENTS

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THE HORSE FLIES AND DEER FLIES OF SOUTH DAKOTA
NEW STATE RECORDS AND AN ANNOTATED CHECKLIST (DIPTERA: TABANIDAE)[1, 2]

Emmett R. Easton[3]

ABSTRACT: Collecting data are reported for 33 species of Tabanidae from South Dakota. New state records and ecological data are presented for 6 tabanid species: *Haematopota americana* Osten Sacken, *Hybomitra epistates* (Osten Sacken), *H. opaca* (Coquillett), *Tabanus lineola* Fabricus, *T. marginalis* Fabricus, and *Tabanus punctifer* Osten Sacken.

The horse and deer flies have always been considered one of the more economically important groups in the order Diptera. They not only possess the potential for transmitting pathogenic organisms to livestock and man (i.e. anaplasmosis, equine infectious anemia, tularemia) but their control is difficult to achieve by any means. Insecticides, although widely used, are only partially effective.

Egg masses of *Tabanus similis* Macquart and *Chrysops aestuans* Van der Wulp are laid on aquatic emergent vegetation that surrounds farm ponds and impoundments in many of the north central states. When beef cattle have access to these sites, vegetation is often consumed or trampled, reducing the available oviposition sites for these flies. The lower numbers of horse and deer flies that inhabited farm ponds in western South Dakota in 1980 indicate that vegetative management on farms and ranches can appreciably lower populations of both *T. similis* and *C. aestuans* (Easton 1982).

The present list includes 33 species, of which six are reported in the state for the first time. Records are based on specimens in the South Dakota State University insect collection, in addition to those collected by the author. Determination of Tabanidae in the SDSU collection has been made previously by L.L. Pechuman of Cornell University and C.B. Philip (California Academy). The initials following each collection refer to the original collector. Records of species lacking an initial were collected by the author.

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Subfamily Chrysopsinae

Genus *Silvius* Meigen

Silvius quadrivittatus (Say). 14 June 1936, Springfield, Bon Homme County, HCS; 10 July 1924, Hot Springs, Fall River County, H; 22 July 1982, 10 miles east, 5 miles south of Buffalo, Harding County; 23 June 1923; Philip, Jackson County, HCS; 1 July 1946, Elk Point, Union County, HCS; 23 June 1946, Yankton, Yankton County. Miller (1978) first reported this species in South Dakota but county records were not given.

Silvius pollinosus Williston. 1 July 1978, Badlands National Park, Jackson County; 18 July 1980, 2 miles east of Cottonwood, Jackson County; 9 July 1979, Haakon County; 15 July 1977, 10 miles east, 3 miles south of Buffalo, Antelope Range and Livestock Research Station, Harding County; 12 July 1979, Wasta, along the Cheyenne River, Pennington County. Reported earlier in South Dakota by Philip (1965) and more recently by Easton (1982) from the Cottonwood Range and Livestock Experiment Station in Jackson County.

Genus *Chrysops* Meigen

Chrysops aestuans Wulp. 24 June 1939, 10 miles south of Wolsey, Beadle County, HCS; 28 June 1939, 5 miles east of Wessington, Beadle County, NPL; 5 August, 1967, LaCreek Lake Wildlife Refuge, Bennett County, EUB; 25 June 1924, Springfield, Bon Homme County, H.; 24 June 1923, Newell, Butte County, HCS; 31 July 1940, Belle Fourche, Butte County, NPL; 19 June 1921, Volga, 24 Aug. 1923, Bruce, Brookings County, HCS; 19 June 1933, Hecla, Brown County, HCS; 12 July 1966, Aberdeen, Brown County; 5 July 1946, Henry, Codington County, HCS; 5 July 1946, Watertown, Codington County, HCS; 20 July 1967, McIntosh, Corson County, EUB; 5 August 1967, Stockade Lake, Custer State Park, Custer County, EUB; 15 August 1924, Waubay, Day County, H; 16 July 1967, Dry Lake, Hamlin County, EUB; 15 June 1977, 15 miles southeast of Buffalo, Harding County; 15 July 1945, Canning, Hughes County, HCS; 11 July 1974, Farm Island, Hughes County, PEC and EUB; 17 July 1947, Pierre, Hughes County, HCS; 5 July 1945, Highmore, Hyde County, HCS; 8 July 1947, Kennebec, Lyman County, GPS; 17 July 1947, Presho, Lyman County, HCS; 12 July 1974, Fate Dam, Lyman County, PEC and EUB; 24 June 1950, Cottonwood, Jackson County, HCS; July 1977, 2 miles east of Cottonwood, Jackson County, JR; 11 August 1969, 2 miles west, Arlington, Kingsburg County, JR; 12 July 1974, 1 1/2 miles north of Vivian, Lyman County, PEC and EUB; 26 June 1940, Faith, Meade County, GPS; 30 June 1977, West River Beef Research Unit, Ft. Meade, Meade County; 18 June 1929, Hartford, Vermillion River, Minnehaha County, HCS; 7 July 1966, 2 miles southeast of Rutland, Moody County, EUB; 15 August 1979; 1 mile north Hill City, Lake Mitchell, Pennington County; 30 June 1981, 15 miles east of Pine Ridge, Shannon County, BB; 2 August 1967, Hayes, Stanley County, EUB; 18 June 1924, Elk Point, Union County, H; 19 June 1924, Elk Point, Union County. C. Aestuans is the most commonly distributed deer fly in the state and probably the most important fly species affecting man in recreational areas. It is found in most of the lakes, rivers, and farm ponds in this state from east to west. Cobb and Balsbaugh (1976) reported *C. aestuans* from Clark, Kingsbury and Spink counties.

Chrysops callidus Osten Sacken. 4 June 1953, Yankton, Yankton County, HCS. First reported by Miller (1978).

Chrysops carbonarius Walker. 21 June 1941, 10 miles southwest of Belle Fourche, Butte County, N.P. Larson; 19 June 1936, Newell, Butte County, HCS; 19 July 1924, Sylvan Lake, Custer County, H; 4 June 1981, Bear Butte State Park, Ft. Meade, Meade County; 27 May, and 31 May 1977, 2 miles east of Cottonwood, Jackson County: 10 June 1940, Porcupine, Shannon County, LKB; 3 June 1981, Wanblee, Washabaugh County.

Chrysops discalis Williston. Jellison (1950) reported this species from Tulare, Spink County, HCS.

Chrysops fulvaster Osten Sacken. 6 July 1924, Martin, Bennett County, H; 25 June 1935, Springfield, Bon Homme County, HCS; 28 June 1923, Newell, Butte County, HCS; 29 June 1939, Fruitdale, Butte County, NRL; 16 July 1924, Custer, Custer County; 13 July 1924, Hot Springs, Fall River County, H; 21 Aug. 1978, Antelope Range and Livestock Research Station, 10 miles east, 3 miles south of Buffalo, Harding County; 21 July 1950, Cottonwood, Jackson County, HCS; 28 June 1941, 10 miles southwest of Spearfish, Lawrence County, NPL; 26 July 1947, Tinton, Lawrence County, HCS; 24 June 1935, Newton Hills, Canton, Lincoln County, NCS; 22 June 1940, 2 miles northwest of Rapid City, Pennington County, HCS; 13 July 1928, Tulare, Spink County, HCS. Cobb and Balsbaugh, Jr. (1976) were first to record this species from Spink County.

Chrysops furcatus Walker. 19 July, 1924, Custer, Custer County, H. Reported by Miller (1978) but without date of collection or locality.

Chrysops indus Osten Sacken. 3 June, 1969, Gary, Deuel County, EUB. Reported by Miller (1978).

Chrysops mitis Osten Sacken. 16 July 1924, Custer, Custer County, H; 21 July 1950, 2 miles east of Cottonwood, Jackson County; 18 June 1968, Cheyenne Crossing, Lawrence County, EUB; 13 June 1978, Antelope Range and Livestock Research Station 10 miles east, 3 miles south of Buffalo, Harding County; 23 June 1950, Pierre, Hughes County, HCS. First reported by Miller (1978).

Chrysops pikei Whitney. 30 July 1935, Edgemont, Fall River County, HCS. Reported by Miller. (1978).

Chrysops sequax Williston. 25 July 1981, 7 miles south of Brookings, Brookings County; 31 July 1966, Hide-A-Woods, Deuel County, EUB; 2 miles east of Cottonwood, Jackson County; 2 August 1967, Bear Butte, Meade County, EUB. Reported originally by Miller (1978).

Chrysops univittatus Macquart. One female specimen collected from Yankton, Yankton County, is represented in the Nebraska State Museum.

Subfamily Tabaninae

Genus *Haematopota* Meigen

Haematopota americana Osten Sacken. NEW STATE RECORD. 1 female, 15 July 1977, Antelope Range and Livestock Research Station, 10 miles east, 3 miles south of Buffalo, Harding County.

Genus *Atylotus* Osten Sacken

Atylotus bicolor (Wiedemann). 24 June 1938, Springfield, Bon Homme County, WH. Reported originally by Miller (1978).

Genus *Hybomitra* Enderlein

Hybomitra criddlei (Brooks). 25 July, 1924, Spearfish, Lawrence County, H; 4 August, 1967, 5 miles northwest Rockford, Road 231, Lawrence County, EUB. Listed in Miller (1978).

Hybomitra epistates (Osten Sacken). NEW STATE RECORD. 1 female collected from Spearfish, Lawrence County, is in the Nebraska State Museum (Lincoln).

Hybomitra frontalis (Walker). 24 Aug. 1924, Brookings, Brookings County, GPS; 12 July

1923, Lake Hendricks, Brookings County, HCS: 15 July 1946, Henry, Codington County, HCS; 19 July 1924, Custer, Custer County, H; 15 August 1924, Waubay, Day County, H; 16 July 1967, Dry Lake, Hamlin County, EUB; 30 June 1977, West River Beef Research Unit, Ft. Meade, Meade County; 12 July 1932, Onida, Sully County, GPS. McAlpine (1961) reported this species from numerous fresh water sloughs characterized by aspens or willows at 3 localities in the northeastern and one locality in the southwestern area of the state near the Nebraska state line.

Hybomitra illota (Osten Sacken). 6 July 1982, 7 miles south of Brookings, Brookings County; 10 July 1976, Willow Lake, Clark County, PEC; 25 June 1967, Sieche Hollow, Roberts County, EUB. Cobb and Balsbaugh, Jr. (1976) reported this species from Clark and Kingsbury counties of eastern South Dakota.

Hybomitra lasiophthalma (Macquart). 22 July 1924, Custer, Custer County, H. Reported by Miller (1978).

Hybomitra opaca (Coquillett). NEW STATE RECORD. 1 female, 30 June 1978, Antelope Range and Livestock Research Station, 10 mi. east, 3 miles south of Buffalo, Harding County.

Hybomitra pediontis (McAlpine). 16 July 1978, Antelope Range and Livestock Research Station, 10 miles east, 3 miles south of Buffalo, Harding County. Adults and immatures are associated with alkaline sloughs. *H. pediontis* was first reported in this state by McAlpine (1961) in August and July from Henry, Codington County and Gettysburg, Potter County.

Hybomitra rhombica rhombica (Osten Sacken). 17 July 1932, Custer, Custer County, FRB; 4 August 1967, Crooks Tower Lake, Lawrence County, EUB. Reported by Miller (1978).

Hybomitra rupestris (McDunnough). Custer, Custer County H. Reported by Miller (1978).

Hybomitra tetrica hirtula (Bigot). 22 June 1924, Custer, Custer County, H; 28 June 1977; West River Beef Research Unit, Ft. Meade, Meade County. Recorded originally from South Dakota by Philip (1965).

Genus *Tabanus* Linnaeus

Tabaus atratus Fabricius. 29 June 1923, Newell Butte County; 28 July 1940, Belle Fourche, Butte County, NPL; 24 July 1937, Gary, Deuel County, NCS; 25 August 1925, Faulkton, Faulk County, NCS; 11 July 1938, Estelline, Hamlin County, HCS; 17 July 1947, Pierre, Hughes County, HCS; August 1941, Wessington Springs, Jerauld County, HCS; 18 July 1933, Lead, Lawrence County; 17 August 1931, Canton, Lincoln County, HCS; 9 August 1921, Wood, Mellette County; July 1980, Soiux Falls, Minnehaha County, SM; 17 July 1939, Flandreau, Moody County, HCS; 7 Sept. 1979, 9 miles south of Brookings, Moody County; 1 July 1948, Sisseton, Roberts County, HCS; 12 August 1922, Witten, Tripp County; 17 July 1921, Parker, Turner County: 11 August 1980, Centerville, Turner County, JG. Reported by Miller (1978).

T. atratus, as a pest of livestock, is the largest fly in the state however, numbers of this species are not particularly high in any area. Manitoba or black-ball traps do not particularly attract this species.

Tabanus lineola Fabricus. NEW STATE RECORD. 1 specimen from Yankton, Yankton County, collected by J. Edman, is in the Nebraska State Museum.

Tabanus marginalis Fabricus. NEW STATE RECORD. 1 female, 6 August 1977, Cottonwood Range and Livestock Research Station, Jackson County.

Tabanus orbicallus Philip. First reported in S. Dakota by Philip (1936) at Yankton in Yankton County, however, Easton (1982) reported it more recently in the western part of the state at Cottonwood in Jackson County.

Tabanus punctifer Osten Sacken. NEW STATE RECORD. 4 females, 15 July 1977, 10 miles east, 3 miles south of Buffalo, Harding County; 4 July 1982, Spearfish, Lawrence

County; 1 July 1980, Presho, Lyman County; 30 June 1977, West River Beef Research Unit, Ft. Meade, Meade County.

Tabanus quinquevittatus Wiedemann. 27 June 1924, Springfield, Bon Homme County. Listed originally from S. Dakota by Philip (1965).

Tabanus reinwardtii Wiedemann. 2 August 1924, Springfield, Bon Homme County, H; Antelope Range and Livestock Research Station, 10 miles east, 3 miles south of Buffalo, Harding County; 23 July 1969, Wood, Mellette County, HCS.

Tabanus similis Macquart. 5 August 1967, LaCreek Lake Wildlife Ref., Bennett County, EUB; 25 June 1924, Springfield, Bon Homme County, H; 30 June 1923, Brookings, Brookings County, HCS; 16 June 1944, Hecla, Brown County, HCS; 25 August 1944, Chamberlain, Brule County, HCS; 29 June 1923, Newell, Butte County, HCS; 30 June 1924, Lake Andes, Charles Mix County, H; 19 June 1974, Willow Lake, Clark County, PEC; 18 June, Mitchell, Davison County, HCS; 14 July 1951; Bristol, Day County, JAL; 15 July 1945, Canning, Hughes County, HCS; 26 July 1948, Highmore, Hyde County, HCS; July 1977-83; 2 miles east of Cottonwood, Jackson County; 28 June 1941, 10 miles southwest of Spearfish, Lawrence County, NPL; 12 July 1974, Fate Dam, Lyman County, PEC and EUB; 2 August 1967, Bear Butte, Meade County, EUB; 28 June 1977, West River Research Station, Meade County; 19 June 1924, Elk Point, Union County, H. Cobb and Balsbaugh (1976) reported this species from Day, Kingsbury and Spink Counties of eastern South Dakota.

Tabanus stonei Philip. 11 July 1941, Belle Fourche, Butte County, NPL. Reported by Miller (1978).

Abbreviations for collectors: BB, Bruce Baran; EUB, Edward U. Balsbaugh, Jr.; FRB, Fred R. Bingham; LKB, Lynn K. Brunn; PEC, Philippe E. Cobb; JG, Joey Gednalske; H, H.C. Hallock; WH, William Horsfall; NPL, N.P. Larson; JAL, John A. Lofgren; SM, Stephen Munk; JR, Jerry Riedel; WMR, William M. Rogoff; HCS, Harry C. Severin; and GBS, G.B. Spawn.

ACKNOWLEDGMENTS

The author wishes to thank Dr. Richard H. Roberts (USDA, Gainesville, Florida) and Dr. John F. Burger (Department of Entomology, University of New Hampshire, Durham) for determining the species of Tabanidae collected by the author in this study.

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PREY-STALKING BEHAVIOR OF A THOMISID SPIDER, *XYSTICUS CALIFORNICUS* KEYSERLING (ARANEAE: THOMISIDAE)[1]

Roy R. Snelling[2]

ABSTRACT: The thomisid spider, *Xysticus californicus* Keyserling, was seen to deliberately stalk and capture individuals of the ant, *Veromessor chicoensis* M. Smith, at three localities in northern California.

Xysticus (X.) californicus Keyserling is a common crab spider that ranges from British Columbia to southern California (Schick, 1965). While many thomisids secrete themselves in flowers to await potential prey, others actively pursue their prey (Gertsch, 1939). *Xysticus californicus* is one such active predator. Within a period of a few days, I was able to observe the stalking behavior of this spider at three different sites in northern California.

The first observation site was situated along State Highway 32, 4.4 miles east of its junction with U.S. Highway 99 in the city of Chico, Butte County. This site, at an elevation of about 1100 feet, is oak woodland grading into chaparral. In early evening, 18 June 1979, alate females and males of the harvester ant, *Veromessor chicoensis* M. Smith, were emerging from nests for mating flights. Individuals of both sexes usually climbed up nearby grass blades and took flight shortly thereafter. A few, especially males, milled about on the soil surface amidst the many workers. At 1940 hours PST, an adult female of *X. californicus* was seen at about 10 cm from the periphery of the area occupied by the milling group of ants. She slowly approached to within 3 or 4 cm of the group, near a quiescent male ant. After hesitating for a few seconds, the spider rushed up to the ant, seized it and retreated into the grass, climbed a few cm up a grass stem and began feeding.

Several meters away, at another nest, much the same procedure was utilized by another *X. californicus* female. The ant initially attacked, however, was a large worker. The ant responded to the approaching spider by adopting a threatening posure, facing the spider, with gaping mandibles. The spider immediately withdrew a few cm along the periphery of the area occupied by the ants. She then successfully attacked another smaller worker and disappeared into a clump of grass.

The second site was in Tehama County along State Highway 36,

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approximately 5.8 miles northeast of the junction with U.S. Highway 99. This site, at an elevation of about 550 feet, now consists of open grassland with scattered live oaks. Observations here were made late in the afternoon on 22 June 1979. A foraging column of the harvester ant was crossing the pavement of old Highway 36. At 1905 hours PST, an adult female of *X. californicus* approached the file of ants and halted about 4 cm away. After a few minutes, the column of ants thinned momentarily; the spider darted forward, seized an isolated ant and rapidly retreated about 10 cm. There she halted a few seconds and then moved at a more leisurely pace into a small clump of grass.

A final observation was made on 24 June 1979 along Neal Road, about 6.1 miles northeast of its junction with U.S. Highway 99, Butte County. This site was a grassy clearing in chaparral, at an elevation of about 1000 feet. An adult female of *X. californicus* approached a foraging column of *V. chicoensis* at 1932 hours PST and took an isolated worker ant from the column.

During the period in June when these observations were made, foraging columns and mating flights of another *Veromessor, V. andrei* (Mayr), were also studied. This is a larger species of ant than *V. chicoensis* (the sexual forms are much larger) and has monomorphic workers, rather than polymorphic workers. *X. californicus* never attacked or approached *V. andrei,* although both ant species occupied the same sites and have similar periods of activity. Possibly the larger size of *V. andrei* is a deterrent to predation.

Veromessor workers lack a functional sting, but, when disturbed, emit a somewhat foul-smelling liquid from the gastric apex. Their powerful mandibles, used to crush seeds, are capable of inflicting serious damage to other anthropods. *V. andrei,* by virtue of its larger size and correspondingly more powerful mandibles, probably is a more formidable opponent than *V. chicoensis.* It seems possible, then, that some individuals of *X. californicus* may by able to discriminate between the two ant species.

According to MacKay (1982), another thomisid, *Misumenops californicus* (Banks), preys upon foraging workers of another harvesting ant, *Pogonomyrmex rugosus* Emery, capturing the ants in vegetation around nests. Holldobler (1976) observed *M. coloradensis* Gertsch capture resting females of *Pogonomyrmex* spp. MacKay (1982) mentions that *Xysticus* sp. preys primarily or exclusively upon *Pogonomyrmex rugosus.* Neither of the authors comments on spider foraging behavior.

It would be interesting to learn more about the prey preferences, if any, of individuals of *X. californicus.* The specimens I observed seemed to be performing a routine procedure.

ACKNOWLEDGMENT

I wish to thank Dr. J.H. Redner for the identification of the crab spider. Thanks are due also the several reviewers of this note.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

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

ITZN 59 20 July, 1983

The following Opinions have been published by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature,* vol. 40, part 2, on 15 July, 1983:

Opinion No.

1247 (p. 77) *Dactylopius* Costa, (Nov. 1829) and *Pseudococcus* Westwood, 1840 (Insecta, Homoptera): designation of type species.

1248 (p. 81) *Lethocerus* Mayr, 1853 (Insecta, Hemiptera): conserved.

1250 (p. 85) *Gyrohypnus* Samouelle, 1819, ex Leach MS, *Xantholinus* Dejean, 1821, ex Dahl, and *Othius* Stephens, 1829, ex Leach MS (Insecta, Coleoptera): type species designated for these genera.

1255 (p. 97) *Lespesia* Robineau-Desvoidy, 1863 (Diptera, Tachinidae): designation of type species.

The Commission regrets that it cannot supply separates of Opinions.

R.V. MELVILLE,
Secretary

PERISSOPHLEBIODES, A REPLACEMENT NAME FOR *PERISSOPHLEBIA* SAVAGE NEC TILLYARD (EPHEMEROPTERA: LEPTOPHLEBIIDAE)[1]

Harry M. Savage[2]

ABSTRACT: A new generic name, *Perissophlebiodes*, is proposed for *Perissophlebia* Savage nec Tillyard (Ephemeroptera: Leptophlebiidae: Atalophlebiinae). A misspelling of *Perissophlebia* Tillyard (Odonata: Anisozygoptera) is noted.

Recently, Savage (1982) established a new genus, *Perissophlebia*, for a curious new species of mayfly, *P. flinti*, from the southern coastal mountains of Brazil. Previously, Tillyard (1918) had established *Perissophlebia* based upon a fossil wing fragment placed as Odonata *incertae sedis* from the Triassic Ipswich Fossil Bed in Queensland, Australia. *Perissophlebia* Tillyard was recently placed as Anisozygoptera *incertae sedis* in Rohdendorf's (1962) treatment of the fossil Odonata. *Perissophlebia* Tillyard was misspelled as *Periassophlebia* by Rohdendorf (1962), and this misspelling was repeated by Hennig (1969).

Perissophlebia Savage is a junior homonym of *Perissophlebia* Tillyard; therefore, I propose the replacement name *Perissophlebiodes* for *Perissophlebia* Savage.

Etymology: perissos, Gr., meaning odd, extraordinary; phlebos, Gr., vein, a common stem within the Leptophlebiidae; -odes, Gr., suffix denoting likeness; masculine.

Type-species: *Perissophlebia flinti* Savage = *Perissophlebiodes flinti* (Savage) NEW COMBINATION.

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MOUNTING AND PRESERVING NEUROPTERA FOR SCIENTIFIC STUDY[1,2]

Charles W. Agnew[3]

ABSTRACT: Proper techniques for mounting and preserving adult specimens of Neuroptera are described. All neuropterans should be pinned or pointed except the Coniopterygidae, which are best preserved in alcohol. Summaries of special mounting practices for each family are provided. Procedures for preparing genitalia for study are also discussed.

Authors of publications dedicated to proper techniques for mounting and preserving insects have generally assigned methods of preservation to groups of insects based on body size and structure without regard to important taxonomic characters of individual families. Generalizations within certain orders such as Neuroptera, with its widely varied forms, have proved unsatisfactory and usually vary with authors. Consequently, specimens of a single taxon within a large collection may be preserved in a variety of ways due to confusion or disagreement of collectors as to the best techniques.

Members of each family possess certain characters important for their determinations to species. Any specimen should be preserved to: 1) best retain and allow examination of important characters with a minimum of future manipulation; 2) reduce the likelihood of breakage; and 3) facilitate incorporation into a large permanent collection for future study. The best techniques often require a compromise of these considerations.

This paper deals specifically with the best methods for mounting and preserving Nearctic species of Neuroptera. There seldom is unanimous agreement as to which methods should be employed. This paper is a compilation of ideas with the purpose of identifying inferior practices, suggesting which techniques are superior and providing alternatives when no consensus exists.

METHODS AND MATERIALS

The fact that most Neuroptera tend either to shrivel or discolor when dried has prompted many collectors to opt for alcoholic preservation of specimens. One advantage of alcohol is that specimens remain soft and

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flexible, thus reducing breakage problems associated with fragile insects such as neuropterans. Another advantage is that broken parts remain associated with the specimen. Generally, however, dried specimens retain all important taxonomic characters and usually require less trouble to maintain than those in alcohol. Most neuropterists find it easier to work with pinned material. Even liquid-preserved specimens are often difficult to manipulate and wing tearing or antennal breakage can result. In addition, coloration nearly always fades in alcohol (for example, Chrysopidae), although color usually is of limited importance in taxonomic studies. Occasionally, neuropterists will retain a few specimens of certain groups in alcohol when collecting a series, but pinning (or pointing) remains the general preference.

Some collectors use glassine envelopes for storing larger forms such as ascalaphids or myrmeleontids. Envelopes allow more compact storage and help keep broken parts from being lost without the disadvantage of fading caused by alcohol; however, they are not recommended except for temporary storage before spreading. Specimens so preserved are often difficult to examine and breakage is frequently a problem. The fact that alcohol, envelope, and pinned collections must be maintained separately is inconvenient. In the interest of standarization, pinning or pointing neuropterans should be the general rule with the exception of the Coniopterygidae. The latter should be stored in alcohol.

Materials needed for mounting and preserving Neuroptera are basically simple. For a detailed treatment of general collecting and mounting techniques, see Martin (1977). There is disagreement regarding which sizes of pins to use. Most neuropterists use sizes no. 1 to 3; however, some prefer the use of size 0 to 00 pins for more delicate forms in order to reduce damage to the thorax and the need for double-mounting or pointing. The main disadvantages of thin pins are: they are only practical for foam pinning surfaces; they tend to bend easily; and their springing action, if flipped, can cause destruction of the specimen. For these reasons, and the fact that characters of the mesothorax are seldom important, I do not recommend specimens be pinned directly with anything smaller than a no. 1. A good rule is to use the largest pin that will not cause damage to the specimen.

For small specimens that are too delicate to be pinned, there are two alternatives: double-mounting and pointing. Double mounting, using a minuten pin through a strip of polyporous material (pith), is preferred. When pointing, the right side of the specimen is glued to the paper point which has been bent at the tip. The disadvantage of this technique is that specimens often break loose and become damaged, lost or cannot be associated with proper labels. One should use a sufficient amount of glue for a good bond and affix the point to the thorax of the specimen rather than to the wing. Specimens bonded at the wing alone tear loose more frequently leaving only the forewing attached.

A styrofoam block is useful for support during drying, or a grooved spreading board is useful when the spreading of wings is desired. Specimens can also be dried in a box placed in the vertical position. This eliminates the need for support and allows the abdomens to dry parallel to the pinning bottom.

A few general rules should be followed when mounting Neuroptera. It is preferable to pin freshly collected material. Relaxing dried neuropterans should be avoided, when possible, to prevent wings from sticking together and loss of color. When mounting, care should be taken that wings and antennae do not dry in a position where they might be broken by subsequent handling of the specimen. Bending the head and antenna downward before drying, and the use of pins securing the wings will prevent this. It is also important not to allow the wings to dry in a position too close to the abdomen so that removal of terminal abdominal segments is difficult.

Special Instructions

The Hemerobiidae are usually too small to be pinned directly with anything except the smallest size pins. It is recommended that they be double-mounted. Because examination of external male genitalia is sufficient to determine most species, it is desirable to pull out at least one pair of wings to allow a better view of the abdomen. This procedure also allows examination of hindwing characters which sometimes aid in determinations. It can be easily accomplished by pulling out the wings individually with a pin beneath the wing and securing them in place as illustrated in Fig. 1. A spreading board can also be used for drying the wings flat. Double-mounting should be done before embedding the minuten in the strip. When using paper points, allow the glue to set with the specimen supported on a block of styrofoam, then pull the left pair of wings away from the body and secure with pins. If spreading the wings flat is desired, this can be done in a grooved board after the glue dries. If the specimen dies with the wings in an upstroke position, some manipulation of the wings may be necessary in order to allow forewing characters to be seen.

Most Chrysopidae are large enough to be pinned directly with no. 1 pins. Because wings are transparent, it is seldom necessary that they be spread, but it may be advantageous for several specimens of a series or for uncommon species. Wing venation is used extensively as a taxonomic character at the generic level, but male genitalia, which are primarily internal, are the most important for specific (and some generic) determinations. Markings of the head and body are also used to a great degree but variation can make them unreliable characters.

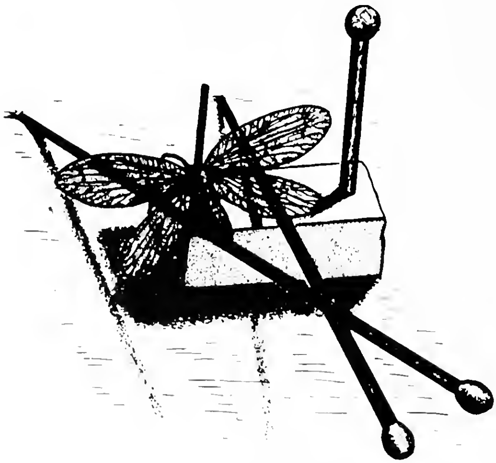

Fig. 1. Double-mounted hemerobiid.

If preserving chrysopids in alcohol is necessary, it should be noted that color markings, especially reds and oranges, often fade completely and some dark veins in the wing may become pale. This can cause confusion when attempting determinations.

It should be noted that chrysopid genitalia do not fully develop and sclerotize until a few days after emergence. For this reason, it may be wise to hold live specimens for a few days if genitalic examinations are desired. This is essential for reared material.

The Sisyridae are small and should always be double-mounted or pointed. The few North American species of this family can be separated by characters of the forewing. Still, genitalia of both sexes are usually diagnostic so it is suggested these insects be mounted like Hemerobiidae (wings partially spread).

The Mantisipidae are usually large enough to be pinned directly. The wings may be spread if desired, but wing venation is seldom used for determinations. Mantisipid taxonomy is in need of revision, thus important diagnostic characters have not been identified in some cases. Color patterns are important in determining Mantispinae (Redborg 1982), while male genitalia are used in Platymantispinae (Rehn 1939). The only special mounting consideration might be to spread the forelegs so that setal patterns are easily seen.

The Myrmeleontidae are among the largest Neuroptera and can create spatial problems if wings are fully spread. Stange (1970) prefers pining antlions with wings held rooflike over the body and recommends against use of a stabilizing pin to prevent loss of the abdomen. I have found that spreading the right pair of wings slightly out from the body (Fig. 2) allows easier examination of the important hindwing without sacrificing much additional space. This can be done with a grooved spreading board, a block of styrofoam or by the use of pins in a box. Some workers prefer the right pair of wings spread at right angles, primarily for aesthetic reasons.

The Ascalaphidae are the most robust Neuroptera and no. 3 pins can always be used. As with ant-lions, specimens require more space in collections if wings are spread. Moreover, their long antennae are easily broken if left to dry while extended away from the body, thus, wings should be held over the body and antennae pulled back as in Fig. 3. This practice can reduce space requirements by about one-half. The six recognized Neartic species can usually be separated without difficulty and the visibility of characters is not a problem in this group.

The Coniopterygidae is the only group best preserved in alohol. Pinned material is much more difficult to determine and removal of terminalia for genitalic examination is always required. In alcohol, the characteristic whitish coat of wax covering the insect is lost, but this proves to be an

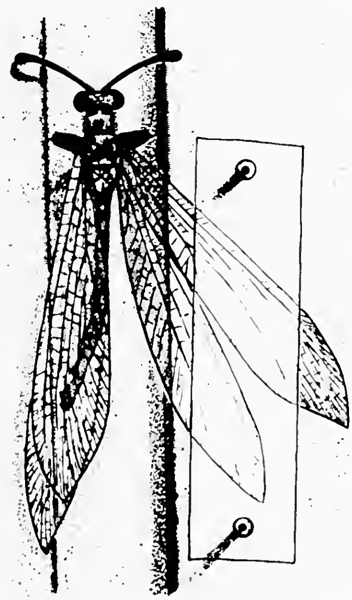

Fig. 2. Suggested method of mounting myrmeleontids.

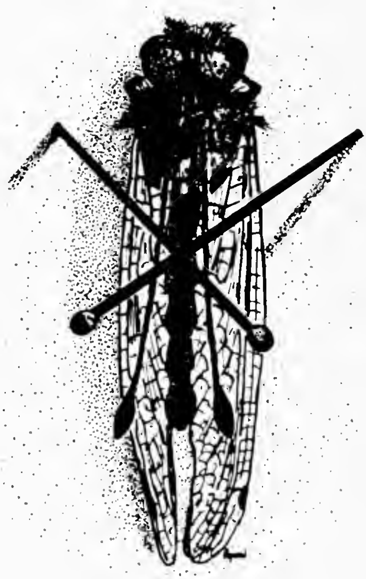

Fig. 3. Suggested method of mounting ascalaphids.

advantage since removal of the wax facilitates interpretation of veins which can aid in placing specimens to genus. Specimens in alcohol can be manipulated to allow examination of the hindwing and external genitalia of the male, which can sometimes be diagnostic without having to be cleared in KOH. This may prove unreliable unless one has experience with the group, but is time-saving if many specimens are to be examined. Females, for the most part, lack sclerotized structures (except in the *Aleuropteryx*) and cannot be determined to species unless associated with males.

There are a few lesser-known families of Neuroptera that are not often encountered by collectors. The Berothidae are similar to Hemerobiidae but can usually be pinned successfully with no. 1 pins. The shape, venation, and markings of the forewing along with internal genitalia are the most important characters. Spreading of wings is recommended since these insects are not usually common.

The Dilaridae are rare in collections, partially because they resemble small moths and are overlooked. The two Nearctic species of this group are easily separated by wing venation and geographic range. They are delicate insects and should be double-mounted.

Our few species of Polystoechotidae and Ithonidae are large and can be pinned without any problem. They all have distinctive forewings and spreading is unnecessary for determination.

Sometimes considered as part of the Neuroptera are the Megaloptera (Corydalidae and Sialidae) and the Raphidioptera (Raphidiidae and Inocelliidae. These insects should be pinned. It might be necessary to examine the hindwing of some Corydalidae to be able to work certain keys, but on the whole, no special procedures are needed. The genitalia remain the most important characters in making determinations, especially in Sialidae.

There are several exotic families not considered here. A basic rule is to pin or point everything except Coniopterygidae. If there are external genitalic structures, their view should be unobstructed by wings and if the forewing is not wholly transparent, some degree of spreading may be necessary to see hindwing characters. Also keep in mind the risk of breakage and conservation of space.

Genitalia Preparation

Accurate identification of most neuropterans to species often requires examination of genitalic structures, usually of the male. In some cases, the last few abdominal segments must be removed and treated in a 10% solution of KOH[4] to dissolve internal tissue and clear the abdominal wall

[4]Bram and Bickley (1963) used a 15% KOH solution to clear chrysopid genitalia (boiling for 13 minutes) while Meinander used a 5% solution for Coniopterygidae).

for examination of internal sclerotized structures. The time of treatment depends largely on size of the specimen and temperature of the solution. The clearing procedure will usually take about 24 hours in a room temperature solution (Tauber 1969). The smaller Coniopterygidae require less time, about 2-10 hours (Johnson 1980). A hot or boiling solution of KOH greatly reduces the time required for clearing. Dr. Phillip Adams (pers. comm.) recommends about 5 minutes for chrysopids. Martin (1977) recommended bringing the solution short of an actual boil to prevent possible damage. To eliminate this risk, a small beaker with KOH and genitalia can be placed inside a larger beaker of water. The water boils, heating the KOH without damaging setae.

After the abdomen has been cleared, it is usually desirable to flush out any remaining residue using a small (27 gauge) hypodermic syringe (Bram and Bickley (1963). After flushing, terminalia should be rinsed in distilled water. Sometimes structures may be everted for better viewing with a strong flush with a syringe (Tauber 1969) or with forceps for large forms such as myrmeleontids (Stange 1970).

Staining is often desirable in order to better discern the internal structures. Dr. Adams' method (pers. comm.) requires injecting the cleared abdomen with 5%[5] chlorazol black E aqueous solution and rinsing in distilled water. The specimen is placed in glycerine for viewing with glycerine being injected into the abdomen. A fine needle is used to apply the stain. For best results, the tip should be nicked, broken off square and the edges rounded with Arkansas stone.

Some workers mount genitalia on slides, but they should be preserved in glycerine-filled microvials (known as genitalia vials) and pinned with the specimen or placed in the vial of alcohol (silicone stoppers preferred). Mounting genitalia on slides does not allow manipulation to view dorsal or ventral aspects and they usually must be dissolved off slides for critical examination.

Female genitalia are not extensively used in most groups for species determinations. Usually structures are not sclerotized and while some are diagnostic, they are difficult to interpret. Structures such as spermatheca, copulatory bursa or subgenital plate have been used in some groups. Stange's 1970 revision of the brachynemurine ant-lions uses digging setae and posterior gonapophysis in the keys.

Larvae

Larvae of Nearctic species of Neuroptera are poorly known and represent a challenge for future workers. In some groups such as the Coniopterygidae, larvae of very few species have been described, while others such as Chrysopidae are better known.

[5]Some workers recommend a 1% solution to reduce the risk of overstaining, noting that destaining with Clorox® is possible, but hard on specimens.

Larval stages should be treated in KAAD (Peterson 1959) and preserved in 80-90% alcohol (ethyl or isopropyl). Dr. Catherine Tauber (pers. comm.) recommended treating chrysopids and hemerobiids for 20 minutes while Stange (1970) treated myrmeleontid larvae for about 24 hours. Henry (1976) discussed a method for clearing ascalaphid larvae for study.

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I would like to thank Drs. P.A. Adams, H.R. Burke, J.E. Eger, R.S. Peigler, K.E. Redborg, L.A. Stange and C.A. Tauber for their contributions to this manuscript.

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PARAPHROSYLUS PRAEDATOR AND *P. NIGRIPENNIS*, NEW TO WASHINGTON, WITH NOTES ON THE GENUS (DIPTERA: DOLICHOPODIDAE)[1,2]

Larry D. Corpus[3]

ABSTRACT: Adult *Paraphrosylus praedator* (Wheeler), *P. nigripennis* (Van Duzee), and *P. direptor* (Van Duzee) were collected from Freshwater Bay, Clallam County, Washington, This represents the first report of *P. praedator* and *P. nigripennis* occurring within the state. Habitat preferences of the 3 species are described.

Paraphrosylus Becker, originally proposed as a subgenus of *Aphrosylus* Haliday (Becker 1922) later considered a synonym of *Aphrosylus* (Foote et al., 1965; Cole 1969) is presently considered a valid genus (Robinson and Vockeroth 1981). *Paraphrosylus* contains 8 species (Van Duzee 1924; Harmston 1951, 1952) found in the western Nearctic region. Collection of adult Diptera, at low tide, from a beach in Freshwater Bay, 22.5 km west of Port Angeles, Clallam County, Washington on 23 May 1981 yielded 3 species of *Paraphrosylus*. Six males and 6 female *Paraphrosylus praedator* (Wheeler), 4 male and 3 female adults of *P. nigripennis* (Van Duzee), and 4 male and 3 female adults of *P. direptor* (Van Duzee) were collected. The finding of *P. praedator* and *P. nigripennis* represents new records for Washington state.

Prior collection records for *P. praedator* list various California locations from La Jolla in the south to Bodega Bay in the north (Wheeler 1897; Cole 1969) and Departure Bay in British Columbia (Saunders 1928). *P. nigripennis* has been recorded from Seaward, Alaska (Van Duzee 1924) and Waldport, Oregon (Cole 1969). Cole incorrectly indicated Waldport as being in Washington. *P. direptor* has been collected from Pacific Grove in California, and Ilwaco, Pacific County, Washington (Cole 1969). Specimens of the latter two species, in the James Entomological Collection at Washington State University, are from Seaview, Pacific County, Washington (Fig. 1).

Adults were collected during low tide, between 1000 and 1130 hours, by sweep netting close to the shaded regions of rocks covered with *Fucus*

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[2]Scientific Paper Number 6454, Washington State University, College of Agriculture Research Center, Pullman. Work done under Project 0037.

[3]Department of Entomology, Washington State University, Pullman, WA 99164-6432.

sp. This alga is found in abundance along the beach (Fig. 2). Adults seemed to congregate only about the *Fucus*, since intensive sweeps and disturbance of other beach debris and seaweed wrack yielded only coelopid and ephydrid adults. This may be an indication that members of *Paraphrosylus* prefer to congregate on and may be attracted to *Fucus*.

Wheeler (1897) and Saunders (1928) described the larvae and pupae of *P. praedator*, and indicated that the immatures were found in the algae growing on beach rocks. A thorough search of the *Fucus* at Freshwater Bay failed to provide immatures, but continued investigations should eventually result in other life stages of these species being found here.

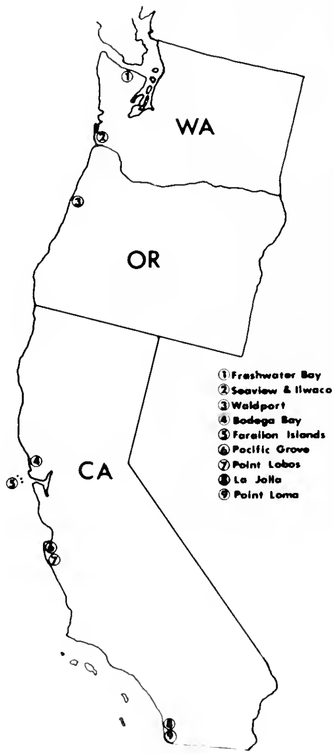

Fig. 1. Collection localities of *Paraphrosylus* in Washington, Oregon and California.

Fig. 2. Specific collection sites of *Paraphrosylus* from shaded portions of *Fucus* covered rocks (arrows).

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A NEW SPECIES OF *PRIONUS (HOMAESTHESIS)* FROM THE MONAHANS SANDHILLS OF WESTERN TEXAS (COLEOPTERA: CERAMBYCIDAE)[1,2]

Frank T. Hovore[3], Robert H. Turnbow, Jr.[4]

ABSTRACT: *Prionus (Homaesthesis) spinipennis* is described as new from the Monahans Sandhills of western Texas. Comparisons are given for related and sympatric species, and the taxonomic parameters of the subgenus are re-examined. A key to species of *Homaesthesis* is provided.

Prionus (Homaesthesis) arenarius Hovore, described (1981) from Monahans Sandhills State Park in western Texas, is one of several *Homaesthesis* species associated with sand dune habitats. During a visit to the Monahans dune system in August, 1982, R.H. Turnbow, Jr., and T.P. Friedlander collected yet another undescribed *Homaesthesis* with structural adaptations similar to those of *P. arenarius* (and common to many arenicolous arthropods). The two species share a number of secondarily derived characters, and may have a common distribution in the Monahans dune system, but the new species is taxonomically quite distinct from *arenarius*. In fact, it exhibits characters which might be interpreted as intermediate between *Homaesthesis* and *Prionus sensu stricto*. The inclusion of this new species and *arenarius* in *Homaesthesis* limits considerably the definition of the subgenus (see generic discussion below). For the present, *Homaesthesis* may be recognized by the opaque, nonstriolate poriferous areas on the male antennal segments, 12- to 14-segmented antennae in both sexes, and smaller overall size (average length usually less than 30 mm.).

Prionus (Homaesthesis) spinipennis, new species

Male: Form moderate-sized, robust, dorsal surface broadly convex, integument castaneous to piceous, thoracic sternites, coxae, femora, and head reddish-brown, antennal segments 3 to 12 lighter reddish-brown.

Head with antennae attaining apical one-third of elytra, 12-segmented, external processes of segments 3 to 11 broadly rounded or feebly truncated, apical segment elongate, flattened, rounded at tip; upper lobes of eyes separated on vertex by about one-third greatest width of head.

Pronotum with discal surface coarsely, irregularly punctate, margins strongly produced and reflexed, anterior tooth arcuate, acute, antemedian tooth acute, moderately produced, posterior angle strongly dentiform, feebly acute or right-angular in dorsal outline; metasternum

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[2]Contribution number 18271 to the Texas Agricultural Experiment Station.

[3]Placerita Canyon Nature Center, 19152 W. Placerita Canyon Road, Newhall, California 91321

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finely, densely punctate, clothed with fine, moderately long pubescence; scutellum with sides angulated at middle, then tapered to apex, basal two-thirds coarsely, irregularly punctate.

Elytra feebly explanate apically, parallel-sided for most of length, discal surface coriaceous, coarsely, irregularly punctate, costae strongly elevated, apices rounded to suture, sutural angle produced into a narrow acute spine (Fig. 2).

Legs with outer angle of protibia subspiniform, tibial spurs long, thin, laminiform, metatibial spurs thickened, tarsi broad, flattened (Fig. 4), first metatarsal segment lacking spongy setal pads on ventral surface, pads greatly reduced on segments 2 and 3, ventral surface of segments densely punctate and pubescent with short, suberect setae, margins of segments 1 to 3 acute, dentiform.

Length (exclusive of mandibles): 19.5 - 32 mm.

Female: Form robust, coloration as in male.

Head with antennae nearly attaining basal one-half of elytra, 12-segmented, external processes of segments increasingly produced apically, apical segment simple.

Pronotum similar in dorsal outline to that of male, lateral teeth conspicuously produced; metasternum very finely punctate, glabrous.

Elytra with sides slightly expanded behind humeri, gradually tapered from middle to suture, sutural angle spinose.

Legs with tibial spurs slightly more pronounced than in male, tarsal spongy pads reduced or absent on all tarsi, tarsal segments similar in form and setation of those of male.

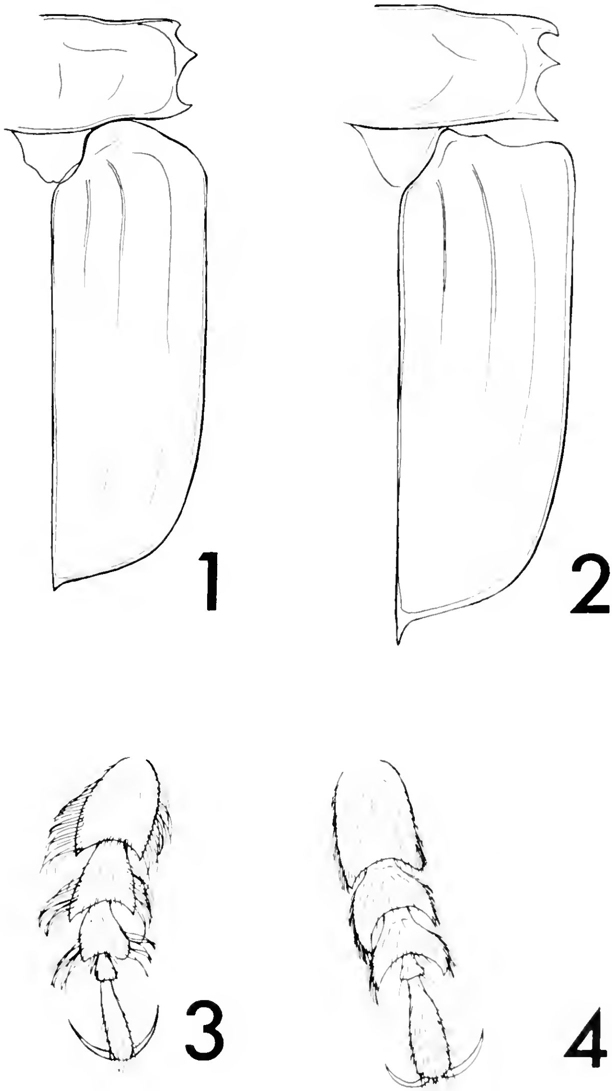
Length (exclusive of mandibles): 29 - 30 mm.

Type data: Holotype male, allotype (California Academy of Sciences) and 35 paratypes (34 ♂, 1 ♀) from: TEXAS, Ward County, Monahans Sandhills State Park, at lights, 21 August 1982 (R.H. Turnbow, T.P. Friedlander). Paratypes deposited in the following collections: Texas A&M University; University of California, Berkeley; U.S. National Museum of Natural History; Museum of Comparative Zoology, Harvard University; R.H. Turnbow, Jr.; F.T. Hovore; R.L. Penrose; M.E. Rice; and J.E. Wappes.

Diagnosis: *Prionus (H.) spinipennis* may be distinguished from all other known *Homaesthesis* by the combination of 12-segmented antennae, expanded tarsi, dark-brown to piceous integument with wholly reddish antennae, and spinose sutural angle of the elytra (Figs. 1, 2). From *P. (H.) rhodocerus* Linsley, which it resembles in coloration and 12-segmented antennae, *spinipennis* may be further differentiated by the more elongate form, more narrowly placed upper eye lobes (separated by more than one-third greatest width of head in *rhodocerus*), larger antennae with more strongly developed external processes, and, in males, the much more densely pubescent metasternum. In the limited material available, females of *spinipennis* possess a thin, elevated line on the apical abdominal tergite, absent in female *rhodocerus*.

Of the known *Homaesthesis, P. spinipennis* appears most closely related to *P. (H.) palparis* Say, from which it differs (in addition to the combination of characters enumerated above) by the more widely-spaced upper eye lobes (separated by only one-fourth greatest width of head in *palparis*). The strongly developed pronotal margins, form of the tarsi and antennae, and coloration would have placed *spinipennis* with *palparis* and *P. (H.) simplex* (Casey) in Casey's genus *Prionina* (synonymized with *Homaesthesis* by Linsley, 1962).

At the Monahans locality, *spinipennis* and *arenarius* appear to be allochronically separated, the latter having been taken only in late May and early June; little, however, is known of their habits or life histories. Two of



Figures 1, 3: *Prionus arenarius* Hovore, male: 1, right dorsum, pronotum and elytron; 3, right metatarsus. Figs. 2, 4: *P. spinipennis* new species, male: 2, right dorsum, pronotum and elytron; 4, right metatarsus.

the paratypes of *P. spinipennis* were collected away from lights in association with shinnery oaks (*Quercus havardii* Rydb.) growing on the dunes.

Generic Discussion and Key to Species: The number of characters by which *Homaesthesis* may be distinguished has been reduced by the inclusion of *arenarius* (possessing rounded apices on the third metatarsal segment) and *spinipennis* (possessing strongly produced and reflexed anterior pronotal angles). For the present, the 12 to 14-segmented antennae, with non-striolate poriferous areas will suffice to differentiate all known *Homaesthesis* from other nearctic subgenera of *Prionus.*

Key to the Species of ***Homaesthesis*** (adapted from Linsley, 1962)

1a Antennal processes distinctly emarginated and bilobed; color reddish-brown 2
1b Antennal processes at most truncated-or very feebly emarginated, not bilobed; coloration variable, usually brownish or piceous 3
2a Antennae 12-segmented; pronotal disk glabrous; metatarsi broadly expanded, flattened, fimbriate with long hairs (Fig. 3)........................... *arenarius* Hovore
2b Antennae 13- or 14-segmented; pronotal disk sparsely to densely pubescent; metatarsi narrow, elongate, without fringe of hairs .... *emarginatus* Say
3a Antennae 12-segmented... 4
3b Antenna 13-segmented.................................. *integer* LeConte
4a Eyes separated on vertex by one-third or more the greatest width of head; coloration variable; antennal segments all or in part light reddish-brown.................. 5
4b Eyes separated on vertex by one-fourth or less the greatest width of head; coloration piceous to black; antennae concolorous with body .... *palparis* Say
5a Coloration dark brown, castaneous, or piceous; antennae all or in part lighter reddish-brown 6
5b Coloration concolorous light reddish-brown, antennae not contrasting........... 7
6a Metatarsi expanded and flattened (Fig. 4); sutural angle of elytra distinctly spinose; male metasternum densely pubescent .... *spinipennis* Hovore and Turnbow
6b Metatarsi narrow, elongated; sutural angle of elytra acutely or obtusely dentiform, not spined; male metasternum thinly pubescent.................. *rhodocerus* Linsley
7a Anterior pronotal angle distinct; sides of scutellum evenly rounded to apex; first metatarsal segment subtriangular in dorsal outline, less than twice as long as broad.... .... *simplex* (Say)
7b Anterior lateral pronotal angle irregularly rounded; sides of scutellum obtusely angulated at middle; first metatarsal segment slender, elongate, parallel-sided, three times as long as broad .... *linsleyi* Hovore

Corrigenda: Hovore (1981) incorrectly cited Monahans Sandhills State Park as located in "Webb County;" it is in Ward County, Texas.

ACKNOWLEDGMENTS

We thank D.H. Riskind, Texas Department of Parks and Wildlife, for permission to collect in Texas State Parks, and R.L. Penrose and H.R. Burke for manuscript reviews.

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RANGE EXTENSION AND EMERGENCE OF SUBTERRANEAN NESTING BY THE GERMAN YELLOWJACKET, *VESPULA GERMANICA*, IN NORTH AMERICA (HYMENOPTERA: VESPIDAE)[1,2]

John F. MacDonald[3], Rogers D. Akre[4]

ABSTRACT: The German yellowjacket, *Vespula germanica* (Fab.), has continued to extend its distribution to the west and northwest and now is established in such cities as Minneapolis/St. Paul and Winnipeg. In addition, this species has been found in Nampa, Idaho and in the Seattle area as of 1981-82. However, *V. germanica* had not spread into the south Atlantic states or the southwest.

Previously known only as a structural nester in North America, subterranean colonies of *V. germanica* have appeared in Indiana, where they constituted 38% (11/29) of the colonies studied in the Lafayette area in 1982.

More so than any other yellowjacket species, the German yellowjacket, *Vespula germanica* (Fab.), has displayed a remarkable propensity for becoming distributed and established throughout temperate regions of the world (Edwards 1976). Although periodically introduced into the northwestern United States over the past century, this species probably did not become established until the late 1960's (Morse et al. 1977). Since then, *V. germanica* has spread rapidly and steadily from the northeast into the upper midwest (Fig. 1; Dunn 1980; MacDonald et al. 1980).

The established North American biotype is noteworthy because of its pronounced tendency to nest inside structures, forsaking the typical subterranean nesting site of European conspecifics. Indeed, *V. germanica* in North American was reported as nesting almost exclusively in structures (Dunn 1980; Keyel 1983; MacDonald et al. 1980; Morse et al. 1977). In contrast, other *Vespula* species may occasionally nest inside structures, but they are predominately subterranean nesters (Akre et al. 1981). Thus, structural nesting surfaced as one diagnostic criterion for the presence of *V. germanica* in various communities in eastern North America.

This paper reports the current distribution of *V. germanica* in North American and reveals the emergence of subterranean nesting by this

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species in Indiana.

Distribution of the German Yellowjacket in North America

As predicted, the German yellowjacket has continued its spread west-northwestward as evidenced by recent (1981-82) reports from collaborators plus specimens from Chicago, Milwaukee, Minneapolis/St. Paul, and Winnipeg. To date, we have no specimens (or suspicious reports suggesting establishment) of *V. germanica* westward between the Dakotas and the Pacific northwest, but we feel eventual establishment is inevitable, at least in urban areas.

The first record of the German yellowjacket on the west coast of North American was the collection of workers in Puyallup, Washington in September 1982 (Fig. 1). Initially four poorly preserved specimens, sent to us for identification by a King County extension agent, were tentatively determined to be *V. germanica.* This determination was confirmed during the next several days with nine additional workers collected from the same locality in Puyallup. Subsequently, a worker was collected in a garage in Puyallup, and six males were sent from a colony found in the ceiling of a home in Spanaway, Washington. In addition, a queen *V. germanica* was collected in Puyallup in January 1983. These collections, plus reports of at least three structural colonies in the Puget Sound area that persisted late into the year and chewed through walls of homes, strongly suggest that the German yellowjacket is established in the area.

In March of 1983, workers, queens, and males from a *V. germanica* colony collected in October 1981 were received from Nampa, Idaho. In this case the colony was subterranean and was located inside an abandoned irrigation pipe. Although specific data are lacking, the colony was large and had produced numerous queens.

Despite the efforts of collaborators, *V. germanica* still has not been detected south of Virginia, the southeast or the central midwest. For example, although the German yellowjacket is common in the Indianapolis area, it has not been detected in the southern part of Indiana.

Emergence of Subterranean Nesting in Indiana

Establishment of *V. germanica* in Indiana probably occurred in 1975-76 (Mac Donald et al. 1980). For the last few years, all colonies studied were located inside structures, with just over 87% (69/79) situated inside structural voids, including 57 inside wall voids (Table 1). The first subterranean *V. germanica* colony was discovered in 1980, situated among roots of ivy adjacent to a building; an additional subterranean nest was found in 1980 and another in 1981 (Table 1). However, subterranean nesting became readily apparent in 1982, with 38% (11/29) in such sites as in lawns, shrub beds and in soil behind retaining walls.

Discussion and Implications

The rate of range extension of the German yellowjacket has been far too rapid to be explained by natural dispersal of inseminated queens. Rapid dispersal, initial detection of *V. germanica* in urban areas, and the presence of isolated populations in Idaho and Washington suggest the major mode of dispersal has been via commerce. However, once established in an urban area, natural dispersal by queens occurs, for we have discovered an occasional *V. germanica* colony in rural homes near Lafayette, Indiana the past two years. Thus, while most problems associated with the German yellowjacket occur in urban areas, dwellings in less populated areas are also subject to infestation.

The sudden appearance of *V. germanica* on the west coast suggests that this species may be discovered in other disjunct areas in the near future, at least in the northern portion of the United States and Canada. The continued absence of *V. germanica* in the South remains unexplained, but climatic factors may be responsible (Keyel 1983).

Subterranean nesting in other *V. germanica* populations may already

Fig. 1. Distribution of *V. germanica* in North America as of May 1983.

exist (undocumented) or may develop in the future. Accordingly, we should not continue to rely so strongly on nest site as a criterion for diagnosis of *V. germanica.* It appears our early characterization of the German yellowjacket in North America as an exclusively structural nester was inaccurate.

Table 1. Nest locations of *Vespula germanica* in the Lafayette, Indiana area 1977-82.

		NUMBER OF COLONIES				
Year	Subterranean	Structural				Total
		Enclosed voids[a]	Basements	Attics	Other[b]	
1977	0	5	0	0	0	5
1978	0	11	0	1	0	12
1979	0	10	2	1	0	13
1980	2	8	2	1	1	14
1981	1	18	0	1	0	20
1982	11	17	0	1	0	29
Totals	14[c]	69	4	5	1	93

[a]Most nests inside wall voids; 4 above drop ceilings, 3 above soffits, 3 inside porch voids, 1 in a chimney void.

[b]Inside a wood duck house suspended in a tree ca. 8m above ground.

[c]Five in lawns, 7 in shrub beds, 2 in soil behind retaining walls.

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Appreciation is extended to Ron Mundell, Purdue University Exterminator, for his years of cooperation in facilitating research on social wasps on the Purdue campus. We also thank Byron Reid and Donald Ross for assistance in locating many of the yellowjacket colonies. S.J. Collman, A. Antonelli, and A. Stanford provided specimens and records of western *V. germanica.*

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A REVISED KEY TO THE *IDIODONUS* (HOMOPTERA: CICADELLIDAE) OF MEXICO AND BOLIVIA[1]

Dwight M. DeLong[2]

ABSTACT: A revised key is presented for the forty described species of *Idiodonus* of Mexico and Bolivia. Species treated are 2 described by Ball: *I. wickhami* and *I. schwartzi*, and 38 described by DeLong: *I. graeculus, I. costatus, I. rubellus, I. spatulatus, I. tubulus, I. sexpunctatus, I. marginatus, I. albifrons, I. anademus, I. nigridens, I. apertus, I. beamerellus, I. vinculatus, I. incisurus, I. caldwelli, I. pallidus, I. turpiter, I. albocinctus, I. bicinctus, I. dampfi, I. acus, I. pravus, I. claustrus, I. verecundus, I. titulus, I. mexicanus, I. goodi, I. copulus, I. latidens, I. incidus, I. nigifrons, I. insculptus, I. clastrus, I. edentulus, I. excavatus, I. dicerus, I. bakeri,* and *I. plummeri.* All species are from Mexico except *I. costatus* which is from Bolivia. Illustrations of the color markings on the head, pronotum and scutellum, and of the 7th sternum of the females are included.

The genus *Idiodonus* was described by Ball (1936) with *Jassus kennicotti* Uhler designated as the type species. DeLong (1946) described 32 Mexican species of *Idiodonus* and published a key with illustrations. Five additional Mexican species and one from Bolivia were described by DeLong (1983). Since the male genital structures in this genus are of little or no value, the color patterns and ♀ genitalia are used for species identification in this revised key to the species of *Idiodonus*. Illustrations of the color markings on the head, pronotum and scutellum of all species and the female 7th sternum of most species are included. Females of a few species are not known. The species of *Idiodonus* in Mexico occur normally on perennial plants and shrubs, and are found mostly at higher altitudes, 5000 to 12000 feet elevation.

Revised Key to the Species of *Idiodonus* of Mexico and Bolivia

1.	Crown without black markings	2
1'	Crown with black markings	3
2(1)	Face with 2 black spots.....................(Fig. 7) *graeculus* DeLong	
2'	Face with black markings ....(Fig. 73) *costatus* DeLong	
3(1)	Crown and pronotum with small punctate spots or flecks of red	4
3'	Crown and pronotum without reddish coloration	5
4(3)	Margin of crown, only, with black spots ..... (Figs. 4, 66) *rubellus* DeLong	
4'	Crown and pronotum with black markings .... (Figs. 14, 37) *wickhami* Ball	
5(3')	Crown, only, with black markings..................................	6
5'	Crown with black markings and black or dark fulvus markings on pronotum	20
6(5)	Crown, only, with black rounded spots	7

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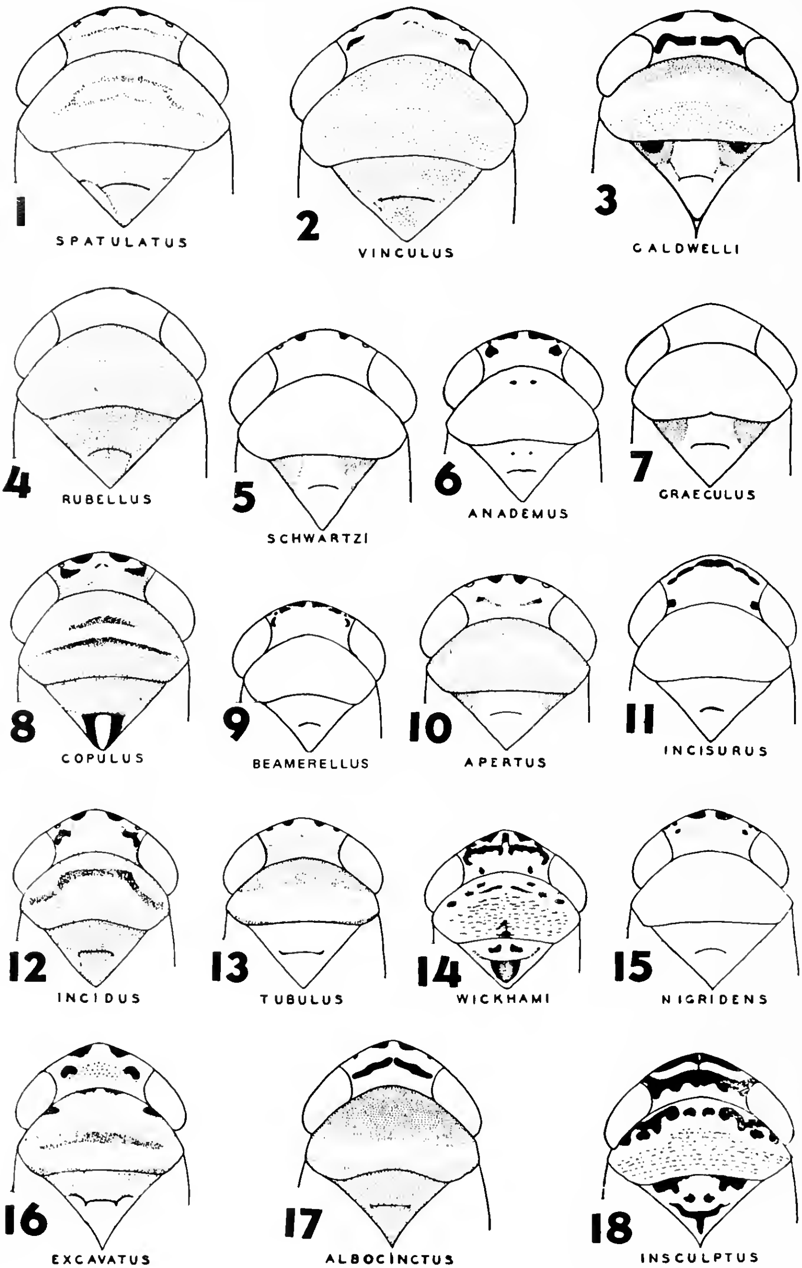
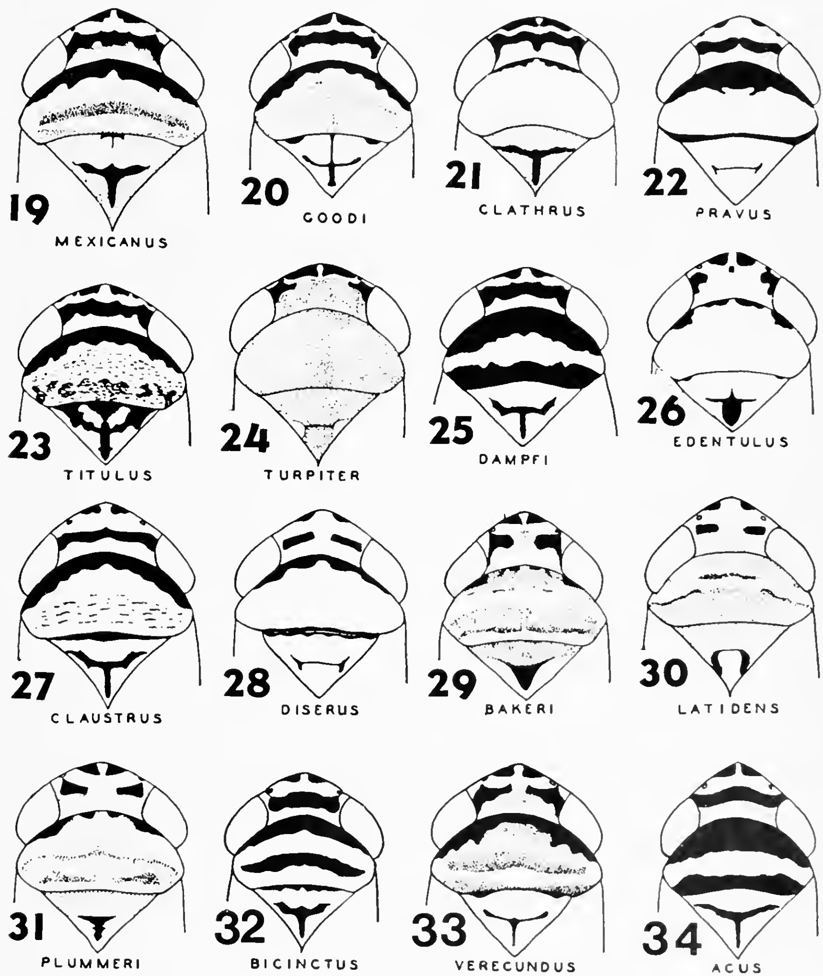
6'	Crown with rounded spots in combination with other color markings or with elongate spots, or transverse bands	11
7(6)	Crown with round black spots only on or near margin	8
7'	Crown with 2 black spots on margin and 2 distal spots	10
8(7)	Female 7th sternum with spatulate process..... (Figs. 1, 40) *spatulatus* .... DeLong	
8'	Female 7th sternum not spatulate..................................	9
9(8')	Female 7th sternum broadly rounded, produced .... (Figs. 5, 46) .... *schwartzi* Ball	
9'	Female 7th sternum produced, broadly, shallowly excavated apically... ....(Figs. 13, 55) *tubulus* DeLong	
10(7')	Margin of crown with 2 large elongate spots at middle and a small spot on margin, close to each eye....... (Figs. 69, 75) *sexpunctatus* DeLong	
10'	Margin of crown with a series of fused black spots (fig. 70) *marginatus*. .... Delong	
11(6')	Crown with rounded spots distal to margin..........................	12
11'	Crown with elongate markings distal to margin	14
12(11)	Basal portion of crown with 2 proximal small round spots............. ....(Figs. 68, 74) *albifrons* DeLong	
12'	Crown with small black spots close to each eye.....................	13
13(12')	Female 7th sternum roundly produced, with a slight V-shaped notch at apex ....(Figs. 6, 38) *anademus* DeLong	
13'	Female 7th sternum produced, excavated at apex and bearing a small tooth in excavation ....(Figs. 15, 50) *nigridens* DeLong	
14(11')	Margin of crown with 4 rounded spots and a black dash spot next to each eye..	15
14'	Without a small dash spot next to each eye	17
15(14)	Female 7th sternum with a spatulate process..... (Figs. 10, 42) *apertus* .... DeLong	
15'	Female 7th sternum produced and rounded	16
16(15')	Female 7th sternum broadly rounded with a U-shaped notch 1/3 length of segment........................ (Figs. 9, 43) *beamerellus* DeLong	
16'	Female 7th sternum more produced, with a slight U-shaped notch at apex ....(Figs. 2, 35) *vinculus* DeLong	
17(14')	Crown with a narrow black band just above margin ...... (Figs. 11, 44) .... *incisurus* DeLong	
17'	Crown without a continuous black band	18
18(17')	Distal portion of crown with a broken blackband .... (Figs. 3,45) *caldwelli* .... DeLong	
18'	Distal portion of crown with a broken black band..................	19
19(18')	Crown with 4 dash lines, basal angles of scutellum black............. ....(Figs. 71, 76) *pallidus* DeLong	
19'	Crown with 4 dash lines, basal angles of scutellum not black ....(Figs. 24, 57) *turpiter* DeLong	
20(5')	Pronotum with white transverse band between fulvus transverse bands ....(Figs. 17, 52) *albocinctus* DeLong	
20'	Pronotum with black spots or bands...............................	21
21(20')	Pronotum with 2 broad, transverse, black bands	22
21'	Pronotum with black spots or only 1 transverse black band...........	24
22(21)	Pronotum with distal band on apical margin........................	25
22'	Pronotum with distal band on disc..... (Figs. 32, 63) *bicinctus* DeLong	

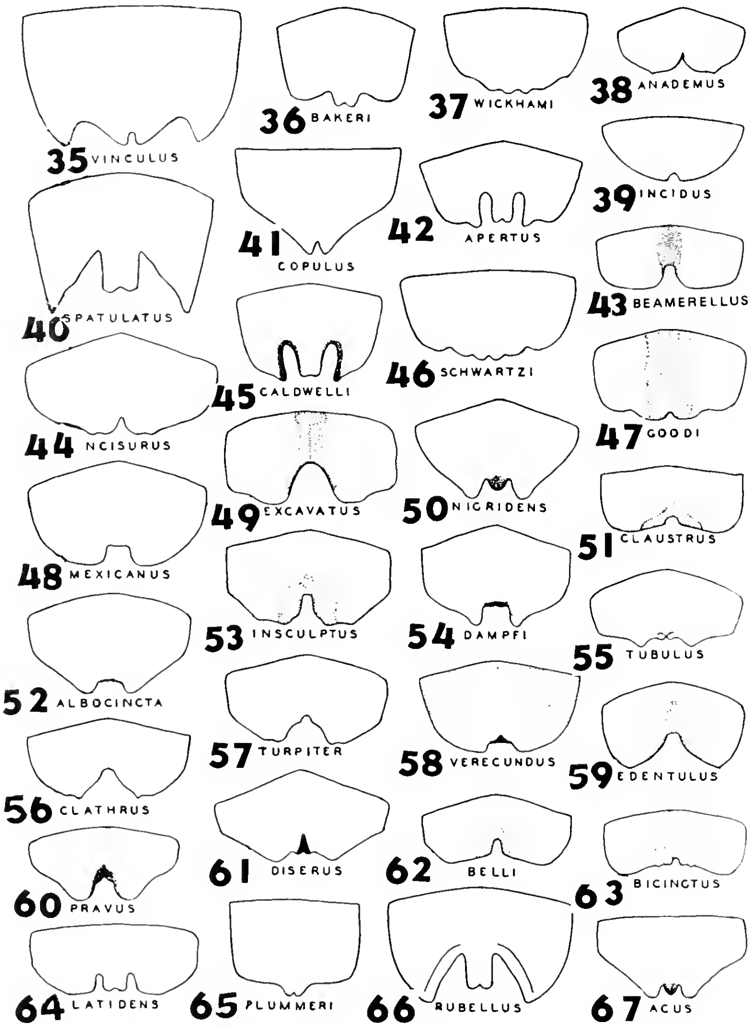
23(22) Female 7th sternum with posterior margin produced, with a squarish notch at center ....(Figs. 25, 54) *dampfi* DeLong
23' Female 7th sternum with posterior margin notched at apex and bearing a small tooth..........................(Figs. 34, 67) *acus* DeLong
24(21') Pronotum with a black transverse band on basal margin 25
24' Pronotum with a faint line or spots................................ 30
25(24) Apical margin of pronotum slightly margined with black 26
25' Apical margin of pronotum not margined with black.................. 27
26(25) Female 7th sternum angularly produced, with a broad U-shaped notch 1/3 length of segment....................(Figs. 22, 60) *pravus* DeLong
26' Female 7th sternum broadly, slightly concave with a slight U-shaped notch...........................(Figs. 27, 51) *claustrus* DeLong
27(25') Crown with a transverse black band................................ 28
27' Crown with a broken transverse black band...(Figs. 33, 58) *verecundus* .... DeLong
28(27) Pronotum with irregular dark markings on disk ....(Figs. 23, 55) .... *titulus* DeLong
28' Pronotum without irregular dark markings 29
29(28') Female 7th sternum produced, with a shallow squarish excavation ....(Figs. 19, 48) *mexicanus* DeLong
29' Female 7th sternum roundly produced, with a slight V-shaped notch at apex ....(Figs. 20, 47) *goodi* DeLong
30(24') Pronotum with a faint transverse line, straight or irregular............. 31
30' Pronotum with black spots or irregular markings.................... 33
31(30) Pronotum with 2 incomplete transverse dark lines.........(Figs. 8, 41) .... *corpulus* DeLong
31' Pronotum with a broken line, or line bent cephalad at middle.......... 32
32(31') Pronotum bearing a broken transverse line..............(Figs. 30, 64) .... *latidens* DeLong
32' Pronotum with a transverse line bent cephalad at middle.....(Figs. 12, 39) .... *incidus* DeLong
33(30') Pronotum with large lateral black spots next to eyes.................. ....(Fig. 72) *nigrifrons* DeLong
33' Pronotum with spots along basal margin........................... 34
34(33') Pronotum with a row black spots extending almost across basal margin 35
34' Pronotum with black spots only on central portion of pronotum........ 36
35(34) Pronotum with large black spots and transverse black bands on crown ....(Figs. 18, 53) *insculptus* DeLong
35' Pronotum with smaller black spots and one broken transverse band on crown.............................(Figs. 14, 37) *wickhami* Ball
36(34') Crown with a black transverse band ....(Figs. 21, 56) *clathrus* DeLong
36' Crown with a broken band, with spots or dashes.................... 37
37(36') Crown with rounded black spots only 38
37' Crown with elongate or squarish spots............................. 39
38(37) Scutellum with black spots at apex....(Figs. 26, 59) *edentulus* DeLong
38' Scutellum with black spots...........(Figs. 16, 49) *excavatus* DeLong
39(37') Distal portion of pronotum margined with black .....(Figs. 28, 61) *diserus* .... DeLong
39' Distal portion of pronotum without black margin.................... 40
40(39') Female 7th sternum slightly notched each side of median apical tooth...... ....(Figs. 29, 36) *bakeri* DeLong
40' Female 7th sternum sloping to median notched tooth ....(Figs. 31, 65) *plummeri* DeLong



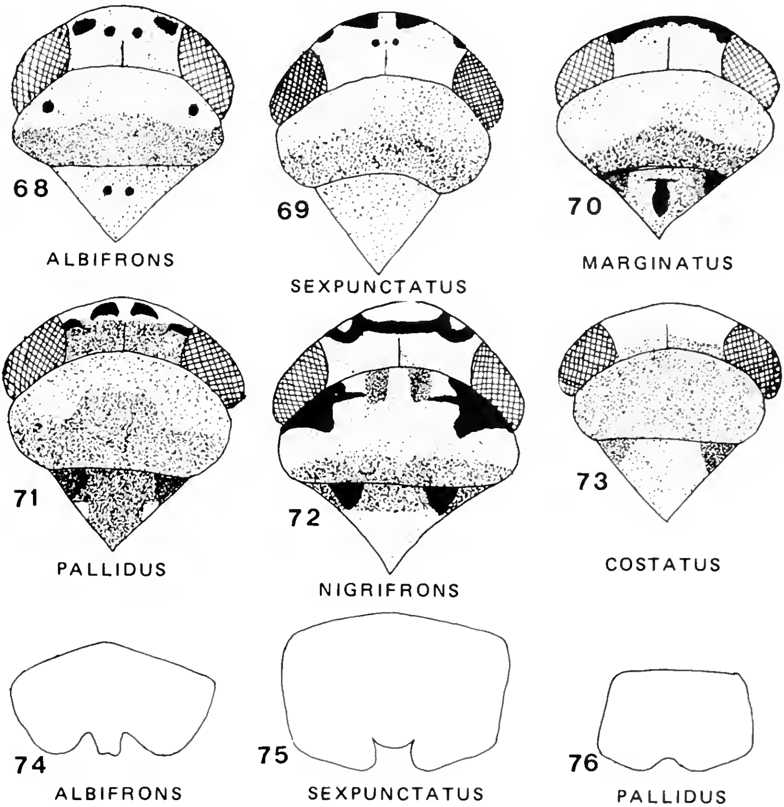
Figs. 1-18, Head, pronotum, species of *Idiodonus,* as labeled.



Figs. 19-34, Head, pronotum, and scutellum of species of *Idiodonus*, as labeled.



Figs. 35-67, Female 7th sterna of species of *Idiodonus,* as labeled.



Figs. 68, 74. *I. albifrons:* 68. head, pronotum, and scutellum; 74. female 7th sternum. Figs. 69, 75. *I. sexpunctatus:* 69. head, pronotum, and scutellum; 75. female 7th sternum. Fig. 70, *I. marginatus:* head, pronotum, and scutellum. Figs. 71, 76, *I. pallidus:* 71. head, pronotum, and scutellum; 76. female 7th sternum. Fig. 72. *I. nigrifrons:* head, pronotum, and scutellum. Fig. 73: *I. costatus,* head, pronotum, and scutellum.

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A NEW SPECIES OF *TROGLOPEDETES* (COLLEMBOLA: PARONELLIDAE) FROM GUERRERO, MEXICO[1]

Margarita Ojeda, José G. Palacios-Vargas[2]

ABSTRACT: *Troglopedetes oztotlicus* n.sp. from Juxtlahuaca Caves, Guerrero State, is described and differentiated from its closest relatives. Fifteen drawings are included.

RESUMEN: Se describe la nueva especie *Troglopedetes oztotlicus* de las Grutas de Juxtlahuaca, Estado de Guerrero se diferencia de las especies mas cercanas. Se proporcionan 15 dibujos.

In America, the genus *Troglopedetes* has been found only in caves of the Neotropical Region of Mexico and in Central America, and in leaf litter in South America. To date only four species have been described. *T. maya* (Mills, 1938), described from Yucatan caves, is the only species known from Mexico, although there must be more undescribed taxa in the tropical areas of the country. *T. delamarei* Massoud and Gruia, 1973 was described from Cuba and cited from Dominican Republic by Mari Mutt (1977). *T. lamottei* (Delamare-Duboutteville, 1950) occurs in the French Guinea and *T. millsi* (Arle, 1939), known from Brasil, probably belongs to *Troglopedetina*.

The new species described below was reported by Palacios-Vargas (1982) as *Troglopedetes* sp. and belongs to the Neotropical fauna that probably invaded southern habitats of Mexico recently (maybe during the Pleistocene) after the formation of the Eje Neovolcanico, which now is a barrier for the distribution of this family. In Mexico, the genus has invaded various caves such as Grutas de Atoyac in Veracruz State, where we have found a different undescribed species.

The species of this genus are remarkable because of the troglomorphism they present, e.g., lack of eyes and modifications of the tibiotarsal complex. There also must be some physiological adaptations, because of the difficulties of rearing these animals in laboratory conditions.

Troglopedetes oztotlicus n.sp.

Length 2-3 mm. Without eyes or trace of pigmentation in body and ocular region. Head and body covered with several types of setae and trichobothria (Fig. 1). Scales elliptical, oval or somewhat lanceolate, with regular longitudinal striations (Fig. 2). Dens with ciliated spines.

Ratio diagonal head: antennae (average of five specimens) = 1.0:3.0; ratio of antennal segments I:II:III:IV = 1:1.1:0.9:1.7. Ant. I and ant. II with scales and setae, the basis of the

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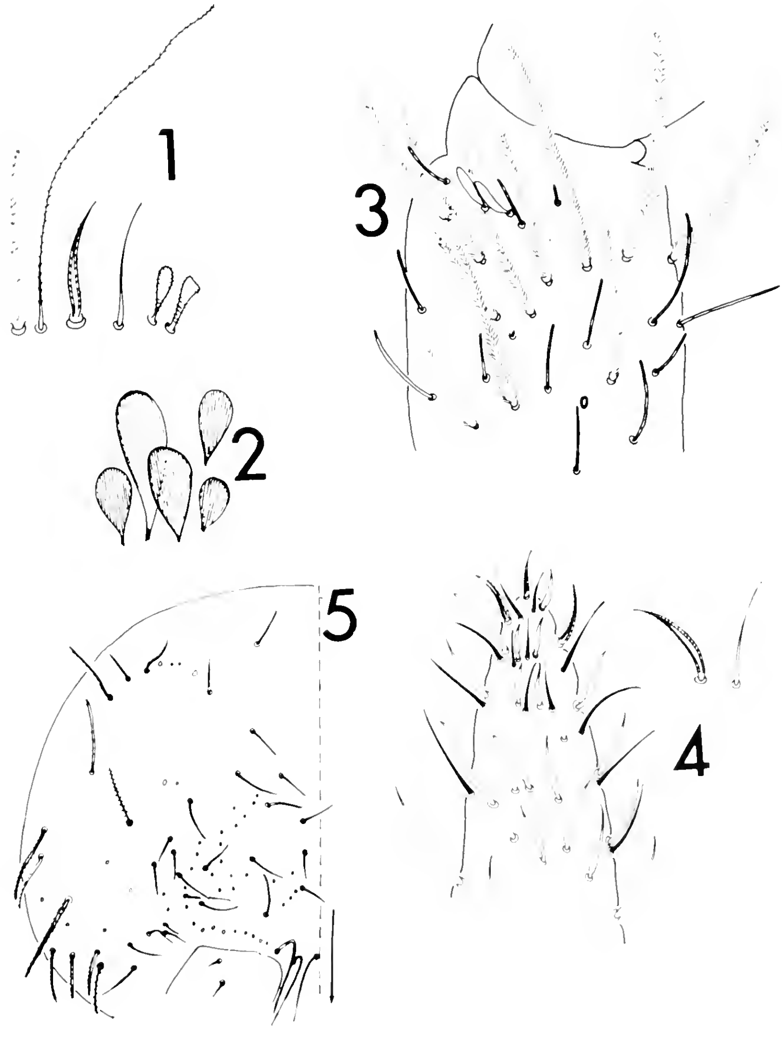
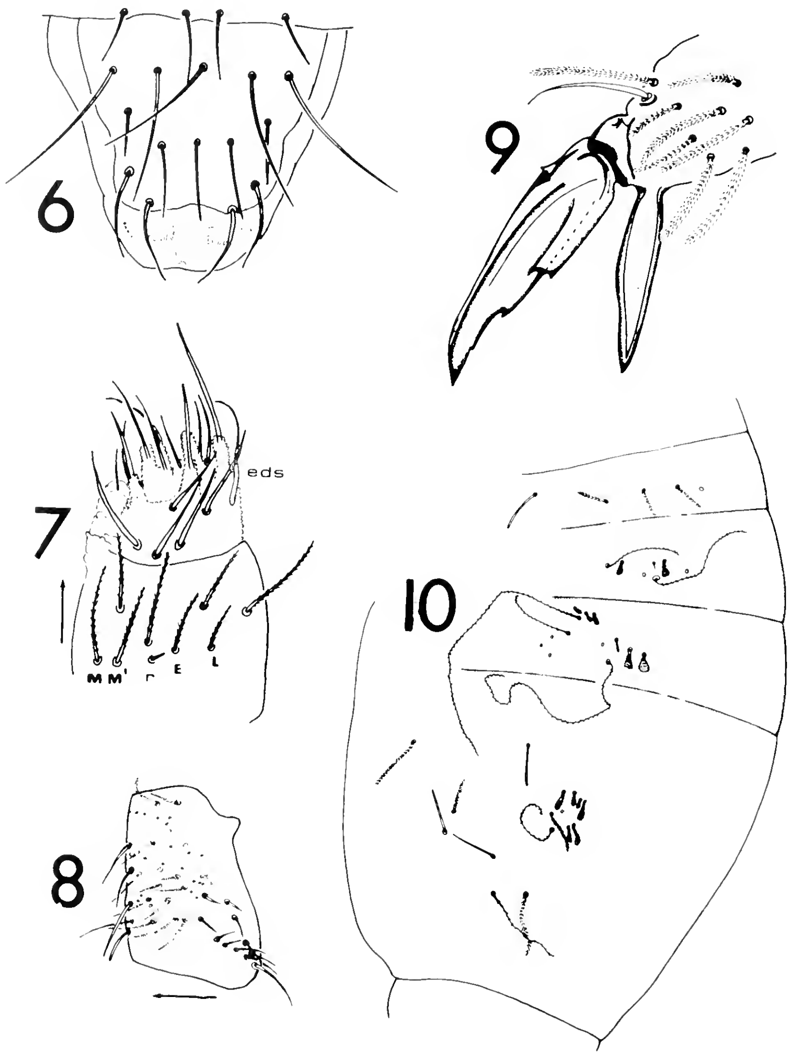
first with small spinelike setae. Sense organ of ant. III of 2 blunt sensillae and 2 guard sensillae subequal in length but thinner than the first pair (Fig. 3). Ant. III has several sensillae of various lengths and numerous ciliated setae. Ant. IV with weak tendency to annulated and covered by ciliated setae and sensillae (Fig. 4).



Figs. 1-5. Troglopedetes oztotlicus n.sp. 1. Types of setae; 2. Scales; 3. Apex of Ant. III; Apex of Ant. IV; 5. Dorsal setal pattern of head.

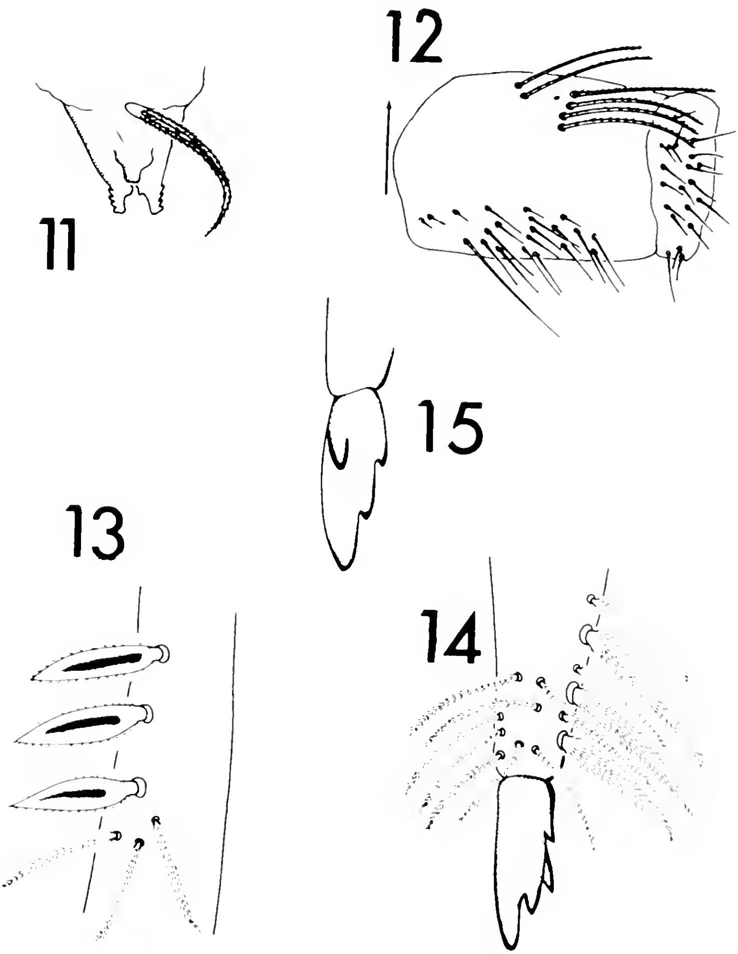
Head with two dorsal trichobothria, setae of several lengths, scales and pores (Fig. 5). Labrum with five long posterior setae, five smaller medium setae and four anterior thicker setae (Fig. 6). Base of labium with setae "r" small and the others longer and ciliated (Fig. 7), apex of labium with an external differentiated setae.



Figs. 6-10. *Troglopedetes oztotlicus* n.sp. 6. Setal pattern of Labrum; 7. Chaetotaxy of Labium; 8. Trochanter; 9. Tibiotarsus; 10. Abdominal setal pattern.

Tenent hair apically lanceolate, short and thin. Unguis with a pair of minute outer teeth, a pair of subequal inner teeth in the middle region and 2 unpaired inner teeth, 1 median and 1 distal, the latter much smaller. Unguliculus lanceolate, ventral lamella weakly crenulate (Fig. 9). Ratio unguis: unguiculus = 1.0:0.6; ratio unguis: tenent hair = 1.0:0.4. Trochanteral organ as in Figure 8.

Abd. I without trichobothria; Abd, II, III, and IV with 2, 3 and 2 pairs of trichobothria respectively (Fig. 10). Tenaculum with 4+4 teeth and a thick setae on the corpus, which often



Figs. 11-15. *Troglopedetes oztotlicus* n.sp. 11. Tenaculum; 12. Collophore; 13. Basal spines of dens; 14. Distal spines of dens; 15. Mucro.

appears bifid (Fig. 11). Collophore with anterior setae much longer and thicker than posterior ones (Fig. 12). Genital region with many thick ciliated setae.

Manubrium covered with setae and scales. The ventral setae thin and long but not differentiated. Dens with 2 rows of spines (35-40 each row). Proximal spines thick and weakly ciliated (Fig. 13), distal ones larger and thoroughly ciliated, similar to setae (Fig. 14). Mucro with 4 teeth, 3 in a row and 1 in paramedial position (Fig. 15). Ratio dens: mucro = 1.0:0.06.

Type Locality: Mexico, Guerrero State, Grutas de Juxtlahuaca. *ex* soil and bat guano. 11-IV-1981. J.G. Palacios *leg.* This cave is in the Transitional Region between the Biotic Provinces Guerrerense and Balsas Inferior, Neartic and Neotropical regions respectively (Smith, 1940).

The Holotype and 5 paratypes will be kept in the second authors' collection and 2 paratypes will be deposited in the Museo de Historia Natural de la Ciudad de Mexico. *Derivatio nominis:* from the Nahuatl *oztotl* = cave, referring to the habitat of this species.

DISCUSSION

The new species differ from *T. maya* (Mills, 1938) by its smaller ungual teeth and tenent hair and by the shape of the mucro, *Troplopedetes oztotlicus* differs from *T. delamarei* (Massoud and Gruia, 1973) in having dental spines which are shorter, thicker and less ciliated, and in the length of the tenent hair.

Several characters, e.g., sensorial organ of Ant. III, head and abdominal chaetotaxy, number and shape of dental spines, if included in the description of new taxa, could be of assistance both in differentiating species, and in the clarification of phylogenetic relations.

ACKNOWLEDGMENTS

The authors express their gratitude to the following collembologists who kindly reviewed the manuscript: Dr. José A. Mari Mutt, University of Puerto Rico at Mayagüez; Dr. Peter F. Bellinger, California State University Northridge, California; and Dr. Kenneth Christiansen, Grinnell College, Iowa.

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HELOPICUS RICKERI, A NEW STONEFLY FROM TENNESSEE (PLECOPTERA: PERLODIDAE)[1]

Bill P. Stark[2]

ABSTRACT: *Helopicus rickeri*, n. sp is described from a single male collected in Tennessee (USA). The epiproct is atypical of other *Helopicus* in bearing spines, but the absence of lateral stylets, presence of transverse meso and metasternal pigment bands along with the mesosternal groove conformation suggest this tentative generic placement.

William E. Ricker recently sent a distinctive perlodid male, which he recognized as a new species in 1965, to me for study. As he noted on his determination label, this specimen "does not fit any present subgenus" but it is apparently most closely allied to *Helopicus* Ricker. Since Stark and Ray (1983) gave comparative figures of the known *Helopicus* species, I take this opportunity to bring a remarkable stonefly to the attention of aquatic biologists. Hopefully this description will promote discovery of the nymph and female and subsequently the testing of this generic placement.

Helopicus rickeri n. sp.

Male.- Macropterous. Forewing length 15 mm; body length 13 mm. General color brown, patterned with yellow. Wings hyaline, veins brown. Mesosternum and metasternum with transverse band, interrupted by areas of lighter pigment lateral to midline. Hemitergal lobes broadly rounded, sparsely covered with setae and sensilla basiconica. Dorsal aspect of epiproct bulbous, with slender recurved tip; dorsal sclerite tapered throughout length; a pair of prominent, posteriorly directed sclerotized spines located lateral to dorsal sclerite in apical third; membranous area of epiproct covered with fine short setae. Ventral aspect of epiproct with scoop-like apex (Figs. 1, 2).

Mesosternal grooves typical of genus. Submental gills present. Lateral stylets absent.

Types.- Holotype ♂ (100976) from 5.5 mi W of Hartsville, Trousdale Co., TN, USA, 28-III-1965, M. Braasch, deposited at the United States National Museum of Natural History, Washington, DC.

Etymology. I take great pleasure in naming this species for Dr. W.E. Ricker in honor of his numerous contributions to stonefly systematics.

Diagnosis. - This species is distinguished from other *Helopicus* by the presence of dorsal sclerotized spines on the epiproct. The epiproct superfically resembles that of *Hydroperla crosbyi* (Needham and Claassen) in lateral aspect (Stewart and Stark 1977; Ray and Stark 1981) but these two species are distinguished by the absence of lateral stylets in *Helopicus rickeri.*

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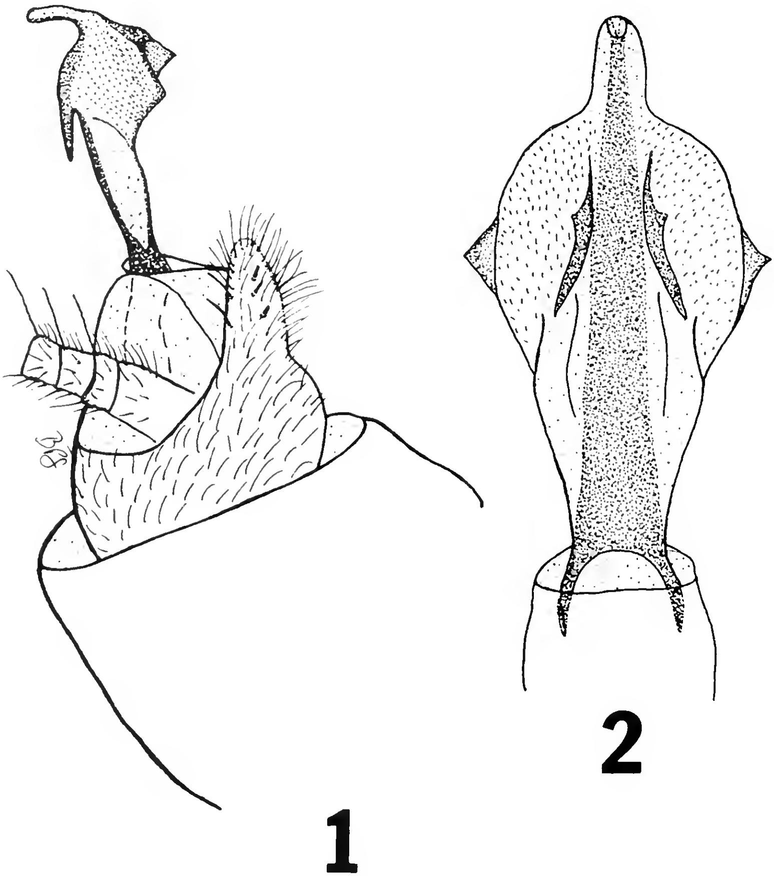

Figures 1-2. *Helopicus rickeri,* male genitalia. 1. Terminalia, lateral. 2. Epiproct, dorsal.

ACKNOWLEDGMENTS

I thank William E. Ricker for his gift of the holotype specimen. Paul Lago and S.W. Szczytko provided helpful comments during review of the manuscript.

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A NEW MEXICAN *EPIDAMAEUS* (ORIBATEI: DAMAEIDAE)[1]

José G. Palacios-Vargas[2]

ABSTRACT: A new mite species in the genus *Epidamaeus*, inhabitating leaf litter on Popocatépetl volcano, is described.

RESUMEN: Se describe una nueva especie de ácaro del género *Epidamaeus*, habitante de hojarasca del Volcán Popocatépetl.

The family Damaeidae (*sensu* Norton, 1979a) is almost unknown in Mexico; only one species (*Belba clavisensilla*) has been described recently (Norton and Palacios-Vargas, 1982). The genus *Epidamaeus* includes about 30 known species, mainly distributed in the Palearctic Region (Norton, 1979b). Only three of them are known to occur in South America and none has ever been described or recorded from Mexico; the first is described below.

The terminology used in the description is mostly that of Grandjean (see Travé and Vachon, 1975 for many references).

Epidamaeus mitlsensillus n.sp.

Dimensions. Mean ventral length of five specimens 681 μm (range 652-740 μm); mean total length 746 μm (range 710-796 μm); mean maximum notogastral width 429 μm (range 403-460 μm).

Cerotegument. Body and legs covered with a layer of reticular cerotegument (Fig. 1).

Prodorsum. (Figs. 2, 3). Relatively narrow, subtriangular. Integument smooth. Dorsosejugal enantiophysis (Da) present; without discernible postbotridial enantiophysis. Setae *le* finely barbulated; *ro* smooth and thinner; *in* relatively short, barbulated. Sensillus (*ss*) smooth, long (190 μm), not tapering, distal end expanded, sagittate.

All setae other than most of tarsi and venter, and sensillus birefrigent in basal 3/4.

Notogaster. (Figs. 2, 3). Slightly ovate viewed perpendicular to circumgastric suture; about 1.1 times longer than broad. Spinae adnatae (*sa*) small. Notogastral setae smooth, gradually tapered, with dark pigmentation except close to insertions. Setae C_1 and C_2 directed anteriad, others directed posteriad (except *ps* setae). Setae decreasing in length from C_2 to h_1. Row *ps* more or less parallel to circumgastric suture; ps_2 and ps_3 much smaller than other notogastral setae and finely attentuated. Opistosomal glands and lyrifissures normal as for family. Nynphal exuviae often carried by adults.

Ventral region. (Fig. 4). Tubercles E2p, Va and Vp well developed. Tubercles Sa and Sp short, difficult to see. Numerical formula for epimeral setae (I to IV) 3-1-3-4. Discidium (*di*) broadly rounded. Anogenital region typical for family.

Legs. (Figs. 5-9). Porose areas on trochanters III and IV, on all femora, tibiae and tarsi. Setal formulas for the legs, from trochanter to tarsus (famulus included, number of solenidia in

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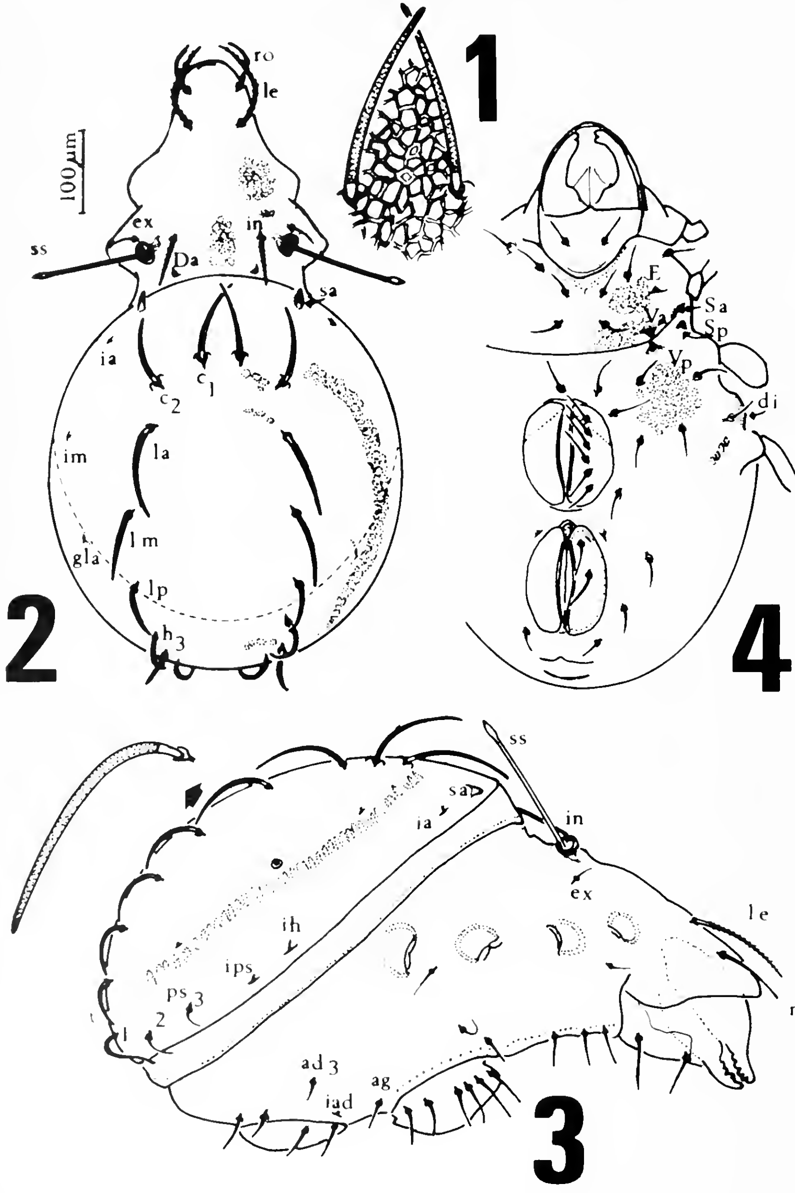
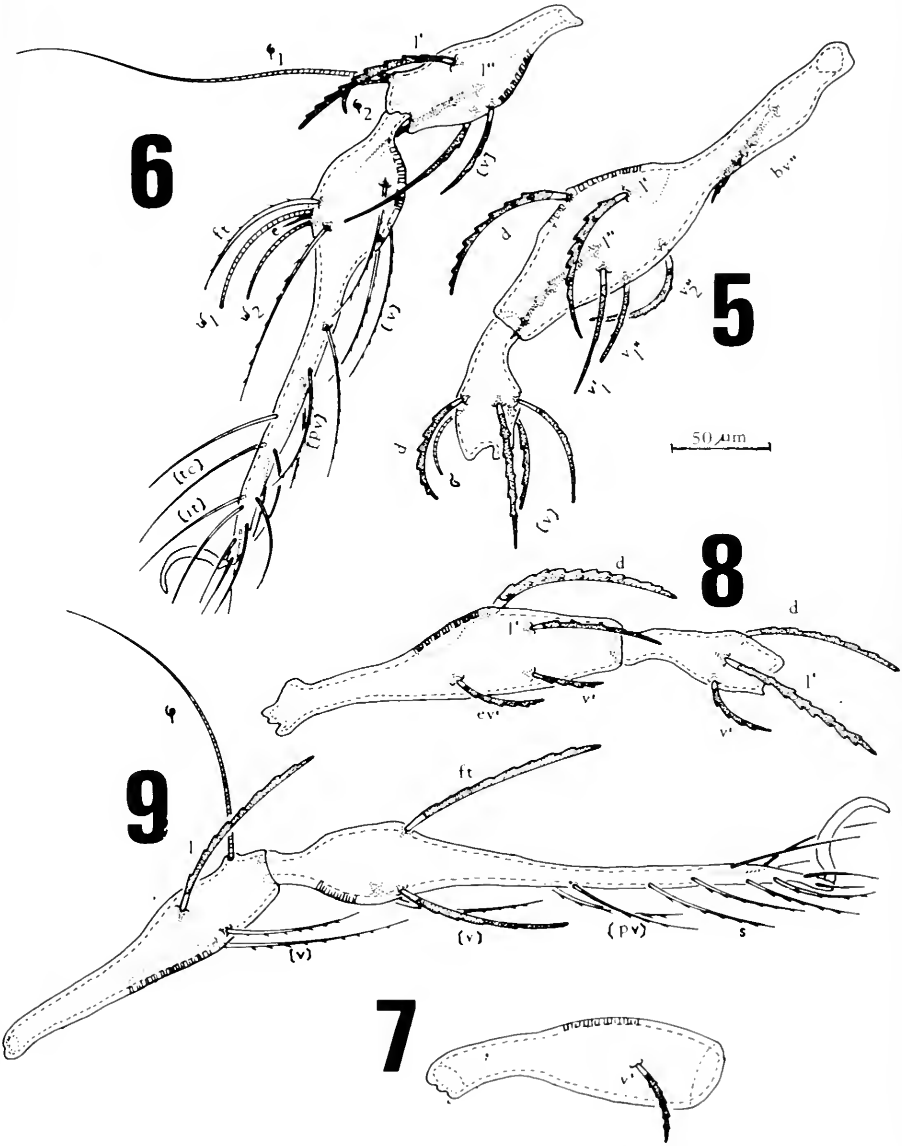


Figs. 1-4. *Epidamaeus mitlsensillus* n.sp. 1, cerotegument between setae C_1; 2, dorsal aspect; 3, lateral view; 4, ventral aspect.



Figs. 5-9. Legs of *Epidamaeus mitlsensillus* n.sp. 5, femur and genua I; 6, tibia and tarsus I; 7, trochanter IV; 8, femur and genua IV; 9, tibia and tarsus IV.

parentheses) as follows: Leg I, 1-7-4(1)-4(2)-20(2); leg II, 1-6-4(1)-17(2); leg III, 2-4-3(1)-3(1)-17; leg IV, 1-4-3-3(1)-14.

Ratio of the length of legs I:II:III:IV = 1:0.8:1.0:1.3. Leg IV about 1.2 times ventral body length. Relative length of leg segments as follows: Leg I, F:G:Ti:Ta = 1:0.3:0.5:1.1; leg II = 1:0.3:0.5:1.3; leg III, Tr:F:G:Ti:Ta = 1:1.3:0.6:1.0:2.2; leg IV = 1:1.1:0.5:1.0:1.9.

Derivatio nominis: from the Nahuatl: *mitl* = arrow and the Latin *sensillum;* referring to the arrow-like form of the sensillus.

Material Examined: Specimens were obtained from *Pinus hartwegii* litter samples from Popocatepetl Volcano, State of Mexico, 3,800 m elevation, 5-IV-1982, J.G. Palacios-Vargas *leg.* There is another record from Sta. Ana, Milpa Alta, D.F. *ex.* leaf litter, D. Chora *leg.* The holotype and two paratypes in alcohol are deposited in the Laboratorio de Acarología, Facultad de Ciencias, UNAM, México. Two paratypes in alcohol will be sent to each of following institutions: Museo de Historia Natural de la Ciudad de Mexico, Mexico, D.F., College of Environmental Science and Forestry, Syracuse, New York; Laboratory of Acarology, Columbus, Ohio, U.S.A.

DISCUSSION

The new species here described is similar to *Epidamaeus flagelloides* Norton, 1979 (Norton, 1979c) but differs in the type of cerotegument, form of setae ps_1, sensillus, notogastral setae and enantiophyses. The new species is distinguishable from all known species of *Epidamaeus* by the reticulate cerotegument and sagittate sensillus.

ACKNOWLEDGMENTS

The author expresses his gratitude to Dr. Roy A. Norton, State University of New York, College of Environmental Science and Forestry, Syracuse, New York, USA, for his advice and comments on this paper; and to Dr. Isabel Bassols, Laboratorio de Acarología, Escuela Nacional de Ciencias Biológicas, IPN, Mexico, who kindly reviewed the manuscript.

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NOTES ON DISTRIBUTION OF EVANIID WASPS IN WESTERN NORTH AMERICA (HYMENOPTERA: EVANIIDAE)[1]

Roy R. Snelling[2]

ABSTRACT: New distribution data are given for *Evaniella californica* (Ashmead) and *Hyptia oblonga* Townes. A possible host, *Parcoblatta americana* (Scudder), is suggested for *E. californica.*

Evaniid wasps are parasitoids in the oothecae of roaches and attain their greatest abundance and diversity in the tropics of both Old and New Worlds. Proceeding away from the tropics, these unusual wasps become increasingly less common; in the arid lands of western North America they are decidedly uncommon. When I wrote my very brief paper (Snelling, 1963) on the evaniids of California, I recorded two species, known from a total of only seven specimens. The few additional specimens recorded below are thus of some interest.

Evaniella californica (Ashmead, 1901)

This species was described from a single male from Sacramento County, California. Snelling (1963) recorded additional material from Tuolumne County, California.

Two females extend the range of *E. californica* south to Tulare County. Both were collected at Kaweah Powerhouse Reservoir No. 3, at Ash Mountain. One was collected on 3 July 1982 by J. Halstead and one on 15 August 1982 by R.D. Haines.

On 23 June 1979 a single female was collected by R.R. Snelling and P. Mehlhop, about 5.8 mi. NE of Chico, Butte County, California, on the Cohasset Highway, elevation 475 feet. The specimen was taken while we were excavating a nest of the harvester ant, *Veromessor chicoensis* M. Smith, and was removed from a chamber into which it had darted when first exposed; the chamber was at a depth of about 2.5 cm. Within the upper chambers of this nest were individuals of both sexes of the roach, *Parcoblatta americana* (Scudder). This roach often resides within nests of *V. chicoensis* during the day and at night emerges to feed on debris in the chaff pile surrounding the nest. Another roach, *Ischnoptera deropeltiformis* (Bruner) has similar habits; both species were found associated with nests of *V. chicoensis* and *V. andrei* (Mayr) in Butte and Tehama Counties. One,

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or both, of these roach species may serve as host for the parasitoid.

Evaniella neomexicana **(Ashmead, 1901)**

This species was described from two male specimens collected at Las Cruces, New Mexico. Snelling (1963) recorded a third male from Riverside County, California. Two additional specimens are now available: 1 ♂, 5 mi. S. of Parker, Yuma County, Arizona, 13 April 1965 (D.A. Barstow); 1 ♀, Kane Springs, Imperial County, California, 22 April 1964 (R.L. Westcott). According to Mr. Westcott (personal communication), the Kane Springs specimen was flying through a clump of *Ephedra* sp.

The female differs from the male specimens in that the entire body is bright ferruginous.

Hyptia oblonga **Townes, 1949**

Townes (1949) described this from specimens from the Huachuca Mountains, Arizona (type locality) and from Alabama (Evergreen), Georgia (Spring Creek), Mexico (Cuernavaca) and Costa Rica (Suerre).

Two females were collected at La Laguna, 5500-5675 feet elevation, Sierra de la Laguna, Baja California Sur, Mexico, 28 August - 1 September 1977 (R.R. Snelling). This is the first record of the species in Lower California. The population there is almost certainly isolated from that which occurs to the northeast in southern Arizona. Presumably the range was continuous during the Tertiary when most or all of the intervening area was forested.

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ANTS (*CREMATOGASTER CLARA* MAYR) NESTING IN BIRD BOXES (HYMENOPTERA: FORMICIDAE)[1]

Wayne H. Davis[2], William C. McComb[3], Pierre Allaire[4]

ABSTRACT: Ants (*Crematogaster clara* Mayr) occupied bluebird boxes on metal posts posted in reclaimed coal mines. Eggs, larvae and pupae were found covering the floor of one of the boxes.

On April 8, 1982, we established 50 stations of experimental bluebird houses on reclaimed surface mines of Falcon Coal Co., near Quicksand, Breathitt Co., KY. At each station 3 boxes were bolted to a board fastened between two standard 1.8 m iron fence posts. The boxes, made of planed, untreated yellow-poplar (*Liriodendron tulipfera*), had inside dimensions of 13 cm x 13 cm and a height of 25 cm. One type was the standard bird house with a circular entrance 38 mm in diameter located 20 mm below the roof. A second type had the front panel reaching to within 38 mm of the roof leaving an entrance space of 38 x 130 mm. The third type had a similar entrance in the roof made by having the roof come within 38 mm of the front panel. The roof of each type was easily removed for inspection. Each station was visited weekly throughout the summer.

Ants, identified as *Crematogaster clara* Mayr by James C. Trager and William F. Buren, began entering the boxes by May 15. In succeeding weeks more boxes were occupied until 8 stations finally came to be utilized by ants. The ants were apparently exploratory swarms. There were no crevices or cavities in the wood that seemed suitable for colonizing by ants. There was no nesting material in any of the boxes used by ants. This exploratory behavior continued through the next month.

On July 15 ant eggs were found on the floor in 3 of the boxes. On August 3 the entire floor of one box was covered with eggs, larvae and pupae.

The 3 box types varied in exposure to light and elements with the circular entrance type having the least exposure and the top entrance type the most. Ants preferred the most sheltered type, but at 3 stations all 3 types were occupied and ant eggs were found on the floor in both the circular entrance and the front slot entrance type.

We know of no instances of ants nesting in situations such as we have described. Ants that nest above ground generally choose crevices with

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small openings to maintain humidity and to dampen temperature fluctuations (Sudd, 1967). *Solenopsis* sp. and *Monomorim minimum* (Buckley) have been reported entering bluebird boxes and devouring young nestlings (Laskey, 1940; Hurst 1980).

ACKNOWLEDGMENTS

We thank James C. Trager and William F. Buren for the identification of the ants, and Paul H. Freytag for help with the manuscript.

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SOCIETY MEETING OF NOVEMBER 16, 1983

The second meeting of the 1983-84 year was held on Wednesday evening at the Academy of Natural Sciences, Philadelphia. Eleven members and two guests heard Joseph M. Harrison speak on "Mounting Insects in Transparent Media."

Mr. Harrison described the history of transparent mounts, which date back to the 2-sided glass "book type" mounts of Titian Peale (ca. 1830), the popular 2-sided glass mounts sold on a large scale by the Dentons (ca. 1890-1925), the familiar "Riker" mounts, and finally, his own acrylic mounts. Many examples of various types of mounts were on display, and samples were passed around the audience for examination. The "Harrison" mounts have a transparent 1/8" acrylic top and bottom, and opaque acrylic sides, and provide excellent sample visibility without the much greater weight and fragility of glass. Polyurethane foam sheeting provides an attractive backing material, but discolors if exposed to sun or artificial light for extended periods. Cotton batting can be substituted in the latter situations. Use of a stainless steel pin through the insect's body during the spreading process allows the pin to be more easily removed before the insect in placed in the mount. Injection of an insecticide solution into the insect's body is recommended to prevent future dermestid attacks.

Numerous practical hints on field methods were also provided by Mr. Harrison. He prefers lighter fluid as a killing agent, injected hot water as a relaxant, and flea collars worn around the lower pantlegs as a tick and chigger deterrant.

Mrs. Mildred Morgan, office secretary of the Society, was presented with an attractive butterfly mount by Mr. Harrison for her conscientious service.

Wm. H. Day

INDICATION OF MOUNTING MEDIA INFORMATION[1,2]

R.D. Waltz, W.P. McCafferty[3]

ABSTRACT: The vast array of mounting media currently being used for slide mounts of arthropods makes it imperative that mounting media be precisely indicated with specimens and in publications. Information should also include the solvent and date of mounting. Such information is necessary for specimen study, curation, and remounting, and is especially important for type specimens.

The recent development of a wide variety of slide-mount media for arthropod preservation gives rise to an urgent need for incorporating medium-related data in the preparation and designation of such specimens (or parts thereof), particularly of type specimens. Recommendations for procedures must be clearly addressed because of taxonomists' increasing use of slide mounted and embedded materials.

Prior to the burgeoning development of the newer media, balsam was used in most slide preparations. Today taxonomists may use any of several acceptable media depending on requirements of the particular taxonomic group, ease of use, personal preference, and other criteria. Frequently a taxonomist will change preferences over time, thus perhaps using many different media in study materials.

The taxonomist must also vary medium usage with specimen usage, as media will variously affect specimens, their characteristics, and the ability to interpret them. For example, Hoyer's or some other medium with similar clearing properties and compatibility with acids or bases may be routinely used by a particular specialist unless permanent storage is needed, when a longer-lived, more stable medium such as Euparal® or other hydrophobic type may be used (cf/Wilkey, 1977). Too much clearing or not enough clearing action may prevent certain characteristics from being studied, just as a refractive index near that of chitin may prevent clarity of setal and surface characteristics (Christiansen and Bellinger, 1980; Salmon, 1951 and 1954).

The taxonomist should select a medium carefully and indicate the medium used. Without such information, others who may have to work with the specimens in the future may not be able to interpret effects peculiar to the medium. Such information is also necessary for dissolving the medium when remounting is required, and an appropriate solvent should also be indicated. Remounting is undertaken i) so that characteristics (often newly discovered ones) may be examined, ii) as part of long term slide curation, iii) for improving permanency, or iv) for collection restoration.

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[2]Purdue Agricultural Experiment Station Journal No. 9429.

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Given the necessity for information on mounting media, we make the following recommendations: For general collections of slide mounted material, data on media should be routinely added to the data label. This could be done, for example, as a line following locality and collection data that would denote the medium used, the appropriate solvent, and the date of preparation. A similar practice should also apply to embedded parts associated with pinned insects, such as Coleoptera genitalia mounted on clear acetate attached to the pin of the whole specimen (cf/Johnson, 1982; Smetana, 1971). Slides bearing type specimens or parts thereof could have any important information, including data on the medium, permanently etched into the glass in addition to the usual label. Important information such as the general locale (country, state, county), mounting medium, solvent, and date of preparation could be appropriately etched under one label area, and type status, genus, species and author under the second label area. The etching could reside under a label or on the back of the slide and could be highlighted with ink.

Data on mounting media should also be available in taxonomic reviews and revisions, and especially with species descriptions. Whenever type specimen data are given, data on mounting media should be included as standard procedure if embedded or slide mounted materials are involved. Certain workers have recognized the importance of this and routinely publish such information (e.g., Braasch, 1980; Johnson, 1982; Puthz, 1974; Smetana, 1971). An excellent format is that of Puthz (1974) including both the medium and its solvent: (p. 916) "Both syntypes have been mounted anew, the aedeagus of the male (internal sac everted) embedded in Euparal® (soluable in alc. abs.) on a strip of celluloid." We hope all taxonomists will adopt these recommendations to aid curators and future researchers, and for the general welfare of collection resources.

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TWO UNDESCRIBED FOSSIL DERMAPTERA FROM FLORISSANT, COLORADO[1]

F. Martin Brown[2]

ABSTRACT: Names are proposed for two undescribed Oligocene Dermaptera from the shales of Florissant, Colorado: *Labiduromma scudderi*, n.sp., and *L. gurneyi*, n.sp.

While preparing a revision and catalogue of fossil Dermaptera for the "Natural History Inventory of Colorado," we set aside several specimens that clearly were not any of the species Scudder had described. Since no one else has described fossil Dermaptera from the Oligocene in North America, these specimens represent currently unnamed species. The specimens represent two distinct species. Both appear to be best placed at this time in Scudder's genus *Labiduromma* (Labiduridae). One of the species falls into the *avia* group and the other into the *commixtum* group of that genus.

Fig. 1. Left: holotype *Labiduromma gurneyi*, n.sp.; center: holotype *L. scudderi*, n.sp.; right: paratype *L. scudderi* n.sp.

Labiduromma scudderi, n.sp.

This new species resembles most closely *labens* Scudder of the *avia* - group. It is considerably larger than *labens*, and the cerci are quite different from the threadlike ones of that species. The resemblance lies largely in the shape of the abdomen.

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Holotype: A female, with counterpart, UCM numbers 29907 & 29908. Collected by Wilmatte Porter Cockerell from UCM (Cockerell) pit 13B, probably in 1908. Total length 21.3 mm, from tip of mouth parts to tip of cerci.

Head: stout pear-shaped (well rounded subtriangular), 2.3 mm long and 2.3 mm wide at eyes.

Antennae: visible length 2.3 mm with only 4 countable segments in view, quite incomplete. Basal segment very stout, 0.9 x 0.5 mm.

Pronotum: trapezoidal; posterior margin narrower than head, anterior margin much more so. Length 1.0 mm, anterior width 1.3 mm, posterior width 1.5 mm.

Tegmina: partly opened, each tegmen probably 1.65 mm wide; when closed probably nearly "square" in appearance; distal margin rounded. Length 3.4 mm.

Legs: poorly preserved. Leg 1: femur 2.2 x 0.5 mm, possibly includes some of tibia, tarsus 3.3 x 0.2 mm; Leg 2: femur 1.8 x 0.7 mm; Leg 3: femur 2.2 x 0.8 mm, tibia 2.1 x 0.4 mm, tarsus 1.8 mm - incomplete, possibly as much as 4.5 x 0.2 mm.

Abdomen: six well defined segments; parallel sided to segment 4. Dorsal outline presents a semi-circular curve to terminate abdomen. Width 3.6 mm.

Note: The abdomen is not part extended as in most fossils but so compressed longitudinally that the heavy chitinous tergites are in contact throughout showing none of the delicate anterior and posterior margins of the segments. This has had a notable effect on the total length.

Pygidium: prominent; a bluntly rounded triangular structure.

Forceps: basal half straight, distal half increasingly curved to tips. Length 5.7 mm, basal width 0.8 mm, midway width 0.5 mm, width near tip 0.3 mm. Forceps are 33.3% of total body length, or, to use Scudder's method, 50% of body length, omitting the forceps.

Named for Samuel Hubbard Scudder, the father of American studies of fossil insects and especially those of the Eocene and Oligocene of Colorado. His "Tertiary Insects of North America" (1890) is the basic work on the topic.

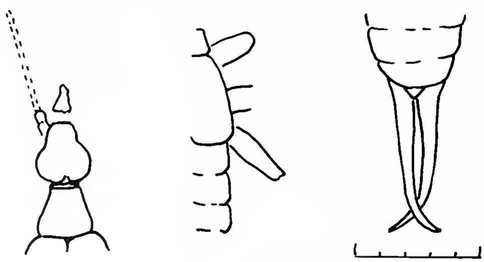

Fig. 2. *Labiduromma scudderi,* n.sp. Left: head and pronotum; center: positions of legs; right: forceps and pygidium. Bar scale is in millimeters.

Labiduromma guerneyi, n.sp.

The structures of cerci and pygidium of this species resemble those of *commixtum* Scudder, thus placing the insect in the *commixtum* - group and differing from all other Oligocene fossil earwings of North America. The new species is much larger than *commixtum* with proportionally larger forceps.

Holotype: a male, UCM number 29902, collected by Wilmatte Porter Cockerell in UCM (Cockerell) pit 13B, probably in 1908. Total length from tip of mouth parts to tip of forceps, 27.3 mm.

Head: broadly triangular with apices. Eyes large but probably not holoptic. Palpi and mandibles well defined. Length 2.5 mm, width 2.3 mm.

Antennae: only 4 mm of length visible. Basal joint swollen, 0.4 x 0.4 mm, second joint 0.55 x 0.25 mm, other too vague to count or measure.

Pronotum: quadrilateral, 1.8 mm long, 1.9 mm wide, corners rounded.

Tegmina: not well defined, partly open, posterior margin almost straight. Length 3.0 mm, anterior width 2.7 mm, posterior 3.9 mm.

Legs: Leg 1: femur 1.7 x 0.8 mm, tibia incomplete 1.0+ x 0.3 mm; Leg 2: femur 2.3 x 0.7 mm, tibia 2.0 x 0.4 mm and slightly curved, tarsus incomplete with basitarsus subchordate; Leg 3: femur 2.8 x 0.75 mm, tibia incomplete 0.4 mm wide, Leg 2 closer to leg 1 than to leg 3.

Abdomen: long and slender which may be an artifact of fossilization: parallel sided, last segment appears much longer than any other and slightly tapered to very shallowly convex posterior margin. This is a ventral aspect so segments II through X can be seen.

Pygidium: broad and bluntly rounded. Base 44% the width of visible hind margin of last abdominal segment.

Forceps: long, moderately stout, gently curved throughout giving a "bow-legged" appearance. Near the base on inner side is a large, strong tooth that embraces the pygidium. This tooth on both cerci almost encircles that structure. Length 6.9 mm, width at base 0.8 mm (across bases of the two cerci 2.6 mm); tooth width 1.1 mm, midway width 0.8 mm. Forceps constitute 25.3% of total length. Using Scudder's method, forceps are 34% of the body length, omitting the forceps.

Paratypes: AMNH: no. 18912, a male, collected by S.A. Rohwer in UCM (Cockerell) pit 14 in 1907.

UCM: nos. 29900 & 29901, counterparts, a female with no specific pit number or collector's initial; no. 29935, a male in ventral aspect, collected by Wilmatte P. Cockerell in pit number 13B in 1908; no. 29936, forceps only, counterparts, probably female, collected by Harry McGinite at University of California pit 3736 in 1937; no. 29957, probably female, with no indication of pit number or collector's initial.

The species is named for Dr. Ashley B. Gurney, United States National Museum, the leading American student of the order Dermaptera.

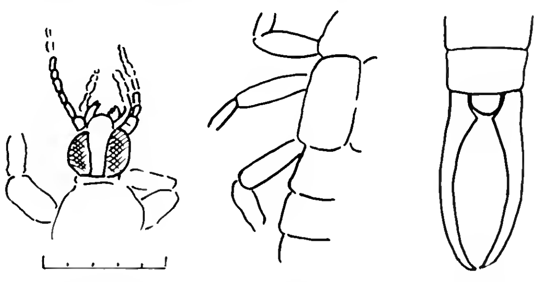

Fig. 3. *Labiduromma gurneyi*, n.sp. Left: head and pronotum; center: positions of legs; right: forceps and pygidium. Bar scale is in millimeters.

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DOES THE OLD WORLD FAMILY PLATASPIDAE (HEMIPTERA) OCCUR IN NORTH AMERICA?[1]

Richard C. Froeschner[2]

Evidence of two sorts leads to the posing of this question.

First: In the national insect collection at the Smithsonian Institution are three females of the Asian (India through Burma into Malaysia) species *Coptosoma duodecimpunctatum* (Germar) hand-labeled "Alaska. 40 yds E. of Kerai Lake Lodge, near Sterling Bay, VII-11-1954, R. Coleman." If this label is correct the exactness of the locality should enable interested persons in that area to concentrate collecting efforts to verify its presence there.

Coptosoma duodecimpunctatum would be easily recognized among North American Heteroptera: 5.9-7 mm in length; broadly rounded, appearing nearly as wide as long; scutellum much enlarged, almost reaching sides and apex of abdomen; dorsum shining black with 8 reddish-yellow elongate spots on pronotum and 4 similarly colored spots in a row across base of scutellum.

Second: In *Catalogus Insectorum Sinensium,* pages 256-257, Wu (1935) listed *Coptosoma biguttulum* Motschulsky from China, Japan, Korea and "America." Review of the reference listed by Wu and in works by other authors found no source for this "America" record. Perhaps "America" was an improper copy of "Amuria" listed by Oshanin (1906, Verz. Palaeark. Hemip., 1:3).

Until fresh records support these occurrences, probably neither species should be considered a member of the North American fauna.

[1]Received and accepted November 26, 1983.

[2]National Museum of Natural History, Washington, D.C. 20560.

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(Continued on inside of back cover)

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A NEW SPECIES OF THE *RHYACOPHILA BRUNNEA* GROUP (TRICHOPTERA: RHYACOPHILIDAE)[1]

S.D. Smith[2], J.S. Weaver, III[3]

ABSTRACT: *Rhyacophila starki*, new species of the *Rhyacophila brunnea* species group, from Oregon and northern California, is described and figured. Adults of *R. starki* are similar to those of *R. inculta*. However, *R. starki* is unique with male in lateral view having posterodorsal margin of abdominal segment IX shaped like a human face in profile, with a short "nose" (a transverse posterodorsal ridge) extending over the base of segment X and with female having posterior of abdominal segment IX bearing a pair of ventrolateral keel-like ridges.

Recent examinations of caddisfly collections from Oregon and California revealed a previously unknown species of *Rhyaophila*. This species is included in the *Rhyacophila brunnea* group (= *R. acropedes* group, *sensu* Schmid 1970) cf. Smith and Manuel (1984). This brings the total number of Nearctic species in the *R. brunnea* group to 7, including *R. brunnea* Banks, *R. grandis* Banks, *R. inculta* Ross and Spencer, *R. neograndis* Denning, *R. sequoia* Denning, *R. starki* Smith and Weaver, and *R. vao* Milne.

Rhyacophila starki, new species
figures 1, 2, 3

This species appears to be most closely related to *R. inculta* Ross and Spencer (1952). However, *R. starki* is unique, with male in lateral view having posterodorsal margin of segment IX shaped like a human face in profile, bearing a short pointed "nose" (a short transverse ridge) just above segment X, and inferior appendages each with 2nd article unlike those of related species, neither foot shaped nor with dorsal margin greatly incised; females distinguished by having posterior of segment IX with short ventrolateral keel-like ridges.

MALE (fig. 1): Length 12 mm. Head and thorax dark brown to black; wings same color, irrorate; legs and abdominal sclerites brown. Genitalia having abdominal segment IX in lateral view (fig. 1A), with dorsum about 1.5 times longer than pleuron and posterior margin in lateral view shaped like human face in profile, just above base of segment X; abdominal segment X in lateral view somewhat rectangular, length about 2 times its height, in dorsal view (fig. 1B) divided into pair of wide elongate lobes with apices each bearing shallow notch, about 3 times as long as basal width; inferior appendages in lateral view (fig. 1A) similar to those of

[1]Received November 30, 1983. Accepted February 14, 1984.

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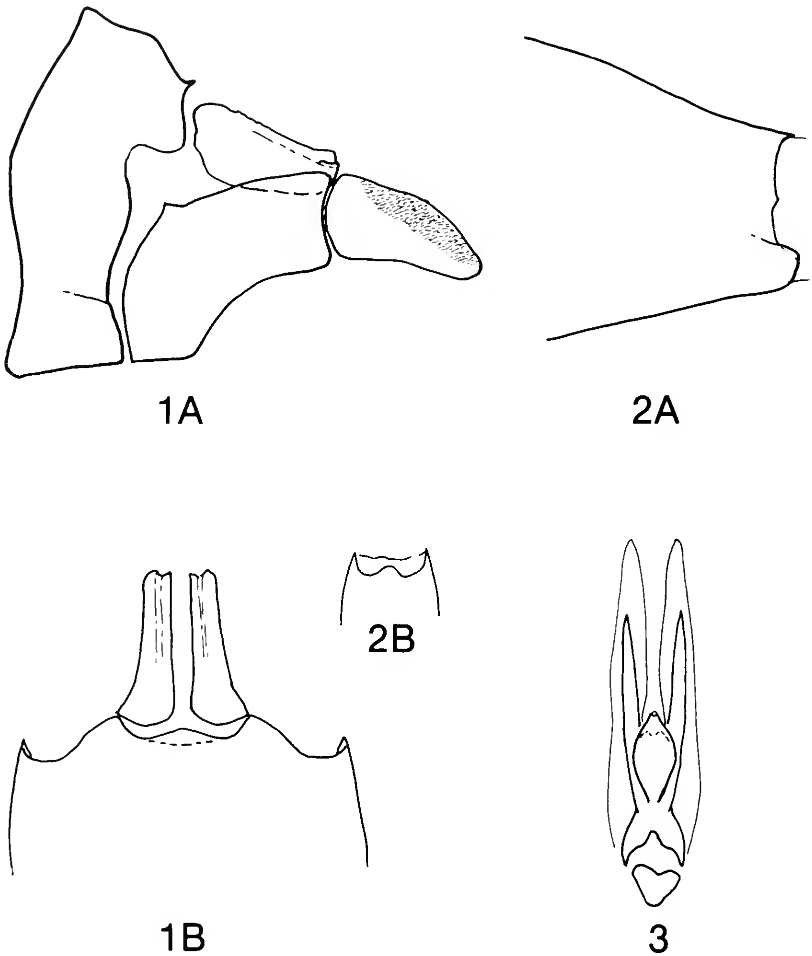
R. inculta, but each with 1st article elongate, not sharply constricted, widest at base, ventral margin concave, and with 2nd article somewhat acuminate, apex blunt, dorsal margin not greatly incised, apical half of mesal surface spinose; phallic apparatus typical of *brunnea* group, lateral arms membranous, extensive, apices spinose.

FEMALE (figs. 2, 3): Length 14 mm, with similar coloration as in male. Genitalia with posterior of abdominal segment IX in lateral view (fig. 2A) bearing ventrolateral, keel-like



Figures 1-3 *Rhyacophila starki.* 1. Male genitalia; A. lateral view; B. dorsal view. 2. Female abdominal segment IX; A. lateral view; B. dorsal view. 3. Female vaginal apparatus, ventral view.

ridges, in dorsal view (fig. 2B) posterior margin having wide, irregular, W-shaped emargination with short mid-dorsal, curved flange. Vaginal apparatus (fig. 3) similar to those of *R. inculta,* having 2 pairs of elongate, acuminate arms and shorter ovate central process about 2 times as long as wide.

Material Examined

HOLOTYPE: Male, Oregon, Jackson Co., 1 mile north of Wrangle Camp, Rogue River National Forest, 8 July 1979, W.P. Stark & K.W. Stewart; deposited in California Academy of Sciences, Şan Francisco, CA.

ALLOTYPE: Female, same data as holotype.

PARATYPE: Male, California, Del Norte Co., seeps, Smith River Canyon, U.S. Hwy. 199, 18 March 1972, R.A. Haick & D.S. Potter; deposited in collection of Dr. D.G. Denning, Moraga, CA.

ACKNOWLEDGMENTS

We are grateful to Drs. D.G. Denning and W.P. Stark who made the caddisfly material available to us for examination which included this new species.

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ELM RESEARCH INSTITUTE TO AWARD FIRST ANNUAL PRIZE FOR DUTCH ELM DISEASE CONTROL

In an effort to develop new controls for Dutch elm disease, Elm Research Institute, Harrisville, NH has announced its first annual research prize of $10,000.

The prize to be announced via national media, will go to the entry which best outlines a research program that will ultimately lead to development of a new systemic repellent for the elm bark beetle.

All proposals will be judged on the basis of:

1. Water solubility for systemic injection
2. Phytotoxicity
3. Beetle deterence at point of feeding
4. Chemical stability of the repellent
5. Bio-assay technique for tracing distribution

ERI stresses that this is not a research grant. It is an award for originality in the presentation of new concepts, new methods of achieving repellency through systemic treatment.

Prizes will be awarded as follows: $5,000. first place, $3,000. second, $2,000. third. Judging will be by a panel of recognized experts composed of entomologists and plant pathologists. All entries should be mailed to Elm Research Institute, Harrisville, NH 03450 by May 1st, 1984 and will become the property of the Institute.

For further information call (603) 827-3048.

DESCRIPTION OF LAST NYMPHAL INSTAR OF *XESTOCEPHALUS ANCORIFER* (HOMOPTERA: CICADELLIDAE)[1]

Paul S. Cwikla[2]

ABSTRACT: The last instar nymph of *Xestocephalus ancorifer* Linnavuori is described and the pharate adult is illustrated.

No nymphal stage of any member of the leafhopper genus *Xestocephalus* Van Duzee has ever been described. Through the kindness of Dr. James P. Kramer, U.S. National Museum, I have been able to examine 2 male specimens of *Xestocephalus,* one of which is a teneral adult still attached to the exuviae and a pharate adult which shares the same size and characteristics as the exuviae. The adult is identified as *X. ancorifer* Linnavuori, 1959.

X. ancorifer ranges from Panama south to Paraguay (Linnavuori, 1959). The biology of the genus is poorly known. Oman (1949) suspects that the nymphs of *Xestocephalus* live in ground litter or other subterranean habitats. In addition, Oman (1949) speculates that the nymphs may also be myrmecophilous because the closely related genus *Myrmecophryne* Kirkaldy has been collected in ants' nests. This is supported by Hamilton (1975) who sifted a species of *Xestocephalus* from topsoil which also contained ants.

This paper describes and illustrates the last instar nymph of *X. ancorifer.* It is hoped that the description and illustration will aid in future identifications of immature *Xestocephalus* species. The collection data for the specimens used in this study are: Brazil, Bahia, Itabuna, July 1971, T.A. Winder, in cacao leaf litter. The specimens are deposited in the U.S. National Museum.

Description of Last Instar Nymph

Length: 3.2 mm., width of pronotum - 0.9 mm.

Form: Elongate, stout dorsoventrally, widest at wingpads. Head rounded anteriorly in lateral view, antennal pits not well developed, beak 3-segmented, extending to mesosternum, crown and clypeus roughened by tuberculi bearing small setae, surface of clypellus, lora and gena smooth. Pronotum asperate, trapezoidal in dorsal view, episternum triangular, coxa of prothoracic leg about 2/3 that of femur, tibia with single row of spines on dorsal margin, tarsomeres of prothoracic legs 2-segmented. Dorsum of mesonotum asperate, mesonotal wingpad almost as long as metanotal wingpad, episternum not divided as in the adult, coxa 2 smaller than coxa 1, rest of mesothoracic leg like prothoracic leg. Dorsum of metanotum asperate, wingpad extending to anterior margin of third abdominal tergite, metathoracic femur laterally flattened, tibia with 2 rows of spines on dorsal and ventral sides, apex of tibia ringed

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with setae, tarsomeres 3-segmented. Abdomen 8-segmented, ninth segment forms the genital capsule, posterior margin of abdominal tergites with row of setae, small setae occasionally scattered on surface of tergites.

Coloration: Dorsum rust brown, ventral surface of abdomen and thorax pale yellow, legs in dorsal view light brown.

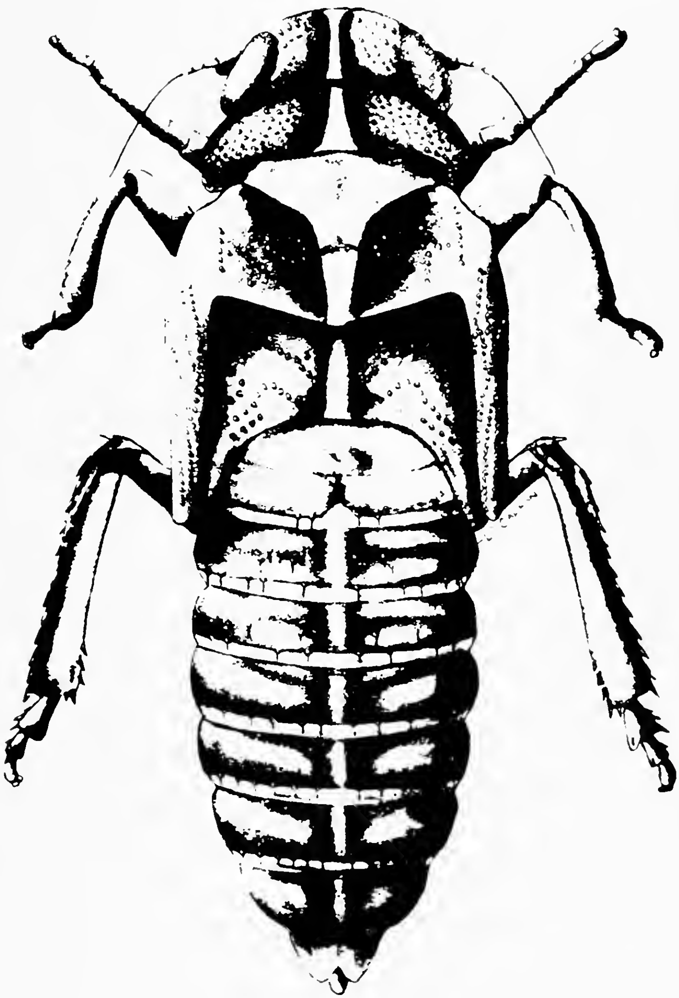

Fig. 1. Habitus of the pharate adult of *Xestocephalus ancorifer* showing last nymphal instar characteristics.

ACKNOWLEGMENTS

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BOOK REVIEW

NEW ZEALAND BUTTERFLIES Identification and Natural History. George W. Gibbs. 1980. Collins, Auckland. 207 p., 197 pls., 63 text figs. Price $45.

This sumptuously illustrated and beautifully printed book recently made its way to the American market. It is an excellent example of the kind of book those of us interested in butterfly faunistics would like to publish; an exhaustive treatment of all species known from the area under consideration, with sharp colored plates depicting immature stages, living adults, habitats, and spread museum specimens as well. In addition, there are excellent scanning electron photomicrographs of eggs, larval setae, adult scale types, and other ultrastructure. Photos of parasitoids, additional drawings to aid identification of adults, and distribution maps add further to the visual enrichment of this book.

Of the 23 species recorded from New Zealand, 11 are known only from that island country; the rest are common to Australia and New Zealand. Some of the latter group - such as *Danaus plexippus, Pieris rapae,* and *Lampides boeticus* - are widespread in the world. After an introduction in which he discusses New Zealand's paucity of butterfly species and a general history of New Zealand lepidopterology, Gibbs discusses migration and introduction of species "over the Tasman" Sea from Australia. The body of the book is devoted to meticulous treatment of identification, life histories, ecology, and habits of the 23 species, with diagnostic introductions for each family, subfamily, and genus. The fauna consists of 2 Pieridae, 3 Danaidae, 7 Satyridae (these last 2 families treated as subfamilies of the Nymphalidae), 5 Nymphalidae (*sensu strictu*), and 6 Lycaenidae (4 coppers and 2 blues). No Papilionidae or Hesperiidae have been recorded there as yet.

The book is rounded out with a chapter discussing how and where to look for butterflies in New Zealand, and a glossary and extensive bibliography. The quality of writing and illustration is high (though I noticed the irritating use of "larvae" in the singular), and printing and binding are more than satisfactory. Gibbs has given us a well-researched and virtually complete coverage of New Zealand butterflies from all aspects. It could be a model for similar works in other regions where the butterfly fauna is not so overwhelming in quantity as to preclude such a work from a standpoint of labor and expense.

Charles V. Covell Jr., Dept. of Biology, Univ. of Louisville, Louisville, KY 40292

MEGASTIGMUS SPERMOTROPHUS WACHTL. (HYMENOPTERA: CHALCIDOIDEA) (DOUGLAS-FIR CHALCID) FOUND IN NEW YORK STATE[1]

Carl E. Palm, Jr., Lawrence P. Abrahamson[2]

ABSTRACT: A seed and cone insect survey in New York state documented the first recorded occurrence of *Metastigmus spermotrophus* Wachtl. in the eastern United States.

Preliminary surveys of seed and cone insects are being conducted in conjunction with an evaluation of conifer seed production in New York. Seeds and cones were collected and examined for insect damage. Adults of *Megastigmus spermotrophus* Wachtl. emerged from a collection of Douglas-fir [*Pseudotsuga menziesii* (Mirb.) Franco] cones. This is the first record of *M. spermotrophus* in the eastern United States.

M. spermotrophus is widespread in the western United States, throughout the range of Douglas-fir (Hedlin et al. 1980). In addition, it has been recorded in Scotland, Germany and New Zealand (Gourlay 1930, Hanson 1952 and Milliron 1949).

Detection of *M. spermotrophus* is difficult due to the seclusion of larvae in seeds, where the larvae may remain in diapause for up to three years. Larvae can be detected by radiography (Ruth 1980), but no external evidence of damage is present until the adult chalcid emerges in the spring (Hedlin et al. 1980, Keen 1958, and Milliron 1949).

METHODS AND RESULTS

Sixty Douglas-fir cones from Columbia and Orange counties, (Clermont and Windsor townships, respectively) in eastern New York were examined. These cones were collected from the ground beneath ornamental trees in April 1983 and held indoors at approximately 20°C. Within three weeks, 26 chalcids (7 males and 19 females) emerged from the overwintering seeds. Additional collections will be made in the coming year to evaluate the impact and extent of this Douglas-fir seed pest.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

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

ITZN 59 21 October 1983

The following Opinions have been published by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature,* vol. 40, part 3, on 21 October 1983:

Opinion No.

1257 (p. 149) *Tipula ferruginea* Fabricius, 1805 (Insecta, Diptera): conserved.

1258 (p. 151) *Ochthera exsculpta* Loew, 1862 (Insecta, Diptera): placed on the Official List.

1260 (p. 157) *Orthunga* Dohrn, 1859 (Insecta, Hemiptera): added to Official List.

The Commission regrets that it cannot supply separates of Opinions.

R.V. MELVILLE, Secretary

NEW HABITAT RECORDS FOR *GLENANTHE* SPECIES (DIPTERA: EPHYDRIDAE)[1]

B.A. Steinly[2]

ABSTRACT: New habitat records are presented for *Glenanthe interior* Chillcott. Several specimens were collected over an algal-covered seep and sand shore. Also, *G. litorea* Cresson was discovered in the marine sand beach habitat.

Three species of shore flies, *Glenanthe litorea* Cresson, *G. interior* Chillcott, and *G. fascipennis* Sturtevant and Wheeler are recorded from the United States. Sturtevant and Wheeler (1954) reported *G. fascipennis* and *G. litorea* from rather barren, moist saline areas. Also, *G. litorea* has been recorded from saltmarshes (Cresson, 1925; Simpson, 1976). *G. interior* was initially swept from *Petalostoma* sp. growing on stable spruce covered sand dunes in Manitoba, Canada (Chillcott, 1964). A single specimen of *G. interior* collected over a sedge meadow seepage area in Butler County, Ohio, constitutes the only United States record (Regensburg, 1978; Deonier and Regensburg, 1978).

Morphological separation of *Glenanthe* Haliday species is based upon wing and antennal characters. *G. litorea* has hyaline wings lacking pattern and gray antennae. In contrast, *G. fascipennis* has wings with two broad, poorly defined dark fasciae, one including the posterior crossvein and one nearer the wing apex, as well as yellowish antennae (Sturtevant and Wheeler, 1954). Additional descriptive characters include a fourth vein index of 2.2 for *G. litorea* and a fourth vein index of 2.0 for *G. fascipennis* (Sturtevant and Wheeler, 1954). Cresson (1925) listed the body length of *G. litorea* at 1.7 mm, while *G. fascipennis* is slightly smaller with a body length of 1.5 mm (Sturtevant and Wheeler, 1954).

While sampling in southern Ohio, I discovered several populations of *Glenanthe interior* in Butler County. Several specimens were collected with a modified aerial sweep net (Regensberg, 1977) in close proximity to a freshwater creek above an algal covered seep and sand shore. Also, the common saltmarsh inhabitant, *G. litorea,* was collected over a marine sand beach in Milford, Connecticut. The new aquatic and marine records substantiate wider habitat distributions. The two new Ohio records expand the distribution of *G. interior* to four distinctive aquatic habitats. *G. interior* has been collected from these four habitats from May through early July.

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Family Ephydridae

Glenanthe interior Chillcott

Distribution: Butler Co., Ohio Four Mile Creek, Algal covered seep with limestone mud substrate, four adults, V-17-1979; three adults, V-18-1979; Harker's Run, Sand shore, 5 adults, VI-28-1978.

Glenanthe litorea Cresson

Distribution: Milford, Conn., Anchor Beach, Sand beach intertidal area, 1 adult, VIII-7-1978.

ACKNOWLEDGMENTS

I thank Dr. D.L. Doenier for confirmation of species determinations and review of an early draft. I wish to express appreciation to Dr. May Berenbaum for reviewing the final manuscript.

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NEST DEFENSE BY THE SOCIAL WASPS, *POLISTES EXCLAMANS* AND *P. INSTABILIS* (HYMENOPTERA: VESPIDAE) AGAINST THE PARASITOID, *ELASMUS POLISTIS* (HYMENOPTERA: CHALCIDOIDEA: EULOPHIDAE)[1]

Genie G. Lutz, Joan E. Strassmann, Colin R. Hughes[2]

ABSTRACT: *Polistes exclamans* and *P. instabilis* were observed to remove from their nests larvae of *Elasmus polistis*, and to snap at adult parasitoids. These are newly reported defenses against a parasitoid that is new to North American *Polistes*.

Social wasps are plagued by many nest parasitoids which attack and eat brood (Nelson, 1968; Rau, 1941; Jeanne, 1979; Strassmann, 1981). *Polistes* employ several different defenses against these parasitoids. When adult parasitoids are detected near the nest, *Polistes* engage in a "parasite dance" and search all over the nest and substrate for the parasitoids (West Eberhard, 1969; Strassmann, 1981). Litte (1981) found that *Mischocyttarus labiatus* cut their nests down to the pedicel when phorid flies were detected nearby. Jeanne (1979) discovered that *Polistes canadensis* formed multiple combs to protect new brood from tineid moths infesting older cells. Starr (1976) suggested that nests of *Polistes* are not used for more than one season because of the parasitoids that overwinter in them. This hypothesis was supported by the observation that a population of *P. annularis* that was nearly free of parasitoids reused 10% of its nests (Strassmann, 1979).

METHODS

The observations reported here were part of a larger study of the behavior of *P. exclamans* and *P. instabilis*. A wild population of *P. exclamans* on the roof of the biology building at Rice University was observed in the summer of 1982. *P. instabilis* was observed in Puerto Oscondido, Oaxaca, Mexico in August 1983. Females were marked in both cases and nests were monitored daily.

RESULTS

We found that *Polistes exclamans* and *P. instabilis* actively defended their brood against *Elasmus polistis*, a small chalcid parasite whose larvae

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are external parasitoids on prepupae and pupae in capped cells of *Polistes* (Reed and Vinson, 1979). They snapped at adult parasitoids with their mandibles, sometimes cutting them in two, and searched over the nest for females trying to lay eggs. Larvae of *E. polistis* were pulled out of cells and dropped or fed to wasp larvae.

We observed an older worker that had been marked on a regularly-censused nest of *P. exclamans* in Houston, Texas, pull several larvae of *E. polistis* out of a cell and drop them. Since the nest was in a plywood nest box, the expelled larvae fell only a few inches to the bottom of the nest box where about 15 parasitoid larvae had accumulated. The worker *P. exclamans* had reached the larvae of *E. polistis* by chewing through the partition separating them from the remains of the wasp larva. This partition is made of meconia of the larvae of *E. polistis* and is constructed just before pupation, after they have finished feeding on the host prepupa, or pupa (Reed and Vinson, 1979). The partition appears to simulate the texture and color of the meconium normally deposited in the bottom of the cell by larvae of *Polistes* and pupation.

P. instabilis was observed in a tree in Puerto Escondido, Oaxaca, Mexico. After briefly observing the nest one day we returned the following day to find that about half of the cells with pupal caps had been destroyed by the workers on the nest. While we watched, two more paper wasp pupae with larvae of *E. polistis* attached to them were aborted by the workers. The *E. polistis* were chewed up and fed to brood by workers.

DISCUSSION

The short development times from egg to adult of *E. polistis* of 17 to 20 days allow several generations of *E. polistis* to infest the same nest over the season (Reed and Vinson, 1979; Strassmann, 1981). Strassmann (1981) found that males emerged before females, remain near the nest to mate with their sisters who reinfested the nest. Numbers of parasitized cells increased over the season to a maximum of 25 cells per nest parasitized by *E. polistis* (S.D. = 37, N = 41 nests) in an Austin Texas population of *P. exclamans* in 1978 (Strassmann, 1981). Since the potential for increased parasitism on the host nest exist, *Polistes* with a high incidence of parasitism by *E. polistis* may be expected to benefit from an active defense mechanism — even one that removes parasitoids after the wasp brood has been killed.

E. polistis is a parasitoid that is new to central Texas *Polistes.* Burks (1971) described it for the first time in 1971. *Polistes* have been so thoroughly collected and studied that it is unlikely that it was present and undetected previously (Reed and Vinson, 1979 and refs. therein). Rau, a most thorough collector, collected in Austin, Texas, and does not mention

E. polistis or anything similar though he does mention other parasitoid species (Rau, 1943). He stored his nests in bags from which *E. polistis* could not escape (Rau, 1941). It is possible that *E. polistis* has a defense behavior that can be defeated by wasps because *Polistes* are a new host for *E. polistis.*

Parasitoids adopt one of two general types of defense against destruction by *Polistes:* concealment and fortification. *E. polistis* have pupae concealed under a layer which mimics meconium of *Polistes. E. polistis* achieves this by migrating as larvae to one position, and all larvae depositing their meconia at one level resulting in a plate of meconium thicker at the edges than in the center (Reed and Vinson, 1979). The ability of adult *Polistes* to tear through this and remove parasitoids of *E. polistis* once they have defeated the mimicry involved contrasts with the situation of several other parasites. *Chalcoela iphitalis* (Lepidoptera: Pyralidae), another common parasitoid of *Polistes,* builds webbing so strong that workers seem to be incapable of chewing through it. However *C. iphitalis* do not reinfest the nest from which they emerge in the same season so it would only be worthwhile to remove them before they have damaged brood (Strassmann, 1981). *Polistes* may also remove brood of *C. ipitalis* to keep them from attacking nearby nests if those nests are likely to belong to relatives. *Pachysomoides stupides* and *Pachysomoides fulvus* (Hymenoptera: Ichneumonidae) also construct casings that *Polistes* can remove only by destroying that entire region of the nest. *Polistes* also tear great sections of the nest away to remove pupae of *Sarcophaga polistis* (Diptera: Sarcophagidae) which lie across several cells at the very bottom of the nest where they are concealed (Strassmann, unpubl.; Hughes, unpubl.). Apparently these pupae can only be removed by substantial nest destruction.

Of 16 nests which had extensive areas of the nest chewed away at a field site near Houston, seven contained brood of *P. stupidus* and 2 contained brood of *C. iphitalis.* Since some parasitization probably went unrecorded, for example that underneath pupal caps, this nest destruction is probably always a response to parasitoids. Fourteen of the 16 nests were *P. carolinus,* a species which nests very close to its natal nest site (Hughes, unpubl.; Rau, 1931), and would therefore aid relatives by removing parasite pupae from the immediate area.

Over 60% of all nests of *P. exclamans* lose brood to the parasitoids *E. polistis* or *C. iphitalis* or both each year in central Texas (Strassmann, 1981). Though worker wasps appear to make every attempt to keep adult parasitoids from laying eggs in the nest, and to remove parasitoid eggs and larvae when they do, many of these attempts are ineffective. The abundance of *E. polistis* in nests of *Polistis* suggests that workers often do not detect the parasitoids.

ACKNOWLEDGMENTS

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HOST PLANT RECORDS FOR NORTH AMERICAN RAGWEED FLIES (DIPTERA: TEPHRITIDAE)[1]

B.A. Foote[2]

ABSTRACT: Information is given on host plants and infestation rates for 7 of the 8 North American species of *Euaresta.* The host plants are either ragweeds of the genus *Ambrosia* or cockleburs of the genus *Xanthium,* 2 genera of the tribe Ambrosieae (Compositae).

The genus *Euaresta* is a relatively small taxon within the family Tephritidae of the acalyptrate Diptera. It includes 8 species from America north of Mexico (Quisenberry, 1950; Foote, 1965), as well as several from south of the United States; however, virtually no host data are available for these latter species and some doubt exists as to whether they actually belong to the genus (R.H. Foote, in litt.). Relatively little is known of the life histories or larval feeding habits of the Nearctic species except that they seem to be associated either with cockleburs of the genus *Xanthium* or ragweeds of the genus *Ambrosia* (Compositae: Ambrosieae). Marlatt (1891) discussed the natural history of *E. aequalis* (Loew), a seed predator of cocklebur (*X. strumarium* L.). Foote (1965) reported that larvae of *E. bella* (Loew) and *E. festiva* (Loew) attacked the seeds of common ragweed (*A. artemisiifolia* L.) and giant ragweed (*A. trifida* L.), respectively. He also listed host plants for selected species of *Euaresta* and discussed briefly the life cycles of *E. bella* and *E. festiva.* Batra (1979) described in considerable detail the courtship behavior and oviposition habits of these two species. Goeden and Ricker (1974a, 1974b, 1976) recorded host plants for *E. bellula* Snow and *E. stigmatica* Coquillett. Wasbauer (1972) listed hosts for 7 species of *Euaresta.*

Because species of *Ambrosia* are prime sources of hayfever-causing pollen (Dickerson and Sweet 1971) and are important weeds in agricultural regions (Danielson *et al.* 1965), various workers (e.g. Harris and Piper 1970) have suggested that seed predators such as the larvae of *Euaresta* spp. could be important biocontrol agents.

The present paper gives information on the host plants and infestation rates for several of the Nearctic species of *Euaresta.*

MATERIALS AND METHODS

Unless otherwise indicated on Table 1, all of the host plant records were obtained by the author. Collections of seeds obtained in the field were

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transferred to a laboratory where estimates of infestation rates and identifications of the seed predators were made. Each sample consisted of at least 10 involucres containing one or more seeds, with at least three replicate samples of involucres being taken from each host plant. Whenever possible, several individuals of the same plant species were sampled (see columns 3 and 4 of Table 1).

Field-collected involucres were either dissected and examined in the laboratory for *Euaresta* larvae or placed in 4-dram shell vials to allow emergence of adults. Infestation percentages were obtained by dividing the number of seeds containing larvae by the total number of seeds examined in each sample. Identifications of the infesting species of *Euaresta* were based on adult flies that emerged from seeds of each host plant in the laboratory rearings.

RESULTS AND DISCUSSION

Table 1 presents information on the host plants and gives infestation levels for 7 of the 8 Nearctic species of *Euaresta*. Several conclusions can be drawn from the data. It is obvious that considerable variation exists in the amount of seed damage sustained by different host plants. For example, up to 98% of the seeds of canyon ragweed [*A. ambrosioides* (Cav.) Payne] were attacked by larvae of *E. bellula*, whereas never more than 8% of the seeds produced by common ragweed (*A. artemisiifolia*) were destroyed by larvae of *E. bella*. A second observation deals with the infestation levels that were obtained for different species of *Ambrosia* that served as the host plant for the same species of *Euaresta*. Thus, it seems evident that a preferred host of *E. stigmatica* is hollyleaf bur sage [*A. ilicifolia* (Gray) Payne], as up to 90% of its seeds were being utilized. Fairly high infestation levels were also encountered in bur sage [*A. deltoidea* (Torrey) Payne], but no more than 2% of the seeds of canyon ragweed were infested by this species of *Euaresta*. Another conclusion is that different genetic strains of a host plant can show varying responses to *Euaresta* attack. In northeastern Ohio, over half of the seeds of cocklebur contained larvae of *E. aequalis*, whereas the same host plant in southcentral Arizona showed no larval infestation even though the stand occurred well within the range of the fly. Finally, it should be noted that several species of *Ambrosia* apparently are not utilized by any species of *Euaresta*. Seeds of *A. cordifolia* (Gray) Payne (270 seeds examined) collected near Tucson, Arizona and of *A. dumosa* (Gray) Payne (889 seeds) collected in western Arizona contained no larvae or puparia of *Euaresta*. Similarly, no infestations were encountered in *A. bidentata* Michx. (20 seeds, Missouri) or *A. grayi* (Nels.) Shinners (40 seeds, Nebraska).

The data presented above give credence to the idea that the genus

Euaresta is unified biologically by its restriction to host plants belonging to the composite tribe Ambrosieae. It is obvious that the genera *Ambrosia* and *Xanthium* are heavily utilized, but whether species of other genera of Ambrosieae are also attacked remains unknown. Thus, no records are available for species of *Iva, Dicorea,* and *Hymneoclea.*

Table I. Host Plants and Infestation Rates for North American ***Euaresta***

Species of *Euaresta*	Host Plant	No. of Plants Sampled	No. of Seeds Examined	% of Seeds Infested	Locality of Study
aequalis	*Xanthium strumarium*	5	200	8.0-55.0	Northeastern Ohio
	X. strumarium	2	80	0.0	Southcentral Ariz.
bella	*Ambrosia artemisiifolia*	3	180	0.0- 8.0	Northeastern Ohio
bellula	*A. acanthicarpa*	—	—	—	California[1]
	A. ambrosioides	17	2207	50.0-98.0	Southcentral Ariz.
	A. chamissonis	—	—	—	California[2]
	A. chenopodiifolia	—	—	—	California[3]
bullans	*X. spinosum*	—	—	—	California[3,4]
festiva	*A. trifida*	12	2306	2.0-24.4	Northeastern Ohio
jonesi	*A. chamissonis*	—	—	—	Washington
stigmatica	*A. acanthicarpa*	—	—	—	California[1]
	A. ambrosioides	17	2207	1.0- 2.0	Southcentral Ariz.
	A. deltoidea	9	841	4.0-33.0	Southcentral Ariz.
	A. ilicifolia	3	40	70.0-90.0	Southwestern Ariz.
tapetis	Unknown	—	—	—	—

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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.) 128 — 5 January 1984

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 40, part 4, on 30 December 1983 and will welcome comments and advice on them from integrated 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.

2284 — *Caeparia* Stål, 1877 (Insecta, Dictypoptera): proposed designation of a type species under the plenary powers.

2401 — Proposal to suppress the first designation of a type species for the generic name *Megilla* Fabricius, 1805, and to place *Macropis* Klug, 1809, on the Official List of Generic Names (Hymenoptera, Apoidea).

2436 — *Crinodes* Herrich-Schäffer, 1855 and *Pero* Herrich-Schäffer, 1855 (Insecta, Lepidoptera): proposed conservation.

1686 — *Euphaedra* Hübner, [1819] (Insecta, Lepidoptera): proposed conservation under the plenary powers.

1687 — *Ourocnemis* Baker, 1887 (Insecta, Lepidoptera): proposed conservation under the plenary powers.

2180 — *Ceroplesis* Serville, 1835 (Insecta, Coleoptera): proposed designation of a type species under the plenary powers.

2405 — *Zeugophora* Kunze, 1818 (Insecta, Coleoptera): proposed conservation under the plenary powers.

R.V. MELVILLE, Secretary

A SPATE OF GLOWWORMS (COLEOPTERA: PHENOGODIDAE)[1]

Steven R. Wing[2]

ABSTRACT: At several flooded sites phengodid larvae, tentatively identified as *Phengodes nigromaculata,* were found in far greater abundance than any previously reported.

Beetles of the family Phenogodidae are notable for their spectacular bioluminescence (Tiemann 1970), their extreme sexual dimorphism (Tiemann 1967, Lloyd 1979), and their scarcity (Smith 1900). Females and larvae are especially uncommon, though males occasionally turn up in light traps. Phenogodids of the genus *Phengodes* are so rare that Harvey (1952) saw "only four living luminous specimens in 25 years." I was surprised, then, to encounter 90 such specimens in one hour.

The observations were made in a field of grass [mostly *Axonopus affinis* Chase and *Eremochloa ophiuroides* (Munro) Hack.] with scattered pine trees, north of the Gainesville Regional Airport in Alachua County, Florida. This area has been searched for glowing organisms on the ground almost nightly during April-October over the past three years. In that time only one phenogodid was found.

This year phengodids were flooded from the soil in large numbers. The area is usually dry, but heavy rains in 1983 left water standing in ditches and low areas. Glowing phengodid larvae were found in every flooded site in the area shown in Fig. 1, but not in the ditch or in flooded sites to the north, west, and east of the area shown. The larvae, tentatively identified as *Phengodes nigromaculata* Wittmer, measured 0.7 to 2.1 cm in length (n=10). They were found clinging to grass that protruded from the water. No larvae were found in the unflooded area between sites (Fig. 1). As the soil dried, the larvae apparently returned underground. The sites were inspected on nights subsequent to each inundation, but no larvae were seen.

One night I spent about one hour walking through the inundated sites and found 90 larvae. More thorough searches were made in 1 m^2 plots on different nights and at different sites (Table 1). The average count was 5 larvae/M^2. If this reflects the phengodid density in the area between flooded sites, thousands of larvae occur there. Five larvae/m^2 may be an underestimate because only glowing larvae were counted (see Tiemann 1970). Although it has long been known that phengodids occur in soil (Atkinson 1887), densitites of this magnitude have never before been

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reported (see Tiemann 1967).

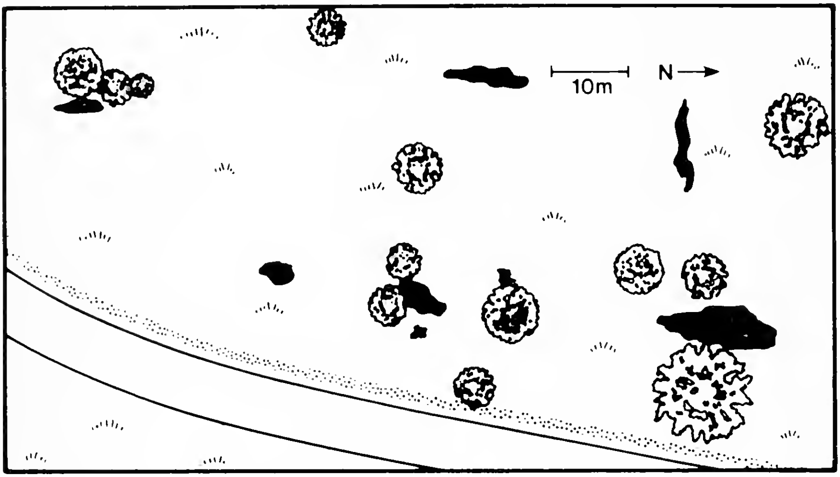

Figure 1. A map showing flooded sites (black), the ditch (stippled) beside a paved road, and some of the trees in the study area.

Table 1. Mean number of *Phengodes* larvae counted in flooded 1 m^2 plots.

Date	Plots (n)	Number of Larvae $\overline{x}$	range
14 August 1983	3	5	5-6
6 September 1983	4	6	5-7
13 September 1983	10	5	2-8

ACKNOWLEDGMENTS

Joe Cicero, Tim Forrest, James E. Lloyd, and John Sivinski reviewed the paper. John Sivinski also identified the specimens, and he and James E. Lloyd gave access to their literature collections. David W. Hall identified the grasses. Susan Wineriter prepared Fig. 1. Barbara Hollien typed the manuscript. Florida Agricultural Experiment Station Journal Series No. 5021.

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(Listing continued on page 62)

A SIMPLIFIED HOLDER FOR EUMENID NESTING BLOCKS (HYMENOPTERA: EUMENIDAE)[1,2]

Judith A. Collins[3], Daniel T. Jennings[4]

ABSTRACT: Materials and construction of a simple, inexpensive holder for eumenid nesting blocks are described.

Many species of solitary wasps (Hymenoptera: Eumenidae) nest in hollow stems and cavities constructed by wood-boring insects. Foundress female wasps also accept and provision predrilled blocks of wood as nesting sites. Numerous investigators have designed and successfully used trap blocks for collecting eumenid wasps (Cooper 1953; Fye 1965a; Medler and Fye 1956; Krombein 1967), and bees (Parker and Bohart 1966). Koerber and Medler (1958) used bundles of sumac stems held together with rubber inner-tube bands. Fye (1965b) developed several methods for placing trap nests in elevated locations. Although trap blocks are not identical to natural nesting sites, they are very useful for collecting and studying eumenid wasps in forest and nonforest habitats.

Most trap designs consist of a bundle of predrilled blocks held together with rubber bands. A solid piece of wood usually is added to facilitate attachment of a wire hanger. The rubber bands frequently stretch and break with prolonged use. This paper describes a simple but effective method of binding and hanging nesting blocks.

MATERIALS

The materials needed for trap and holder construction are readily available at most hardware and fabric stores. Each trapping unit consists of: 1) a bundle of predrilled blocks (usually 9 or 12), 2) a hanging board, 3) a wire hanger, 4) four fastening staples, and 5) two non-roll ribbed elastic bands (Fig. 1).

Our trap blocks were cut from straight-grained eastern white pine, *Pinus strobus* L. Each block was 2 x 2 x 18 cm with a central hole, 8 mm in

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diameter, bored to a depth of 14.9 cm. We used a twist drill for boring holes. Blocks should be straight-grained and free of knots to allow easy splitting and study of nests.

The hanging board is a solid block of wood; common "strapping" is sufficient. Our board was 2 x 6 x 18 cm for a nine-block bundle. The size may vary depending on the number of blocks per bundle. The board should completely cover the top row of nesting blocks.

The hanging wire consists of a wire coat hanger. The botton half of the hanger is cut off about 14 cm below the twisted neck. Pliers are used to bend the cut ends so that they are pointing outward. The hanger is fastened to the center of the hanging board with four #9 double-pointed wood staples, two at each end. For convenience, the hook above the neck of the coat hanger may be cut off; the twisted neck serves as a hanging point.

The bundle of nesting blocks is held together with two pieces of 3/4 inch (1.9 cm) non-roll ribbed elastic, such as used in waistbands of various garments. Each piece, 23 cm long, is formed into a loop with the ends overlapping 2.5-3.0 cm. The ends are sewn together with heavy-duty nylon

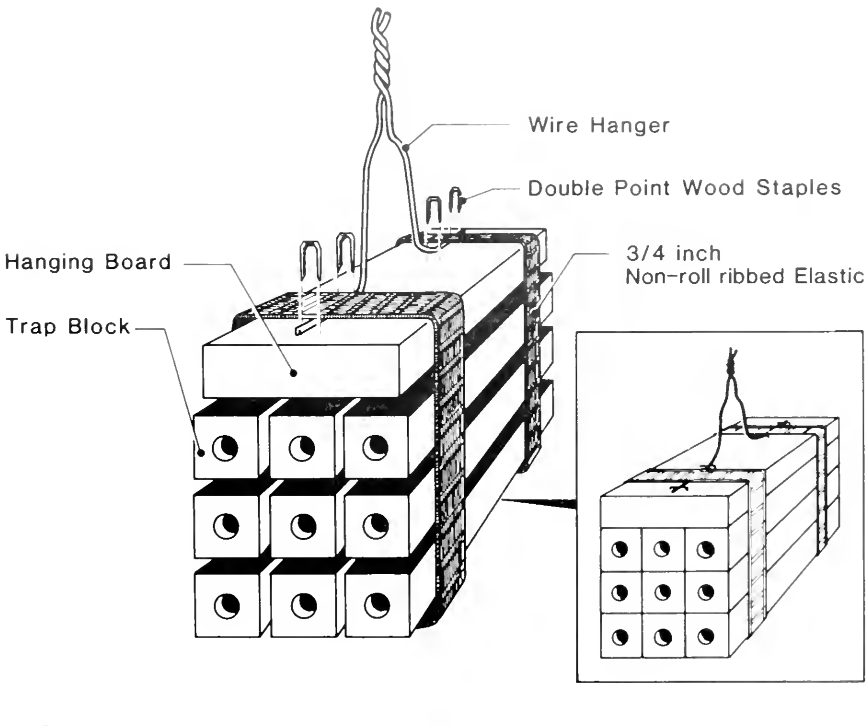

Fig. 1. Design of a simplified holder for eumenid nesting blocks.

Fig. 2. Field placements of trap-nesting bundles in a spruce-fir forest; a) tree-mounted, b) stake-mounted, c) on logging slash.

thread, and for added strength, the ends are oversewn two or three times. Loop size is dependent on bundle size. The elastic bands should be tight enough to hold the blocks firmly together, but also allow easy removal and replacement of nesting blocks.

DISCUSSION

The trap nest holder we describe is simple, easily constructed and relatively inexpensive. Nesting block sizes, numbers of blocks per bundle, diameter and depth of borings, and deployment sites may vary depending on study objectives. Bundles of blocks may be hung from live or dead trees (Fig. 2a); from stakes (Fig. 2b); or from logging slash and debris near the ground (Fig. 2c).

Blocks that have been provisioned by the wasps (i.e., entrance holes sealed with mud plugs) can be removed and replaced with new, unused blocks. Provisioned blocks are taken to the laboratory where they are split with a chisel and rubber mallet. Block contents are examined and reared in situ (Krombein 1967); or, the contents (wasp egg, larva, or pupa and prey) are removed and reared separately in 4-dram shell vials (Jennings and Houseweart 1984).

The elastic bands usually last for one collecting season (4 months). Under rigorous and continued use, the elastic stretches and no longer holds the nesting blocks firmly together. However, the non-roll ribbed elastic is more durable than ordinary rubber bands which readily stretch and crack in open sun.

These trap nesting blocks and holders have been used successfully to determine the species of eumenid wasps preying on spruce budworm, *Choristoneura fumiferana* (Clemens), and other lepidopterous larvae in spruce-fir forests of Maine.

ACKNOWLEDGMENTS

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AN INEXPENSIVE CARRION BEETLE TRAP (COLEOPTERA: SILPHIDAE)[1]

Paul P. Shubeck[2]

ABSTACT: An inexpensive carrion beetle trap is depicted (with diagrams and directions made available to the reader). Eight species of Silphidae and representatives from the families Dermestidae, Staphylinidae, Histeridae, Leiodidae, Scarabaeidae and Nitidulidae have been taken in this trap.

More than two decades of experience with sampling carrion beetles have given me ample opportunity to try out a variety of different traps. In my early studies I used a simple pitfall trap described by Walker (1957). Since then the pitfall method of trapping has been improved and described in detail by Newton and Peck (1975). For a period of time I used ground (surface) traps which were cleaner and easier to operate than pitfall traps (Shubeck, 1976). Although I still consider ground traps excellent in all ways, when being prepared for use they are cumbersome to transport if one must carry them any distance and if a large number of traps must be set up. One way to minimize the transport problem is to use a suspended-type trap which requires two No. 10 cans and a wire coat hanger for its construction (Shubeck, 1968). This trap has been improved by constructing a permanent inexpensive wood frame and rain cover to which a disposable No. 10 food can is attached. This trap is depicted in Fig. 1. It has been used by me in New Jersey, Maryland, and Missouri during the last few years and it has proved to be most satisfactory so long as it is not set up in the direct rays of the sun. Intense buildup of heat in the can may discourage beetles from entering the trap or may even drive some of the individuals out after they have entered.

Eight species of carrion beetles (Silphidae) have been taken in these traps. They are: *Necrophila americana, Oiceoptoma noveboracense, O. inaequale, Necrodes surinamensis, Oiceoptoma orbicollis, N. tomentosus, N. pustulatus,* and *N. marginatus.* Other families of "carrion beetles" that have been taken in these traps include Dermestidae, Staphylinidae, Histeridae, Leiodidae, Scarabaeidae, and Nitidulidae.

Detailed diagrams and directions for the construction of this inexpensive carrion beetle trap have been prepared and duplicated and are available to the reader upon request.

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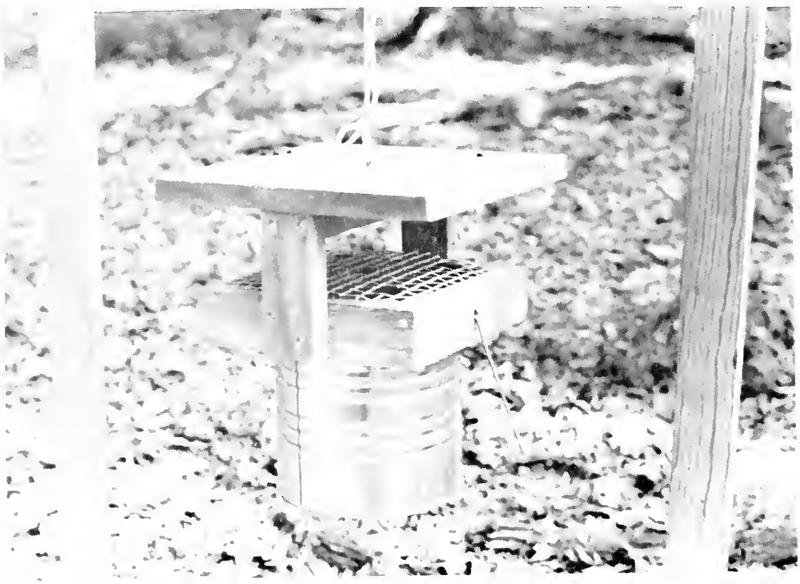

Fig. 1. Inexpensive carrion beetle trap in use at Great Swamp National Wildlife Refuge, NJ. Photograph by Thomas P. Shubeck.

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MASS-REARING METHOD FOR THE LARGE MILKWEED BUG, *ONCOPELTUS FASCIATUS* (HEMIPTERA: LYGAEIDAE)[1]

Karl P. Koerper, Clive D. Jorgensen[2]

ABSTRACT: A method of mass-rearing the large milkweed bug, *Oncopeltus fasciatus,* has been developed that requires limited time and costs. This method allows removal of the eggs without disturbing the adults or damaging them during handling. Eggs are produced for about $1.30/1000 eggs.

The large milkweed bug, *Oncopeltus faciatus,* has been the subject of much experimental research. Mass-rearing methods specifically designed to reduce labor required to maintain the colony, and reduce difficulties experienced in gathering eggs seem to have escaped the literature (Anonymous 1982, Best 1977, Butt 1949, Dingle 1968, Gordon 1974, Richards and Kolderie 1957, Richards and Suanraksa 1962, Siverly 1962). Methods of collecting eggs described in these studies include removing them with small brushes from cotton or gauze oviposition media. These techniques sometimes cause egg damage and always disrupt the adult colony. We have developed a labor conservative method for rearing large milkweed bugs that, if implemented, will assist other researchers in maintaining their colonies. Harvesting and handling eggs will be especially enhanced.

Materials listed are adequate for about 195 breeding pairs of adults. Expansions or reductions in the number of specimens (especially eggs) required should be made according to space requirements of the adult pairs, each pair requiring 38 to 46 cm^2 for optimum egg production. Gordon (1974) found optimum egg production was obtained at about 38 cm^2/pair. Increased densities will cause some reduction in the rate of egg production. Materials required are: five plastic freezer storage containers about 3,019 cm^2 (6.5-7.0 l capacity), ten 250 ml nalgene water bottles, grade 50 (6.5-7.0 l capacity), ten 250 ml nalgene water bottles, grade 50 cheesecloth, cotton, No. 233 and 363 Nitex nylon monofilament screen cloths, 25 mgs of sunflower seeds per week that have not been sprayed with pesticides, and 50 large milkweed bug eggs.

Adult cages (Fig. 1) are designed to give females no choice of where to oviposit. The only satisfactory site is through the cheesecloth onto paper sheets provided outside (below) the cages. The center portion of the original snap-on lid is cut away so that only the snap-on (S) rim remains (Fig. 1A). This rim is used to secure the stretched cheesecloth (Z) onto the bottom of

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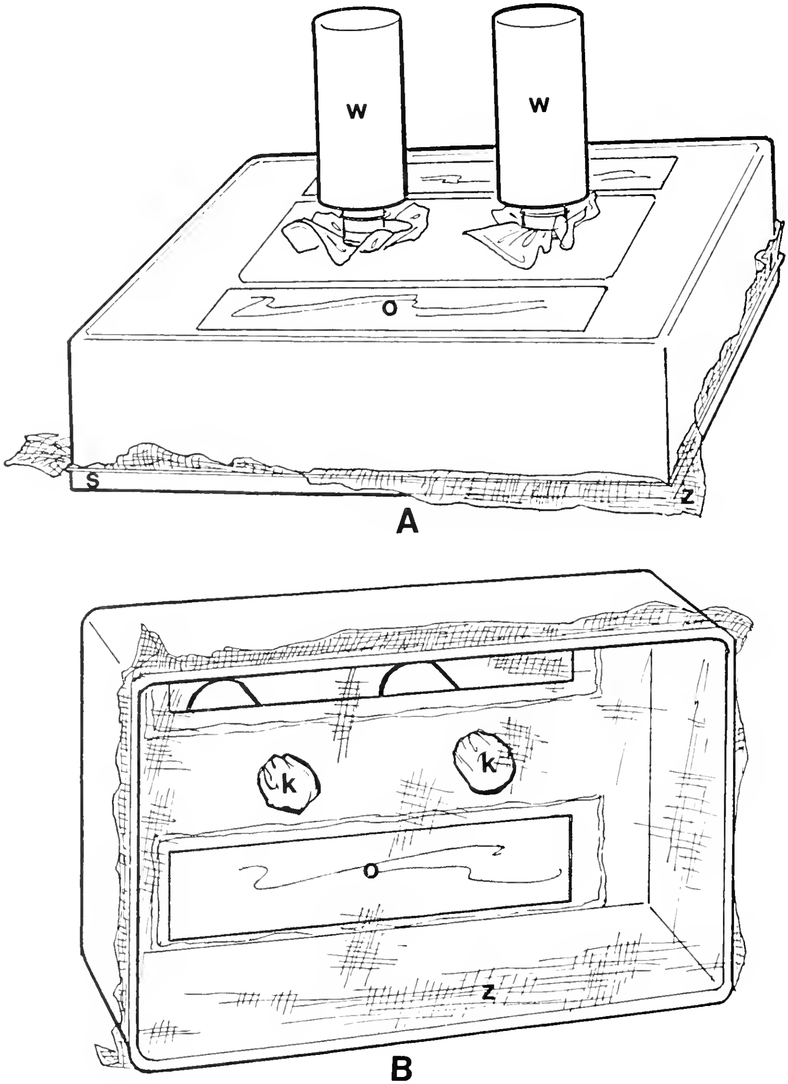

Figure 1. A — Top view of adult rearing cage: W = water bottles; O = windows cut in the original bottom of the freezer storage container; S = snap-on lid with the center removed, leaving only the rim to hold the cheesecloth (Z) bottom. B — Bottom view showing the wicks (K) from the water bottles; cheesecloth (Z) bottom held in place by the rim of the snap-on lid (S); and the windows (O); all seen through the cheesecloth.

the cage. Water (W) is provided through two holes cut in the bottom (which is the top of the cage when completed, (Fig. 1A) of the freezer container, in which water bottles with tight cotton wicks (K) covered with No. 233 screen cloth are inserted (Fig. 1B). The screen cloth prevents oviposition into the cotton. Windows (O) in the top of the cage are covered with No. 363 screen cloth glued into place to allow observation and yet prevent oviposition (Fig. 1). About 15 gms of sunflower seeds and 65 adults pairs are introduced into the cage before the water bottles are screwed in place. The cage is then placed on or above the collection sheets (paper) where eggs are collected as often as needed. Eggs may be continuously collected from outside the cage without ever opening the cage until it is time to discard the adults. Three adult cages are required.

Nymph cages are the same as adult cages except: (1) the center of the lid is not removed, (2) wicks in the water bottles are not covered with screen cloth, and (3) about 50 gms sunflower seeds are cracked to provide a better food base for the young nymphs. Sunflower seeds and eggs are placed in the cages before the water bottles are screwed into place. These cages need no additional care until emerged adults are removed and placed in the adult cages. Two nymph cages are required.

Collecting 200 eggs from the first collection of adults (4 weeks) will take longer than subsequent collections since only 25 adult females are present. More eggs to start with would speed up this process.

Week 14 is the beginning of routine maintenance, with the reinoculation of adults into adult cage "1" after it has been cleaned, and gauze and water bottles with their cotton wicks replaced. After this, 400 nymphs and 195 adults will be maintained continuously. Maintaining this colony indefinitely will require about 25 gms of sunflower seeds per week, which should be stored in refrigeration to avoid contamination with stored products pests. Egg production is maximized with a photoperiod of 16L-8D, and temperature set at 27° C (Dingle 1968).

Cost and time assessments for this method are unusually conservative. The initial cost, excluding intitutional costs, for the entire system ready to maintain at week 14 is estimated at $85, 25% of which is for the cost of 50 eggs. Maintenance cost expressed in terms of eggs produced is about $.70/1000 eggs. In addition, the labor estimate is about $2.50/1000 eggs. We estimate eggs counted into groups of 1000 will cost about $3.20 per group. Of course, if approximate number of eggs is acceptable the cost is much less, about $1.30/1000. Only about five minutes per collection are required to collect eggs, plus one hour twice monthly to clean cages, transfer adults and collect eggs for future generations. This method offers minimal expense in maintaining a colony where specimens are needed continually for experimental purposes.

Colony establishment and maintenance are sequentially explained in the following flow table:

Table 1. Flowtable to explain colony established and maintenance.

Week	Action	Nymph cages		Adult cages		
		Cage contents and collection no.				
0	50 eggs placed in nymph cage "a"	a=1*st* coll	b=empty	1=empty	2=empty	3=empty
4	25 pairs of adults from nymph cage "a" piaced in adult cage "1"	a=1*st* coll	b=empty	1=1*st* coll	2=empty	3=empty
6	200 eggs from adult cage "1" placed in nymph cage "b"	a=empty	b=2*nd* coll	1=1*st* coll	2=empty	3=empty
8	200 eggs from adult cage "1" placed into nymph cage "a"	a=3*rd* coll	b=2*nd* coll	1=1*st* coll	2=empty	3=empty
10	65 pairs of adults from nymph cage "b" placed in adult cage "2." 200 eggs from adult cage "1" placed into nymph cage "b"	a=3*rd* coll	b=4*th* coll	1=1*st* coll	2=2*nd* coll	3=empty
12	65 pairs of adults from nymph cage "a" placed in adult cage "3." 200 eggs from adult cages "1 and 2" placed into nymph cage "a"	a=5*th* coll	b=4*th* coll	1=1*st* coll	2=2*nd* coll	3=3*rd* coll

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A METHOD OF STORING INSECT GENITALIA FOR TAXONOMIC STUDY[1]

J.E. O'Hara, M.G. McIntyre[2]

ABSTRACT: A genitalia tray specifically designed for use by insect taxonomists is described and illustrated. A method is outlined whereby trays can be reproduced using molds and a polyester-based casting resin. Trays are suitable for storage of genitalia during revisionary work, and provide immediate access to series of genitalia for comparative study.

Many insect taxonomists store adult insect specimens on pins in foam-bottomed trays, inside specially designed drawers and cabinets. Specimens stored in this manner are readily available for study and comparison of external structures. Unfortunately, a similar system has not been developed to accommodate the needs of taxonomists interested in studying large series of insect genitalia, so it is often necessary to repeatedly examine genitalia stored in microvials, or temporarily remove limited series of genitalia to porcelain trays or similar *ad hoc* containers for comparative study. With the increasing awareness of the importance of genitalic characters in the systematics of many insect taxa, a method is needed whereby numerous genitalia can be efficiently stored, easily retrieved and readily grouped for study under a dissecting microscope. The gentialia tray here described is one solution to this problem, and over the past several years has not only proved itself useful in practice, but has indirectly encouraged the senior author's study of genitalic structure within the Tachinidae (Diptera) by eliminating time-consuming and inefficient storage difficulties.

MATERIALS AND METHODS

Design of the genitalia tray shown in Fig. 1, and technical aspects of its production and duplication, were developed by the junior author. Production of genitalia trays basically involves machining of a master tray, creation of one to many molds from that tray, and replication of plastic trays from the molds. Our master tray was cut from 0.5in (12.7mm) thick Plexiglass® and sanded to the outside dimensions shown in Fig. 1, and then machined with a 0.5in milling tool to produce the interior contours. The completed tray, approximately 63x66mm square, was placed in the center of a small wooden box, of such a size as to allow about 10mm clearance on each side. A molding compound (Dow Corning Silastic Moldmaking Rubber RTV E, soft) was poured over the tray, covering the top by about 5mm, and allowed

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to set. (To ensure smooth edges in the finished product, trapped air bubbles were removed from the angles of the tray by running a pointed object along tray edges.) Once hardened, the flexible molds were ready for repeated casting of plastic genitalia trays using a polyester-based casting resin, such as commonly found under a variety of brand names commercially and in hobby stores. White dye added to the resin gives superior results, as white trays reflect light more evenly than do clear plastic ones. This is important because the trays are designed for use with a dissecting microscope, with standard illumination.

For best results, trays should be lightly sanded on outside surfaces after removal from molds to smooth slight irregularities caused by shrinkage during the hardening process (interior surfaces are not adversely affected). Lids, which can be fashioned from a variety of materials, should be fitted to finished size of the trays rather than to dimensions of the master tray. (Our lids simply rest loosely on top of the trays, and are not fastened in any way.) We prefer 0.125in (3.2mm) thick Plexiglass® for lid material, as it is transparent and can be written on with India ink.

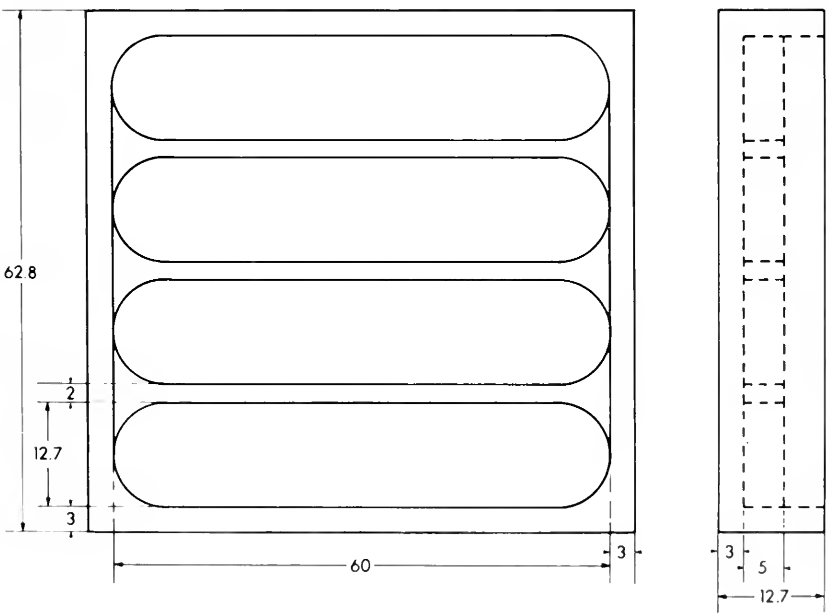

Fig. 1. Dimensions of genitalia tray (in mm).

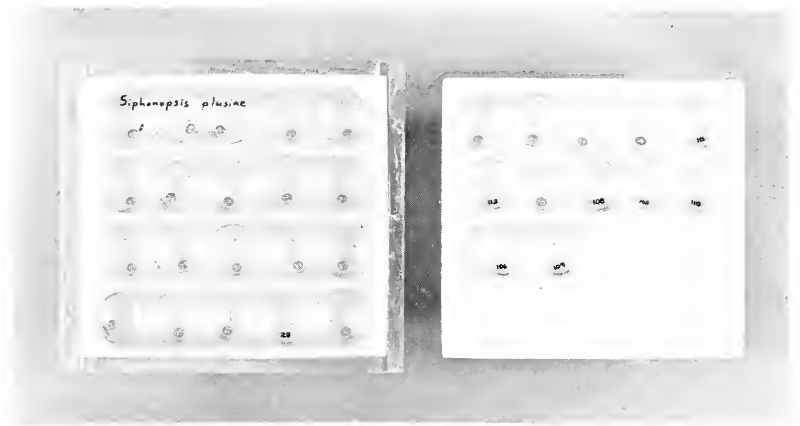

Fig. 2. Two completed trays, left tray with lid and right without, as used for storage of tachinid fly genitalia in glycerin-filled dishes.

DISCUSSION

Each tray is designed to hold 20 genitalia dishes in 4 rows. Dishes are best cut to a height of 7mm from 0.5 dram, 12x35mm, shell vials (such as Kimble brand #60930-L vials). Genitalia are stored one per dish in several drops of glycerin, accompanied by a code number to ensure correct association with the adult specimen. By keeping a record of all code numbers and specimens dissected, pairing of pinned specimens and genitalia are facilitated, even if the former are scattered throughout a large general collection.

Two finished trays, as used for storage of tachinid fly genitalia, are shown in Fig. 2.

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A NEW SPECIES OF *CICINDELA* LINNAEUS (COLEOPTERA: CICINDELIDAE) FROM FLORIDA, AND ELEVATION OF *C. ABDOMINALIS SCABROSA* SCHAUPP TO SPECIES LEVEL[1]

Paul M. Choate[2]

ABSTRACT: A new species of *Cicindela* Linnaeus was discovered during a study of the named forms of *C. abdominalis* Fabricius. This species, *C. highlandensis* n. sp., is described here. Additionally, the various names applied to *C. abdominalis* are examined for validity. *C. abdominalis* is redescribed. Based on examination of types, the following name changes are proposed. *C. scabrosa* Schaupp is found to be a valid species. *C. extenuata* Casey is a synonym of *C. scabrosa* Schaupp, as is *C. abdominalis floridana* Cartwright (NEW SYNONYMY). *C. faceta* Casey is a synonym of *C. abdominalis* F. (NEW SYNONYMY).

C. highlandensis n. sp. is believed to be a sister species of *C. abdominalis*, having evolved on pre-Pleistocene islands in central Florida.

This research began several years ago during a cursory study of the tiger beetle fauna of Florida. An attempt at collecting and identifying the named forms of this group revealed inconsistencies concerning the application of names to *Cicindela abdominalis* and its subspecies *scabrosa.*

Several museum collections that were borrowed had mixtures of the various forms under the same heading, some examples merely set aside with question marks. Invariably it was found that the confused specimens were *scabrosa.*

Cicindela abdominalis Fabricius has included 3 subspecies; *abdominalis, scabrosa* Schaupp, and *floridana* Cartwright. Additionally, Casey (1913) described *C. extenuata* and *C. faceta* as species close to *abdominalis.* Newman (1838) described *C. ventralis* from St. John's Bluff, Florida, but his description is too incomplete to be interpreted. The name must therefore remain a *nomen inquirendum.*

The genus *Cicindela* (*sensu latu*) still requires comprehensive study in North America. Numerous subspecies names have yet to be resolved. Species descriptions, however, have been relatively few in recent years. It is surprising, therefore, to discover a new species in Florida. The following descriptions and discussions are presented to make a species name available for a manuscript dealing with the phylogeny, zoogeography, and ecology of *Cicindela abdominalis* Fabricius and its related species. Detailed discussion of the relationships of this new species is postponed to publication of the above mentioned manuscript.

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Cicindela highlandensis n. sp.

Head: Eyes prominent, approximately as wide as humerus, wider than pronotum. Clypeus black with purple, green, and blue reflection; microsculpture isodiametric. Labrum pale, medially convex with 2 anterior medial setae, 2 lateral setae; slightly wider than long; front margin with central protuberance, edentate; microsculpture isodiametric laterally, effaced or stretched on median convexity. Mandibles pale basally, apical half piceus. Mentum with acute median tooth. Ligula lacking. Maxilla cardo with 2 setae, stipes with 5 setae; segment 1 with 1 apical seta, segment 2 glabrous, segment 3 with 2-3 setae, segment 4 with 2 apical setae, segment 5 glabrous. Labial palp 4 segmented; segments 1 and 2 rufous, glabrous; segment 3 rufous, glabrous ventrally, with 15-18 scattered erect setae dorsally; segment 4 piceus, glabrous. Gena glabrous, bright purple with 8 longitudinally impressed striae terminating anteriorly in a depressed pit under anterior margin of eye; microsculpture effaced medially, isodiametric towards ventral margin. Frons glabrous, longitudinally strigose; laterally purple; medially green; microsculpture isodiametric medially, stretched laterally. Inner margin of eye emarginate; elevated interocular area of head smooth near lateral edge, longitudinally grooved in center of head; 2 supraorbital setae. Antennae with segments 1-4 glabrous except for scattered erect setae, rufous with green reflection; segment 1 with 1 apical seta; segment 2 glabrous; segment 3 with 3 evenly spaced medial setae, several apical setae; segment 4 with 1 medial seta, 2 apical setae; segment 1 slightly swollen apically, 2-3 times length of segment 2; segment 3 equal in length to segments 2 + 4; segments 5-11 covered with short dense pubescence.

Thorax: Pronotum with deeply impressed anterior V-shaped impression; longitudinal median line with impressed transverse strigae; microsculpture isodiametric, tending toward meshes anteriorly and laterally; basal impression deep; posterior angle on elevated bump; surface green with cupreus-purple mixture; lateral margin glabrous. Prosternum glabrous, shining purple. Proepisternum smooth, glabrous, shining purple, microsculpture effaced. Procoxae with small cluster of white setae on inner and lateral margin, glabrous medially; inner surface with single erect seta. Trochanter glabrous. Profemur metallic purple on basal half, rufous apically; 3 erect setae on venter. Protibia rufous with purple reflection; inner surface of apical half covered with dense fringe of short hairs; anterior surface with 6 large erect setae set in green foveae. Protarsi glabrous dorsally; ventrally with 4 pair of erect setae; segment 1 longest, 2-5 subequal. Claws 2, long, smooth. Protarsal segments 1-4 ventrally at apex with 2 larger setae. Mesosternum glabrous. Mesepisternum glabrous, shiny, purple. Mesocoxae setose on anterior lateral surface; glabrous medially on inner surface; posteriorly with a few hairs and a single, fine, erect, seta. Trochanter glabrous. Mesofemur glabrous ventrally. Mesotibia with dense inner fringe of hairs in apical half. Meta sternum glabrous. Metepisternum glabrous. Metacoxae with single erect seta each on anterior and median portion, posterior lateral edge with 3-4 decumbent setae. Trochanter glabrous. Metatibia with short fringe of setae at apex on inner margin. Metafemur with 5 ventral setae. Elytron black; scutellum transversely impressed, with slight purple-green reflection; 7-9 irregular sutural foveae containing a seta set in shallow pit, pit with slight metallic purple reflection. Entire dorsal surface appearing shallowly punctate; microsculpture coarse, isodimetric. Suture terminating posteriorly in spine. Apices microserrulate. Depressed area near humerus with 6 setae.

Abdomen: Rufous, glabrous except for erect tactile setae along posterior margin of apical sternite, and medially on sternites 3-4. Sternite 5 depressed medially with numerous small hairs in depression.

Size: Holotype female: 11.5 mm. in length (Fig. 1).

Variation: (35 measured) Females average 11.4 mm. in length (10.5-12.0); 35 males average 10.9 mm. in length (10.5-12.0). Males have protarsal segments 1-3 dilated with ventral pad of dense setae. Approximately half of the specimens were immaculate. The only maculation seen was a very narrow apical lunule. Neither ventral pubescence nor pronotal lateral hairs occurred on any specimens.

Type Locality: Florida; Highlands Co., Rt. 27, 0.25 mi. south of Josephine Creek, 4.3 mi. north of junction of Rt. S-17 and 621; 10-VII-1976, P.M. Choate & L. Davis, 23 paratypes (15 males, 8 females).

Distribution: Restricted to Highlands Co., FL., on fossil sand dunes south of Sebring. This sand ridge extends into Polk County, thus this species may also occur there.

Etymology: This new species is named for Highlands Co., FL., an area noted for its plant and animal endemics.

Specimens examined: Holotype and 101 paratypes, all from Highlands Co., FL. All but 5 specimens were from the type locality. 30 specimens were collected in June (some teneral) and 71 in July. The 5 specimens not from the type locality are in FSCA (Florida State Collection of Arthropods, Gainesvile, FL, 32602), and bear the data "Hendricks Field, nr. Sebring, on fossil sand dunes," 5 - VII - 1976, H.V. Weems, collr..

Type material will be distributed as follows: Holotype and 9 paratypes from the original series will be deposited in FSCA. Additional specimens (4 ea.) from the same series will be sent to AMNH (New York), USNM, CAS (California Academy of Sciences), MCZ Harvard University), Strickland Museum (Edmonton, Alberta), Carnegie Museum (Pittsburgh), with the remainder in the author's personal collection.

Redescription of *Cicindela abdominalis* Fabricius

Cicindela abdominalis Fabricius, 1801. p. 237, Syst. Eleuth. Type locality "Carolina."
Cicindela ventralis Newman, 1818. p. 413-414. Type locality "St. John's Bluff, East Florida, North America."
Cicindela abdominalis faceta Casey, 1913. p. 38. NEW SYNONYMY. (No locality, single female) Type USNM 45969 red label.

Size: Females average 11.0 mm. (10.3 - 12.5); males average 10.0 mm (9.3 - 10.5).

Head: Eyes prominent, approximately as wide as humerus, distinctly wider than pronotum; black, with purple, green, and blue reflections, microsculpture isodiametric. Labrum pale, with 2 anterior medial setae and 2 lateral setae; edentate, lateral area microsculpture isodiametric, stretched medially. Mandibles pale basally, apical half piceous with metallic reflection. Ligula lacking. Mentum with single acute median tooth. Maxilla with cardo 2-3 setae, stipes with 3-4 setae, segment 1 with single erect seta, segment 2 glabrous, segment 3 with 2-3 setae, segment 4 with 2 apical setae, segment 5 glabrous. Labial palp 4 segmented; segments 1-2 pale rufous, glabrous, segment 3 rufous with 20 erect setae, segment 4 piceous and glabrous. Gena glabrous, shallowly grooved. Frons longitudinally strigose, strigae isodiametric. Inner margin of eye emarginate; 2 erect supraorbital setae. Antennal segments 1-4 glabrous except for isolated large erect setae. Segment 1 with 1 erect apical seta, rufopiceous ventrally. Segment 2 lacks tactile setae. Segment 3 with 3-4 basal setae, 1-2 medial setae, 5 apical setae. Segment 4 glabrous basally, 5-7 apical setae. Segments 1-4 with metallic green reflections. Segments 5-11 densely covered with short pubescence. Segment 5 rufopiceous, 6-11 piceous. Segment 1 swollen apically, 3 times as long as segment 2, one half as long as segments 3 and 4; segments 3 and 4 subequal, elongate.

Thorax: Pronotum dorsally with deep anterior v-shaped impression, longitudinal median line moderately impressed with transverse strigae extending laterally. Microsculpture coarse, isodiametric. Basal impression moderately impressed, posterior lateral angle suggested by an elevated bump. Surface with cupreous (blue-green) reflection. Lateral margin with inconspicous fringe of white hairs which, when missing, are indicated by extremely fine punctures near marginal groove. Prosternum glabrous, microsculpture effaced, with purple reflection. Proepisternum with approximately 15 white setae along basal margin adjacent to procoxae, otherwise glabrous. Microsculpture effaced, shiny. Procoxae with anterior surface with fringe of white hairs, inner surface glabrous. A single erect seta on inner medial surface. Trochanter glabrous, pale rufous. Profemur with metallic blue-green reflection; piceous basally, rufous apically, knees with metallic green reflection. Ventrally with 2-3 erect setae. Numerous large erect setae on anterior and inner surface. Isodiametric microsculpture evident over entire surface. Protibia ventral inner surface with fringe of hair, dorsal surface glabrous except for scattered tactile setae. Tibia with metallic green reflection. Tibia with 2 large ventral apical spines.

Protarsi of male ventrally with segments 1-3 with dense covering of hairs, segments 4-5 glabrous except for a few erect setae. Females with tarsal segments unmodified. Each tarsal segment (both sexes) with 2 ventral apical spines, claws smooth, subequal. Mesosternum smooth, glabrous. Mesepisternum glabrous medially, basally with fringe of white decumbent setae. Mesocoxae as in procoxae. Mesotrochanter glabrous, tibia and tarsi as above. (Posterior surface of coxa with basal setae.) Mesofemur with 1-2 ventrally erect setae on apical half. Mesepimeron with covering of decumbent white hairs. Metasternum glabrous medially, extreme anterior margin with up to 8 white setae; anterior lateral angle labrous; posterior lateral margin with fringe of setae. Metepimeron covered with whte decumbent setae. Metacoxal process with single large erect tactile seta basally and apically, also with lateral fringe of white setae. Metafemur with 2-4 ventral erect setae.

Abdomen: Rufous, sternites 1-4 with decreasing lateral fringe of white setae. Segment 3 laterally overlapping segment 4 in the form of a flange, extending posteriorly to segment 5. Segments 3-5 medially with several inconspicous setae. Segment 5 emarginate apically in male, depressed and setose in female. Segment 6 in male with apical fringe of setae. Elytra black, with apical lunule and other maculation white. Median lunule represented by broken dots or lunule may be totally absent. Scutellum with cupreous to blue-green reflection; microsculpture coarse, isodiametric. Basal elytral punctures at scutellum umbilicate. Elytra with row of 6-9 large foveae, each with metallic blue-green reflection and containing a single umbilicate setiferous puncture. Elytra irregularly and shallowly punctured (Fig. 2), microsculpture isodiametric, granular. Subsutural row of metallic punctures shallow, with blue-green reflection. Apex of elytra spined and microserrulate in both sexes. Humeri with impressed groove containing 5-6 umbiliferous punctures. Male genitalia (Fig. 5).

Distribution: New Jersey, south along the Atlantic seaboard to north central Florida, west along the Gulf States to Louisiana.

Variation: Elytral pattern appears to be more heavily maculated in northern specimens, decreasing southward. This probably led to the naming of Casey's *Cicindela faceta.*

Cicindela scabrosa Schaupp NEW STATUS

Cicindela abdominalis var. *scabrosa* Schaupp 1884, p. 108. type locality FLA (Cedar Keys).

Cicindela extenuata Casey 1913, p. 38. Type locality Crescent City. Holotype USNM Type 45970 red label.

Paratype USNM Type 45970 "extenuata 2," red label.

C. abdominalis floridana Cartwright 1939, p. 364. Type locality Miami, FL., Collr. F.N. Young, Aug. 9-12, 1934, NEW SYNONYMY.

Size: Females average 10.5 mm. (10.0 - 11.5), males average 9.8 mm. (8.2 - 10.3).

Head: Eyes prominent, as wide as humerus, wider than pronotum. Clypeus black with green central area, purple laterally. Microsculpture isodiametric. Labrum pale, with 4 medial setae, 2 lateral. Mandibles piceous with narrow pale basal lateral portion. Mentum with acute median tooth. Ligula lacking. Maxilla cardo with 3 white setae, stipes with 4-5 setae. Segment 1 with 1 apical seta, segment 2 glabrous, segment 3 with 3 setae ventrally, segment 4 with 1 ventral seta (apex), segment 5 glabrous. Labial palpi 4 segmented, segments 1 and 2 glabrous, segment 3 with approximately 20 erect setae on dorsal surface, segment 4 glabrous. Colored as in *abdominalis* and *highlandensis*. Gena glabrous with purple reflection, 3-5 grooves terminating anteriorly in a depressed pit. Frons glabrous with suggestion of striae laterally, central area smooth and elevated. Eyes with 2 erect supraorbital setae. Antennal segments 1-4 glabrous with metallic reflection, 1-2 erect setae on each segment. Segments 5-11 covered with dense tomentose setae. Segment 1 with 1 large erect seta; segment 2 glabrous. Segment 3 with 3-5 medial setae, 6 apical setae. Segment 4 with 1-2 medial setae, 3-5 apical setae. Segment 1 gradually swollen apically, 2 times the length of segment 2. Segment 3 less than 2 and 4, greater in length than 1 and 2. Segment 4 shorter than 3.

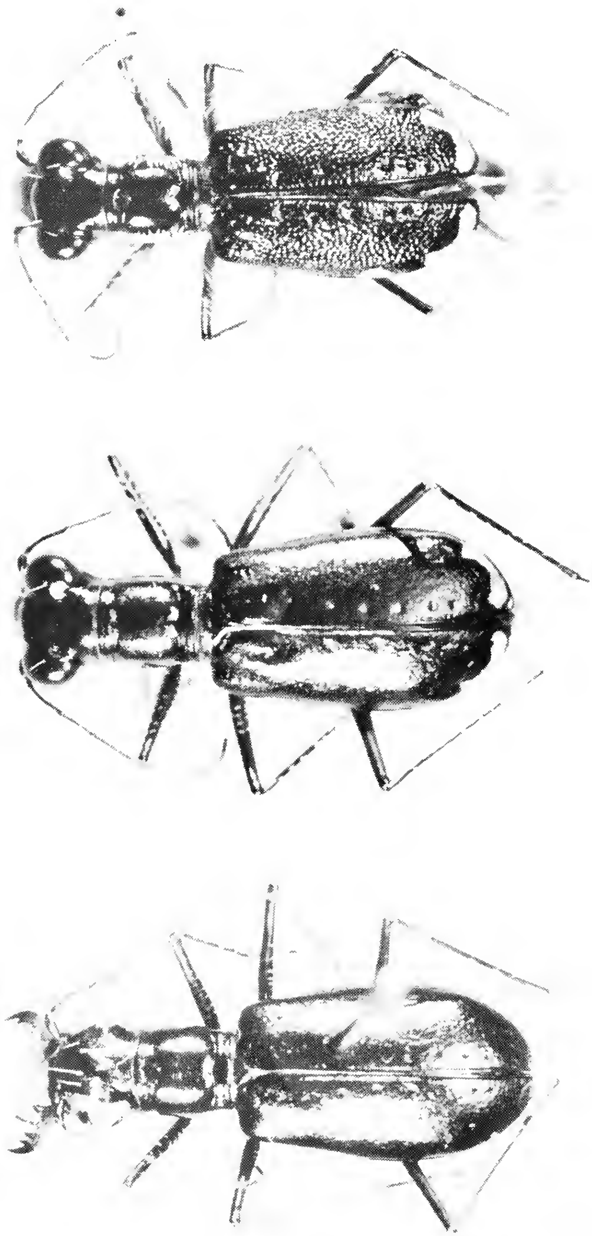
Thorax: Pronotum with anterior v-shaped impression; middle smooth, microsculpture reduced, basal impression shallow. Lateral margin with 30 - 50 flattened setae. Prosternum glabrous, with greenish reflection, shiny. Proepisternum with numerous white setae near procoxae, the remainder smooth, shiny, microsculpture effaced. Procoxae anterior surface with dense layer of flattened setae. Single erect slender seta on inner surface. Trochanter glabrous. Profemur with 6-7 ventral erect setae. Protibia anterior surface with 6-7 short, erect seta in depressions. Inner half surface apically with dense layer of fine setae. Protarsi glabrous dorsally, ventrally with 4 pair of small erect setae and 1 large apical pair. Segment 1 longest, 2-5 subequal. Males with segments 1-3 ventrally with dense layer of hair; female unmodified; 2 tarsal claws, long smooth, subequal. Meso-sternum glabrous, smooth, shiny. Mesepimeron covered with dense fringe of decumbent setae. Mesocoxae anterior surface with numerous white setae, posteriorly with single large erect seta. Trochanter glabrous. Mesofemur with 5-6 erect setae on ventral surface. Mesotibia with dense fringe of short setae near apex on inner surface. Mesosternum with scattered decumbent setae on anterior margin. Metepisternum and metepimeron with dense covering of decumbent setae. Metacoxae with fringe of setae along posterior margin, also with 2 erect setae. Metatrochanter glabrous. Metatibia glabrous apically except for short scattered erect setae. Ventral surface with row of 11-12 erect setae on posterior and anterior margin.

Abdomen rufous. Sternites 1-3 with dense lateral margin of decumbent setae. Sternites 3-5 with 2 central erect tactile setae. Sternite 6 with deep median depression in females, covered with short erect pubescence. Males with sternite 6 moderately emarginate, not depressed. Elytra shiny black, often with greenish luster around humerus (extreme form of greenish cast seen in *C. abdominalis floridana*, but also seen to greater or lesser degree from different localities). Maculation consisting of apical lunules, median lateral mark, and 2 small medial dots slightly anterior to mid-lateral dots. Few specimens lacked the mid-lateral maculation missing in the majority of specimens of *C. abdominalis*. Elytral apices spined in both sexes. Microsculpture largely effaced, finely isodiametric, lending a shiny appearance to the beetles. Microsculpture of type entirely unlike *abdominalis*. Elytral tips microserrulate; surface heavily and deeply punctured throughout (Fig. 3), punctures often separated by less than their own diameter. Large sutural foveae with umbiliferous center.

Genitalia, male: Fig. 6.

Distribution: Restricted to peninsular Florida, in sand-pinescrub and along margins of pine flatwoods.

Variation: This species exhibits little variation. Some specimens are quite greenish (i.e., *floridana*) but this is interpreted to be a sign of recent emergence. Older specimens appear to have lost the greenish tint. Maculation (Fig. 3) is quite constant.



1 2 3

Fig. 1. ***Cicindela highlandensis*** **n. sp., holotype female. Actual size 11.5 mm. Fig. 2.** ***C. abdominalis*** **Fabricius. Actual size 10.2 mm. Fig. 3. C.** ***scabrosa*** **Schaupp. Actual size 10.5 mm.**

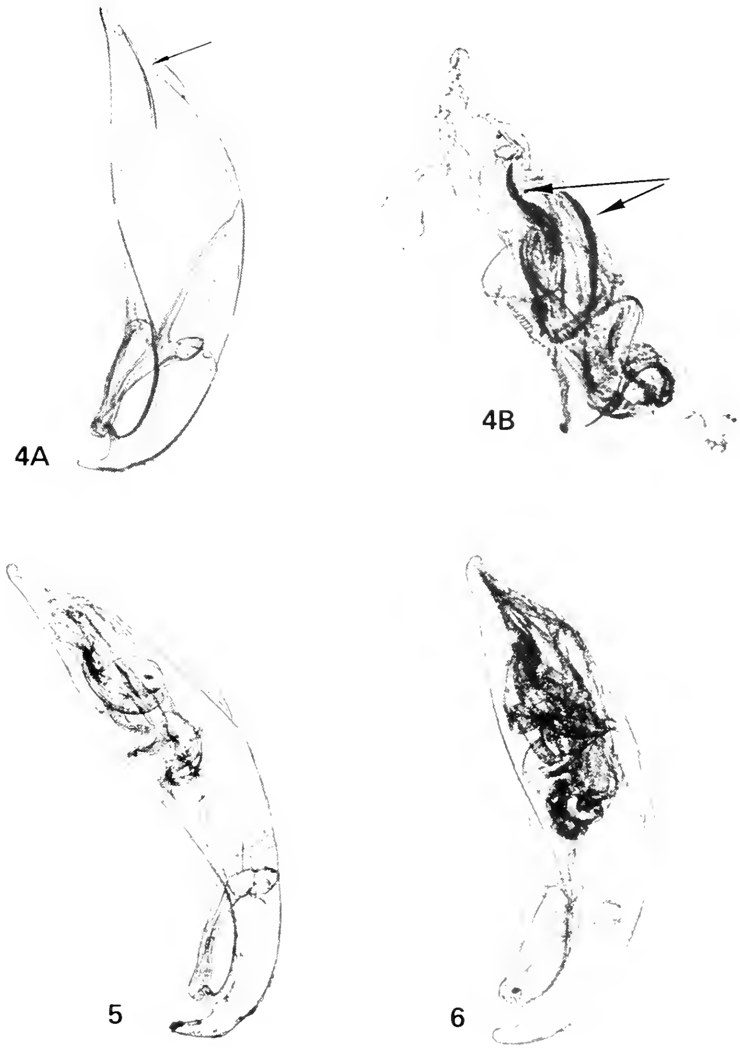


Fig. 4A. *C. highlandensis* n. sp., paratype, aedeagus. Internal sac removed. Fig. 4B. Internal sac, same specimen, removed to show internal sclerites characteristic of *Cicindelidia* Rivalier. Fig. 5. *C. abdominalis* Fab., aedeagus. Fig. 6. *C. scabrosa* Schaupp, aedeagus. Figs. 4, 5 and 6 are printed at the same magnification to show relative size.

DISCUSSION

Cicindela highlandensis n. sp. (Fig. 1) belongs in the subgenus *Cicindelidia* (*sensu* Rivalier's genus *Cicindelidia)* as illustrated by its red abdomen and male genitalia (Fig. 4). It differs from *C. abdominalis* Fab. (Fig. 2) by its total lack of decumbent setae ventrally, by the lack of pronotal hairs, and by reduced maculation. The male aedeagus is more robust than that of *abdominalis* (Fig. 4 vs. Fig. 5).

C. highlandensis will key to couplet 4 in Willis's (1968) key to the North American species of *Cicindela.* This should be modified as follows:

4a. Labrum with 2 anterior medial setae, 2 lateral setae.
 4a'. Ventrally glabrous; lacking pronotal hairs .... *C. highlandensis* n. sp.
 4a.'! Ventrally with lateral sclerites covered with decumbent setae, also sternites I-4 with lateral decumbent setae; pronotum with at least a few lateral setae, or if absent, punctures are visible along suture........ C. *abdominalis* Fabricius
4b. Labrum with 4 anterior medial setae, 2 lateral setae.......................... 5
5a. Elytra deeply punctured, scabrous; surface shiny (Fig. 3).... *C. scabrosa* Schaupp
5b. Elytra shallowly punctate or impuncate.................................... 6
6a. Elytra shallow punctate
 6a'. Proepisternum densely setose .... *C. roseiventris* Chev.
 6a'! Proepisternum with sparse setae near coxal margin...... *C. politula* LeConte
6b. Elytra impunctate 7

Cicindela scabrosa will key to the species with 4 anterior medial setae on the labrum. From *abdominalis* and *highlandensis, scabrosa* may easily be separated by habitus (Fig. 3) and by male genitalia (Fig. 6). Both *abdominalis* and *highlandensis* have 2 medial setae on the labrum.

The most striking differences between *scabrosa* and the other two species are densely punctate elytral surface in *scabrosa* only; conspicuous lateral row of pronotal hairs in *scabrosa* 30-50 per side, 0-15 in *abdominalis.* 0 in *highlandensis;* extensive covering of decumbent setae ventrally in *scabrosa,* while in *abdominalis* is reduced, and *highlandensis* is glabrous.

Cicindela highlandensis n. sp. has been collected only in Highlands Co., Florida, near Sebring. This is an area of high endemism in many groups of plants and animals. Species restricted to this area include spiders (Brady 1972, McCrone 1963, McCrone & Levi 1964), lizards (Carr 1940), camel crickets (Hubbell 1960), millipedes (Keeton 1959), and mutillid wasps (Schmidt & Mickel 1979). The sand dunes near Sebring are considered the southernmost extension of the Lake Wales Ridge (Laessle 1958). Typical scrub as well as sandhill vegetation occupy much of this area, and some of the highest elevations in peninsular Florida are found here. *Cicindela scutellaris unicolor* and *C. hirtilabris* LeConte which would normally occur in this habitat, are absent. Larvae of *C. highlandensis* have not yet been collected, and adult activity probably occurs only in the summer

7

8

Fig. 7. Type locality of *C. **highlandensis*** n. sp.. Fig. 8. New citrus grove near type locality of *C. **highlandensis*** n. sp..

months as in *C. abdominalis* Fab..

The range of *C. highlandensis* is apparently restricted to fossil sand ridges. Unfortunately, these sand ridges are rapidly being converted into citrus groves (Figs. 7 & 8). Unless some means of preserving this habitat is found, numerous organisms will become extinct, including this species.

ACKNOWLEDGMENTS

I wish to thank the following individuals for their encouragement, assistance, and constructive criticism during the preparation of this manuscript: Gary Dunn, John Stamatov, Donald Wilson, Ken Vick, Terry Erwin, Howard Frank, Mike Thomas, Al Undeen, Angela Cameron, Teresa Choate, Pat Carlisle, Brenda Beck, Robert Woodruff, Reece Sailer, and Lloyd Davis.

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A NEW NEARCTIC SPECIES OF *HYADINA* (DIPTERA: EPHYDRIDAE)[1,2]

Philip J. Clausen[3]

ABSTRACT: A new species of *Hyadina* is described, while the generic description and species key is modified for its inclusion.

Not long after completing a revision of the genus *Hyadina* for the Nearctic (Clausen, 1983), I received a number of specimens from the Canadian National Collections for identification. Contained therein were three specimens of a new species. Consequently, this paper should be considered as a supplement to the above revision.

Hyadina vockerothi n. sp.

It is with great pleasure that I name this species in honor of Dr. J.R. Vockeroth who collected the male specimens.

At this point, I should mention that this species contains the only brachypterous specimens of *Hyadina* known from the Nearctic Region. Of the three known specimens, one male has normal or nearly normal wings while the other male and the female are brachypterous. Unfortunately, with this small sample, I have no way of knowing the frequency of brachypterism, therefore I have designated the normal male as the holotype. The wing measurements for each specimen are listed separately in the following description.

Types: Holotype ♂ and paratype ♂, both from Cranberry I., Lockeport, Nova Scotia, 31-VII-1958, J.R. Vockeroth, mouse run among *Carex;* paratype ♀, Upper Rock L., 30 mi. N. Kingston, Ontario, VII-1977, J. Redner, ex. sphagnum bog; all three deposited in the Canadian National Collections.

Diagnosis: Wings with all crossveins dark brown to black; head with 2 pair of large, vertical setae (inners large and convergent, outers large and divergent), and 1 large pair, divergent, orbital setae; face laterally with dense black, velvety patch and medially with dense grayish to silvery pruinosity.

Description: MALE. Total body length 1.26 to 1.40 mm; shining black with grayish, silvery, golden, coppery and dense, black velvety pruinosity.

Head shining black with black, grayish, silvery, golden and coppery pruinosity; length 0.25 to 0.27 mm; 1 large pair divergent, orbital setae; 1 large pair convergent inner vertical setae; 1 large pair divergent outer vertical setae; vertex shining black, laterally with dense

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black, velvety pruinosity above and below, medially with coppery pruinosity above, becoming grayish to silvery below; gena black with dense black, velvety pruinosity above, dense grayish below. Face shining black, laterally with dense black, velvety patch, medially with dense grayish to silvery pruinosity; parafacial setae in 2 convergent and decumbent rows, 4 or 5 outers, 3 inners. Clypeus black with dense grayish to silvery pruinosity. Antennae black with copper pruinosity.

Thorax shining black with sparse golden to coppery pruinosity, no stripes or spots; scutum length 0.31 to 0.34 mm; dense grayish patch of humeral pruinosity; 1 large mesopleural seta. Scutellum shining black with sparse golden to coppery pruinosity medially, laterally with dense black, velvety patch; length 0.14 to 0.15 mm. Legs black with golden to coppery pruinosity; apex of mesothoracic tibiae with a large black spur and 2 small, black, anterior setae. **Wing** slightly clouded, not darkened at crossveins, no whitish spots, veins and all crossveins dark brown to black; R_{2+3} very short and angles upward sharply, meeting costs just beyond junction of R_1 and costa. Normal ♂ with wing rather short and broad, length from humeral crossvein 0.90 mm, width 0.48 mm, distance from h to R_1 0.14 mm, R_1 to R_{2+3} 0.09 mm, R_{2+3} to R_{r+5} 0.66 mm, R_{4+5} to M_{1+2} 0.12 mm, length R_{4+5} 0.66 mm, length M_{1+2} 0.44 mm, costal section from R_1 to R_{2+3} 0.13 times distance from R_{2+3} to R_{4+5}. Brachypterous ♂ with wing veins fused at crossveins, length from humeral crossvein 0.42 mm, width 0.22 mm, distance from h to R_1 0.10 mm, R_1 to R_{2+3} 0.07 mm, R_{2+3} to R_{4+5} 0.25 mm, R_{4+5} to M_{1+2} 0.10 mm, length R_{4+5} 0.29 mm, length M_{1+2} 0.12 mm, costal section from R_1 to R_{2+3} 0.27 times distance from R_{2+3} to R_{4+5}. Halteres light brown; normal in holotype ♂, capitulum reduced in paratype ♂.

Abdomen as in Fig. 1, shining brown with sparse golden to coppery pruinosity.

Genitalia (Fig. 2). Note narrow tergite 9 with very long, narrow surstyli with rounded, slightly broadened and flattened apices, each bearing several short setae; gonites rather long, narrow, curved, pointed apically; gonal arch incomplete; aedeagus large, long, abruptly curved near base, enlarged apically with striations.

FEMALE: Total body length 1.41 mm. Head, thorax and legs as in males except as noted:

Head length 0.27 mm; parafacial setae in 2 convergent and decumbent rows, except 2 outers proclinate, 5 outers, 4 inners.

Thorax with scutum length 0.31 mm, scutellum length 0.14 mm. Wing brachypterous, veins not fused at crossveins, length from humeral crossvein 0.53 mm, width 0.27 mm, distance from h to R_1 0.12 mm, R_1 to R_{2+3} 0.07 mm, R_{2+3} to R_{4+5} 0.32 mm, R_{4+5} to M_{1+2} 0.08 mm, length R_{4+5} 0.32 mm, length M_{1+2} 0.14 mm, costal section from R_1 to R_{2+3} 0.21 times distance from R_{2+3} to R_{4+4}. Halteres normal.

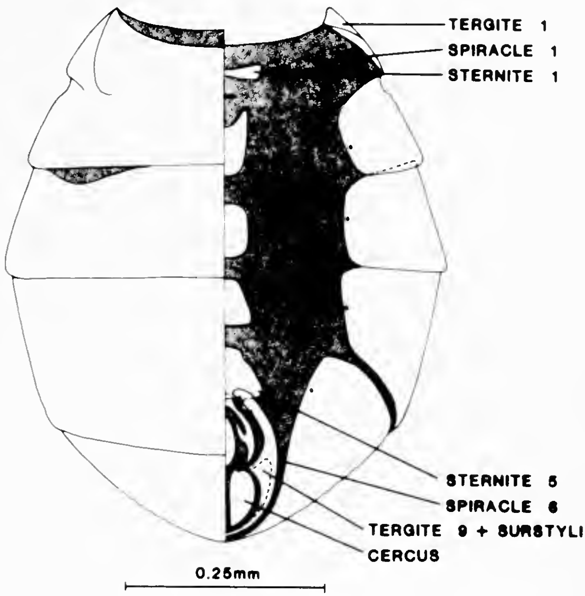
Abdomen as in Fig. 3, sternites 7 and 8 more strongly sclerotized and darker than others. Ventral receptacle as in Fig. 4.

Distribution. Nova Scotia and Ontario.

Specimens examined. 3 specimens (2 ♂♂ and 1 ♀), the types with data as listed previously.

To include *vockerothi* in the genus *Hyadina*, some minor changes in the generic diagnosis and description (Clausen, 1983) are necessary. These are as follows:

Diagnosis and Description. Body length 1.26 to 2.30 mm. **Head** with face black, pruinosity uniform, striped or spotted, pruinosity grayish, silvery, golden, coppery or black; 1 large orbital seta or orbital setae very small. **Wing** with costal section from R_1 to R_{2+3} 0.13 to 1.25 times the distance from R_{2+3} to R_{4+5}.



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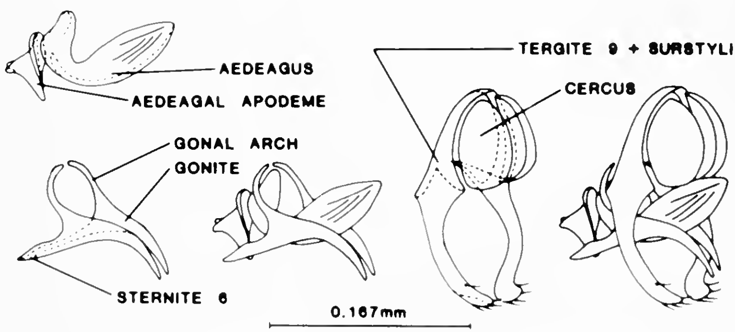

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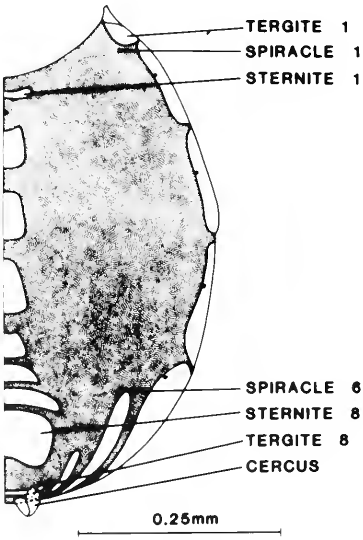
Fig. 1. Male abdomen, *Hyadina vockerothi* Clausen. Fig. 2. Male genitalia, *Hyadina vockerothi* Clausen.

The inclusion of *vockerothi* in *Hyadina* also necessitates the modification of the species key in Clausen (1983). The modifications are as follows:

4. Scutellum laterally with dense black, velvety patch 4A
Scutellum without lateral, dense black, velvety patch, covered uniformly with golden to copper pruinosity .... *pruinosity* (Cresson)

4A. Face laterally with dense black, velvety patch and medially with dense grayish to silvery pruinosity; 1 large pair, divergent orbital setae .... *vockerothi* n. sp.
Face with uniformly dense, grayish to golden pruinosity; 1 to 5 very small, orbital setae .... *binotata* (Cresson)



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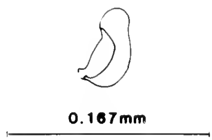

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Fig. 3. Female abdomen, *Hyadina vockerothi* Clausen. Fig. 4. Ventral receptacle, *Hyadina vockerothi* Clausen.

ACKNOWLEDGMENTS

I thank Dr. J.R. Vockeroth and Dr. B.E. Cooper, both of the Biosystematics Research Institute of Ottawa, Canada for providing these extremely interesting specimens.

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ACANTHOSCELIDES WINDERI, NEW SPECIES, (COLEOPTERA: BRUCHIDAE) ASSOCIATED WITH *MIMOSA* SPP. (LEGUMINOSAE: MIMOSOIDEAE) FROM BRAZIL[1]

John M. Kingsolver[2]

ABTRACT: During a survey of *Mimosa* species in Brazil for potential biocontrol agents to control *Mimosa pigra* recently introduced into Australia, a new species, *Acanthoscelides winderi*, was reared from seeds of *Mimosa pigra* and *Mimosa* sp. The species is named after the collector.

John Winder recently collected several series of specimens of a new species of *Acanthoscelides* reared from *Mimosa* sp. and *M. pigra*. All localities are in southeastern Brazil. Since this species is one of those being considered for biological control of *M. pigra* introduced into Australia, a name is needed for reference.

Acanthoscelides winderi Kingsolver, new species
Fig. 1-3

Body length. 2.3-2.6 mm; width.-1.5-1.7 mm.

Color. Integument yellowish red to dark red, eyes piceous. Vestiture of yellow, white, and dark brown slender hairs in mottled pattern (fig. 1) on dorsal surface. Head sparsely clothed; pronotum predominantly yellow with short, narrow, white spot on basal lobe and scattered dark brown hairs on paired apical and median, diagonal, slightly elevated gibbosities. Elytra with 1st, 2nd, 4th, 6th, and 10th intervals yellow, 3rd, 5th, 7th, 8th, and 9th intervals with alternating dark brown and yellow, elongate spots. Pygidium predominantly yellow, with 3 vague basal spots and 1 subapical median spot white, ventral border fringed with yellow, apical 1/2 with prominent, nearly bare, paired dark red reniform spots (fig. 1). Abdomen with lateral row of white spots set in broad band of yellow; metepisternum yellow with white margin.

Structure. Body short, broad, subdepressed. Head turbiniform, eyes prominent, ocular sinus about 1/2 length of eye; vertex microfoveolate, each foveola bearing a hair; frons with fine, short carina flanked by rugose punctation, clypeus with basal 1/2 rugosely punctate, apical 1/2 finely granulose, antenna serrate from 5th segment, 4th slightly eccentric, terminal segment subelliptical. Pronotum campaniform, strongly convex, lateral margins sinuate, apical margin evenly rounded, basal margin straight with somewhat angulate basal lobe; surface microfoveolate, foveolae mostly discrete, separated by a diameter, nearly concealed by vestiture except sparse on dark red gibbosities; prosternum short, triangular, not separating coxae at apices. Scutellum quadrate, bidentate apically. Elytra slightly longer than wide, convex except subdepressed between 4th striae, striae prominent but not deep, 3rd, 5th, 7th, and 9th intervals slightly wider than 1st, 2nd, 4th, 6th, and 8th; intervals minutely imbricate, concealed by vestiture, mesosternum subtriangular, apex rounded, postmesocoxal sulci not

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meeting on midline. Abdomen with 1st sternite longer than remaining sternites in ♂, subequal in ♀; terminal sternite in ♂ broadly emarginate to receive apex of pygidium, in ♀ evenly rounded; ♂ pygidium gently convex, ♀ pygidium nearly flat, surface finely imbricate, nearly concealed by vestiture except sparse on dark red triangular spots. Male genitalia with median lobe (fig. 2) moderately broad, internal sac trilobed; ventral valve bluntly rounded apically, lateral margins incurvate, dorsal valve subtriangular, densely setose; basal 1/3 of internal sac with minute blunt denticles gradating to minute quadrate denticles, middle of sac with transverse cluster of small spines, lateral lobes of sac partly lined with minute triangular denticles; lateral lobes (fig. 3) broad, cleft to 1/2 their length. Pro- and mesolegs normal for genus, metafemur moderately incrassate, pecten with 1 long and 2 or 3 short denticles, metatibia with lateral, ventral, and dorsomedial carinae distinct and complete to apex, lateroventral carina obsolete in apical 1/5, mucro short, acute; lateral dentical short, corona with 3 denticles.

Holotype ♂. BRAZIL: Panorama (SP), 26 April 1981, ex seed pods *Mimosa* sp., J.A. Winder (149-A-1). Allotype ♀ 2 ♂, 2♀ paratypes, same data.

Primary types are deposited in the Departamento de Zoologia (Museu), Universidad Federal de Paraná, Curitiba, Brazil.

Other paratypes. BRAZIL: Uberlandia (MB), 2 May 1981, ex seed pods *Mimosa* sp., J..A. Winder (173-A), 47 ♂ ♀; Ribeirao Preta (SP), 9 May 1981, ex seed pods *Mimosa* sp., J.A. Winder (194-A-1), 45 ♂ ♀; Santa Rite do Araguaia (GO), 28 April 1981, ex seed pods *Mimosa* sp., J.A. Winder (158-2), 1 ♀; Pedra Azul (MG), 20 February 1981, ex seed pods *Mimosa pigra*, J.A. Winder (99-2), 12 ♂ ♀; Vassouras (RJ), 23 March 1981, J.A. Winder (131-B), 8 ♂ ♀. Paratypes are deposited with the primary types and in the C.D. Johnson collection, Flagstaff, Arizona; the National Museum of Natural History , Washington, D.C.; the Institute Miguel Lillo, Tucumán, Argentina; the Museu Paraense Emilio Goeldi, Belém, Brazil, and the CSIRO Museum, Canberra City, Australia.

This species is in the *mexicanus* group (Johnson, 1983: 6) and is apparently closely related to *Acanthoscelides mexicanus* (Sharp); *lapsanae* (Motschulsky), and *piceoapicalis* (Pic) differing principally in its more extensive dark red pygidial spots, and in the armature of the male genitalia. In *A. mexicanus, lapsanae,* and *piceoapicalis,* the pygidial spots are small and submarginal, the basal white patches on the pygidium are vaguely defined, and the lateral pockets of the internal sac are completely lined with thorn-like spines, whereas in *A. winderi,* new species, the pygidial spots are large and triangular or falcate, the basal white patches are large and conspicuous, and each of the lateral pockets of the internal sac has a transverse row of slender spines at the middle, and are only partly lined with minute denticles. Furthermore, in *piceoapicalis,* the apical 1/5 of the elytron is piceous to black whereas the other three species are patterned to the apex of the elytra. The lateral lobes of *A. winderi* are broad as in *lapsanae* and *piceoapicalis* (Johnson, 1983, figs. 259, 406); those of *mexicanus* are slender (ibid, fig. 329). *Acanthoscelides winderi* will key to *lapsanae* in Johnson's key.

I am pleased to name this species for John A. Winder who collected all of the specimens upon which this description is based.

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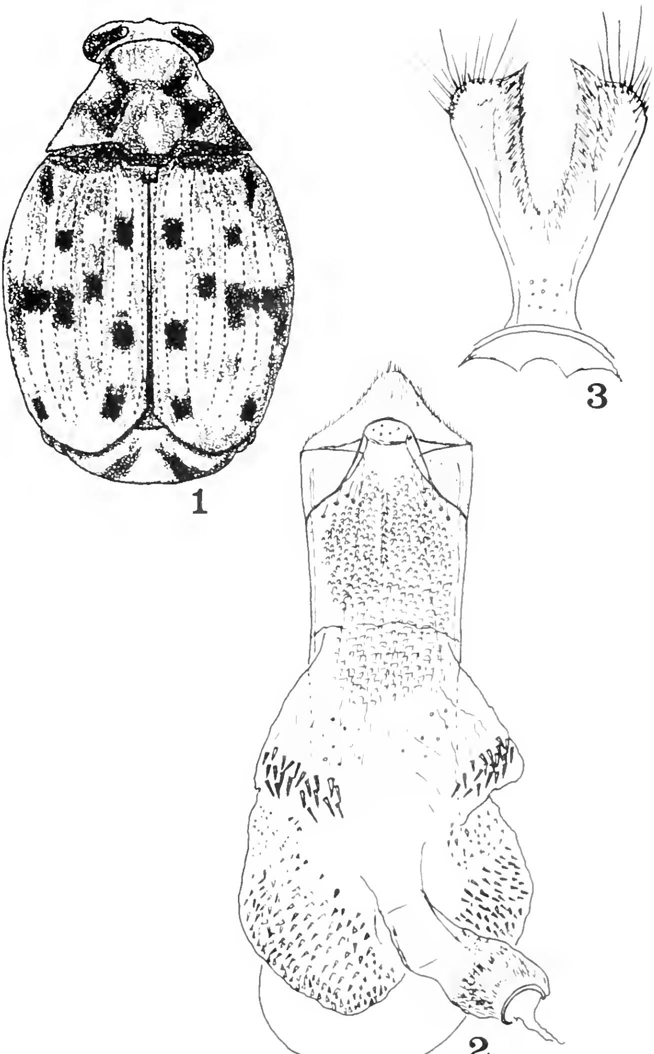

Figs. 1-3, *Acanthoscelides winderi*, n. sp. 1. Dorsal habitus. 2. Male genitalia, median lobe, ventral aspect. 3. Male genitalia, lateral lobes, ventral aspect.

BOOK REVIEW

THE AUSTRALIAN CRICKETS (ORTHOPTERA: GRYLLIDAE). Daniel Otte and Richard D. Alexander. 1983. Academy of Natural Sciences of Philadelphia Monograph 22. 477 pp. $45.00.

This is a major taxonomic monograph that deals with an important fauna in some unusual and noteworthy ways.

Otte and Alexander state that when they undertook their studies of Australian crickets they presumed most species were known. However, in their monograph 376 of 492 species are new, as are 41 of 85 genera. And this is not a matter of splitting taxa recognized by previous workers. Nearly all new taxa are based on specimens taken by the authors during a year of intensive field work throughout Australia and Tasmania. The chief cause of their finding so much more diversity than previous collectors is their use of the male's call to distinguish species in the field. When they entered a new locality, they determined how many species were calling and set about collecting at least one of each. They rightly emphasize that cricket calls are not just one more character that can be used in species discrimination. Male calling songs have a direct relation to species status — females use them in seeking conspecific mates.

This book is beautifully and abundantly illustrated. Insect lovers will gain pleasure in leafing through the pages and viewing the varied shapes and sonagrams (calls) of Australian crickets. The approximately 3070 drawings, arranged in 357 "figures," include 120 whole crickets (representing nearly every genus), 2270 identifying morphological features, 310 sonagrams, and 340 distribution maps. The illustrations accompany appropriate text and are arranged for convenient comparisons of related species.

This monograph is unusual in its thrifty choice of what's included and in its avoidance of redundancy. For example, synonymies are brief and streamlined, and the 905 collecting localities mapped and described in the introduction are thereafter represented by a simple code. One instance where brevity is a flaw is the book's indexing. Its only index is taxonomic and each taxon is referenced to a single page (not always an appropriate one; and some taxa are omitted — e.g. *Eurepa* and *Gryllulus*. This leads me to another flaw — internal inconsistencies and mistakes occur more frequently than one expects in a work otherwise so compelling. Nonetheless, in most respects this is a monograph that other monographers should emulate.

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BOOKS RECEIVED AND BRIEFLY NOTED

INSECTS ON NETTLES, GRASSHOPPERS, SOLITARY WASPS, INSECTS AND THISTLES. Various authors. 1983. Naturalists Handbooks Nos. 1, 2, 3, & 4.

A series of small books for "sixth formers and others without a university training in biology." Each features four colored plates and keys to identification of British insects.

SYSTEMATICS AND BIONOMICS OF *ANTHOPHORA*: THE BOMBOIDES GROUP AND SPECIES GROUPS OF THE NEW WORLD (Hymenoptera: Anthophoridae). R.W. Brooks. 1983. Univ. Calif. Press. 86 pp. $8.50 pbk.

The species groups of *Anthophora* (s. str.) in No. America and the life history of *Anthophora bomboides stanfordiana* Cockerell.

ELEVATION OF *DIABROTICA SICUANICA* (COLEOPTERA: CHRYSOMELIDAE) TO THE SPECIES LEVEL WITH NOTES ON THE ALTITUDINAL DISTRIBUTION OF *DIABROTICA* SPECIES IN THE CUZCO DEPARTMENT OF PERU[1,2]

J.L. Krysan[3], T.F. Branson[3], R.F.W. Schroeder[4], W.E. Steiner, Jr.[5]

ABSTRACT: *Diabrotica decempunctata sicuanica* Bechyne is elevated to the species level. The altitudinal distribution of 17 species of *Diabrotica* in the Cuzco Dept. of Peru, based on material collected in January of 1979 and 1982, is presented. The greatest diversity of species (11) was collected in the altitudinal range of 1250 to 2450 M. At elevations below 2800 M, most beetles were found on flowers of cucurbits. In the altitude zone from 2800 to 3500 M, two taxa were collected, both from *Zea mays* L.: *D. speciosa vigens* Erichson, from 2800 to 3200 M and *D. sicuanica* Bechyne, from 3000 to 3500 M elevation. The two species with the most extensive continental ranges were collected over the greatest range of altitudes.

Diabrotica is a largely Neotropical genus that includes several species of great economic importance in North America, particularly as pests of maize. Given the pest status, the South American members of the genus have been of interest to North American entomologists as, for example, reservoirs of natural enemies. Despite this interest, most South American *Diabrotica* are very poorly known. Except for a few widespread economic pests, the literature consists of original descriptions and catalog entries. Distribution records are scanty and indefinite. Given the nature of Andean ecology, altitudinal distribution patterns are expected, but no such information is available for *Diabrotica.*

In the course of a total of nearly 7 weeks of searches for natural enemies in the Cuzco Department of Peru in January of 1979 and 1982, we made extensive collections of *Diabrotica.* Based on these collections, we herein elevate one taxon, *D. decempunctata sicuanica* Bechyne, to the species level, and report on the altitudinal distribution of 17 taxa of *Diabrotica.*

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Taxonomic Status of *Diabrotica decempunctata sicuanica* Bechyne

Our experience indicates a status change for this taxon is appropriate despite our commitment to the ideal that piecemeal changes separate from a major revision can be detrimental. We have recognized *D. d. sicuanica* as a pest of maize (see below), so a literature might develop which makes nomenclatural simplicity and stability highly desirable. Taxonomic information indicates species status is appropriate, and because trinomials are commonly ignored in general entomological literature, we elevate *D. d. sicuanica* to the species level. A brief description is given here because the original description is limited to a key couplet.

Diabrotica sicuanica Bechyne new status

D. decempunctata sicuanica Bechyne, 1958: 555.

Description. Body elongate oval, lime green nearly throughout, elytra widest slightly post-medially. Length 5 to 7 mm.

Pronotum. Shiny lime green, wider than long, mean ratio length to width, 0.70; disc with 2 foveae tiny or absent, glabrous except for a prominent seta on anterior and posterior angles and 1 or 2 short setae on the lateral margin adjacent to the prominent seta; lateral margin distinct, reflexed; scutellum piceous.

Elytra. Humeral plicae absent, disc asculate, finely, irregularly punctate, surface very finely alutaceous; each elytron with 2 spectrum orange (frequently faded) diffuse spots, one originating on humerus and narrowing apicad, ending at basal one-third to one-half of elytron, other oblong, one-third width of elytron, originating at apical one-third of elytron, one-third of elytral width of suture, directed diagonally towards apical curve. Piceous maculation highly variable; piceous sutural vitta at basal one-sixth of elytron and at most 5 spots on each elytron: 1 humeral; 2 in proximal one-half, 1 on disc near but not touching suture, the other nearer lateral margin lying slightly apicad from the first, 2 arranged similarly in posterior one-third. Piceous maculation may be reduced to a very narrow sutural vitta; distal medial spots are the last to disappear, except occasionally only humeral spots present; when present, the distal spots lie at either end of distal orange spot. Disc essentially glabrous; a few setae on apical margin.

Head. Very shiny, entirely piceous. Antennae entirely piceous, three-fourths length of body in male, two-thirds length of body in female; third segment 1¼ times length of segment 2; segments 2 and 3 together two-thirds length of segment 4.

Ventral side. Prothorax yellow or lime green, meso and metathorax entirely piceous, all legs entirely piceous, abdomen yellow or lime green.

Male genitalia. The internal sac is illustrated in Figure 1a.

Material Examined. Three hundred and thirteen (313) specimens from the localities listed in Table 1 collected by J. Krysan and T. Branson, January 1982, and deposited in USNM and Ministerio de Agricultura y Alimentacion, Lima, Peru; San Jeronimo, Cuzco Dept., Peru III-24-79, G. Buckingham, private colln.; AUTOTYPE, Urabamba, Peru V-16-62, 3200 M, Carrasco, obtained from Dr. F. Carrasco, Cuzco Dept., Peru (to be deposited in USNM).

Distribution. In addition to the material examined, we know of specimens collected at Cuzco, Peru, 3500 M, by G. Molleda, X-15-61 in California Insect Survey and the type material collected at Sicuani, Peru (Museum G. Frey). Thus, the species has been collected only in the Cuzco Dept. of Peru and from localities above 3150 M elevation.

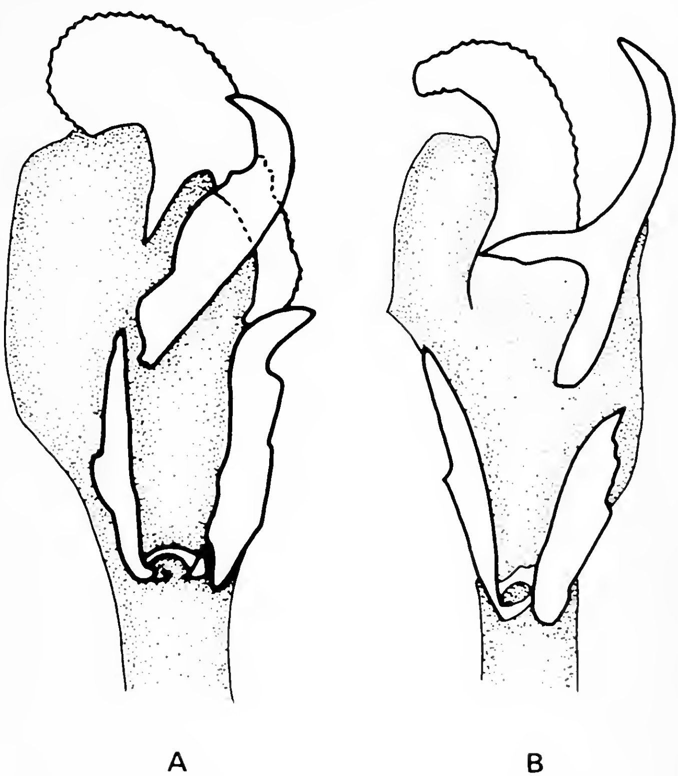

Fig. 1. Internal sac structure of *D. sicuanica* (A) and *D. d. semiviridis* (B).

Taxonomic Discussion. Bechyne (1958) named *D. sicuanica* as a subspecies of *D. decempunctata* Latreille in a key. In that key, he also combined *D. semiviridis* Bowditch as a subspecies of *D. decempunctata.* We collected both *D. d. semiviridis* and *D. sicuanica* in the Cuzco Dept., but their ranges are altitudinally distinct; the former was collected at 1800 - 2500 M and the latter only above 3150 M (see next section). Usually subspecies rank indicates morphological similarity, so at least some specimens should be hard to place. That is not so with these taxa. Size of elytral punctations, Bechyne's diagnostic character for these taxa, is technically a quantitative trait and hence potentially variable, but we have seen no beetles with intermediate punctation size, and Bechyne mentioned none. We consider the internal sac of the male genitalia to bear the most useful characters for distinguishing *Diabrotica*, so we illustrate here the armature of internal sacs of *D. sicuanica* and *D. d. semiviridis* (Figs. 1a and 1b). The differences are obvious and should be taken into account by the next revisor; the important point for now is the relationship between *D. sicuanica* and the nominate taxon *D. decempunctata* Latreille. The type of the latter is a damaged female specimen without exact locality data. The pronotal shapes of *D. sicuanica* and the type of *D. decempunctata* Latreille are obviously different, a difference which can be measured. Of 33 female *D. sicuanica* measured, the length to width ratio of the pronotum (mean 0.70, range 0.66 to 0.74) is clearly different than that of the type of the nominate subspecies (0.78).

Collection Sites and Methods

The climate and ecology of Peru is summarized in Gorbman et al. (1961), and we use their designations for ecological regions. The collections above 2500 M are in the Quechua region. Sites between 1000 and 2500 M in the Valle Lares, and the valleys of the Rio Urubamba and Rio Pilcopata, are in the Fluvial Yunga. The collections between 400 and 1000 M are in the Selva Alta, and those below 400 M are in the Selva Baha. The collection sites near Limatambo and Curahuasi in the Rio Apurimac system, while classified in the Quechua, are considerably drier than the other sites in this biological zone.

In most localities, all plants found in flower were examined for beetles on the foliage as well as the floral parts. The great majority of beetles (exceptions are noted) were collected from the flowers or foliage of domestic or wild cucurbits. Collections in the Selva Baha and Selva Alta were from highly diverse vegetation systems, and few beetles were found. Only a total of four days was spent searching at those elevations. Collections in the Fluvial Yunga were usually from tiny garden plots invariably containing domestic cucurbits and sometimes containing corn. From these complex systems in the Selva and Fluvial regions, numbers of beetles collected would mean little.

Collections in the upper elevations (> 2800 M) of the Quechua region, however, were always from row-crop agricultural land or alfalfa monocultures. In maize fields in these upper elevations we saw evidence of altitudinal change in species composition so we conducted a rather intensive search. This search focused on the Urcos, Sacred, Ccorao, and Cuyo Grande valleys and the valley of the Rio Colorado. The Cuyo Grande valley is above, but contiguous with, the Sacred Valley proper and it was fortuitous that we could collect where maize production was continuous between the two valleys. Twenty-seven fields were searched for a minimum of 30 minutes each. Longer search numbers were adjusted to reflect 30 minutes of search. We think those numbers reflect the elevational relationship between *D. sicuanica* and *D. speciosa vigens.*

The beetles will be deposited in the USNM and the collection of the Ministerio de Agricultura y Alimentcion, Lima, Peru.

RESULTS

Elevation of Collections

The species collected at the various sites summarized by elevation levels are presented in Table 1. In the Selva Alta and Selva Baha, 5 species were found, but each was represented in very low numbers. The greatest variety of species (11) was encountered in the Fluvial Yunga where we collected at elevations from 1250 to 2450 M. All these beetles were collected from cucurbit flowers.

In the Quechua region from elevation 2600 M to 3000 M, *D. speciosa vigens* was by far the most common species found. It was collected from maize, cucurbits, common bean (*Phaseolus vulgaris*) foliage and flowers, alfalfa foliage and flowers, and flowers of the weedy legume *Sparteum junceum.* The one other species (new species, *virgifera* group) collected in this elevation range was represented by a series of 31 ♂ beetles found near Limatambo at 2800 M.

Above 2800 M elevation we found two species, *D. s. vigens* and *D. sicuanaca* (Table 2). In the elevation range from 3000 to 3200 M, *D. s. vigens* occurred with *D. sicuanaca;* we never collected the latter taxon at lower elevations. Above 3200 M, *D. sicuanica* was the only species of *Diabrotica* collected. The highest elevation at which we collected *D. sicuanica* was 3500 M (Table 2). In the Valley of the Rio Colorado, where we collected from 2800 to 3500 M, we did not find *D. sicuanica,* but we did find *D. speciosa vigens* up to 3200 M elevation. Incidentally, the Urcos and Anta valleys, where only *D. sicuanica* was collected, have no accessible openings to valleys at lower elevations comparable to the intersection of the Cuyo Grande and Sacred valleys.

Despite the polycultural nature of many of the fields, we found *D. sicuanica* beetles only on maize plants. Furthermore, larvae of *D. sicuanica* were found feeding on maize roots.

DISCUSSION

These collections were made at the peak of the growing season; e.g., in the Quechuan region, maize was silking and legumes were commonly in flower. Therefore, they make a first approximation of the altitudinal distribution of *Diabrotica* in the southern Andes of Peru.

Some patterns can be detected among the collections. Several of the taxa with restricted elevational distribution have been recorded only from Peru.

Two species, *D. s. vigens* and *D. viridula,* were distinctive in that we collected them over a much greater range of altitudes than any of the other species. This great altitudinal range in this small area of the Andes is consistent with the fact that these two species have the most widespread geographical distributions of any *Diabrotica. Diabrotica speciosa* (sensu lato) range from Columbia and Brazil to Argentina and Bolivia (Smith and Krysan, unpublished). The range of *D. viridula* extends from Mexico and Brazil to Chile (Wilcox, 1972) and the Easter Island (Olalquiaga, 1980).

Our first collections above 2800 M suggeted a change in species composition in a rather narrow altitudinal zone. The two species of *Diabrotica* in that zone were found in association with maize in row-crop agricultural plots, a relatively uniform ecosystem amenable to a systematic search. We have tabulated here (Table 2) the numbers of beetles collected in our rather unrefined survey in preference to simply listing localities to better record our basis for concluding that *D. sicuanica* occurs at elevations above the wide-ranging species, *D. s. vigens.* Ecological characteristics that

Table 1. Species collected at various sites summarized by elevation levels.

	Localities and elevation ranges (in meters)[1]									
	<900	1250-1400	1830	1900-2000	2100	2100-2200	2450	2800-2980	3000-3200	3350-3500
D. sicuanica Bechyne									12	13
D. new sp. (*virgifera* group)[2]								10		
D. nigromaculata Jacoby			4							
D. tumidicornis Erichson			4	5	6					
D. mauliki Barber			4							
D. sharpi usualis Bechyne			4	5	6					
D. decempunctata semiviridis Bowditch			4	5	6	7	8			
D. mapiriensis new ssp.[2]			4	5	6		8			
D. *speciosa vigens* Erichson		3	4	5	6		8	9,10,11	12	
D. viridula Fabricius	1	3	4	5	6					
Unknown species #1		3								
D. peruensis Bowditch		3								
D. limitata quindecimpunctata Germar		3								
D. septemliturata Erichson	1									
Unknown species #2	2									
D. gracilenta Erichson	1									
Unknown species #3 (near *D. godmani* Jacoby)	1									

[1] 1 = Quince Mil; 2 = Pilcopata; 3 = road near Chaullay; 4 = Macchu Picchu; 5 = 50 km south Quillabamba; 6 = Lares Valley, 75 km north Calca; 7 = 140 km post, road to Pilcopata; 8 = 70 km south Quillabamba; 9 = Ollantaytambo; 10 = Limatambo; 11 = Curahuasi; 12 = Pisac and lower Cuyo Grande; 13 = Andahuaylillas (Urcos Valley), Cuyo Grande Valley, Pucyura (Anta Valley), Ccorao (on road from Cuzco to Pisac).

[2] These new taxa will be described in a revision of the *virgifera* group now being completed.

obviously change through this zone and could bear on species distributions are temperature, plant composition of the fields, and edaphic factors related to slope. The Sacred Valley is a flat floodplain, intensively cropped, largely in maize monoculture. By contrast, the Cuyo Grande Valley is very steep and characteristically has small, sloped fields where polycultures are the rule but maize clearly dominates. The Cuyo Grande opens onto the Sacred Valley at 3000 M elevation. Both species were found in floodplain and sloped fields so slope alone is probably not a factor. Also, we found beetles of both *D. sicuanica* and *D. s. vigens* in both maize monoculture and polycultural fields so the admixture of forbs so common in maize fields in the Cuyo Grande Valley is not a likely explanation for the elevation-related changes in species composition.

Given the larval and adult associations, we conclude that *D. sicuanica* is a pest of maize restricted to high Andean elevations. Indeed, in the Cuyo Grande, Ccorao, Urcos, and Anta Valleys, we found *D. sicuanica* at the highest elevations at which we found maize.

Table 2. Numbers of *D. speciosa vigens* and *D. sicuanica* collected at elevations of 2800 M and higher.

Location	Elev. (M)	*D. speciosa vigens*	*D. sicuanica*	Culture
	Sacred Valley (SV) and Contiguous Valleys			
Ollantaytambo (SV)	2800	20	0	maize
Urubamba (SV)	2920	212	0	maize
Yucay (SV)	2990	46	0	maize
9 km N. Pisac (SV)	3020	31	13	maize
1 km S. Pisac (SV)	3050	34	158	poly 6
Cuyo Grande Valley	3170	11	18	maize
Cuyo Grande Valley	3200	8	28	poly 2
Cuyo Grande Valley	3350	0	36	poly 5
Ccorao Valley	3470	0	42	poly 1
Ccorao Valley	3500	0	8	poly 4
		Adjacent Valleys		
Rio Colorado	3050	60	0	poly 3
Rio Colorado	3140	6	0	maize
Rio Colordao	3200	13	0	maize
Urcos Valley	3500	0	18	maize
Anta Valley	3500	0	43	poly 1

Poly 1 - maize + fava beans
Poly 2 - maize + fava beans + snapbeans + peas
Poly 3 - maize + snapbeans
Poly 4 - maize + fava beans + potatoes
Poly 5 - maize + lupine + snapbeans
Poly 6 - maize + peas (few)

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We thank Dr. P. Passerin d'Entreves, Curator, Museo Ed Instituto di Zoologica Sistematica, Universita di Torino, Italy, for loan of the type of *Diabrotica decempunctata* and Drs. Ron McGinley and Al Newton, Museum Comparative Zoology, Harard University, for hospitality extended to JLK while examining types at MCZ.

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Y.E.S.

Y.E.S., the YOUNG ENTOMOLOGIST'S SOCIETY, was originally the Teen International Entomology Group which was formed in 1965. Y.E.S. serves as an organization through which members can exchange information about insects through correspondence and group publications. The oranization's name reflects it's youth orientation, but "young" members of any age are needed for its many activities and functions.

The Societies' publication, Y.E.S. QUARTERLY, is full of "how to" articles, collecting tips, news, field notes, life history information, identification tips, and virtually every other entomological topic, including the non-insect arthropods. Nearly all of the articles are written by the members themselves! In addition, the members tell about themselves and their specific interests via a member directory and the "tradingpost."

Membership in Y.E.S. is open to all individuals, young or old, amateur or professional, with an interest in entomology. There are four membership categories: youth members (up to age 18), collegiate members, adult members and sustaining members. Membership applications and additional information may be obtained from the Department of Entomology, Michigan State University, East Lansing, Michigan 48824-1115.

PSEUDOCOSSINAE: A NEW SUBFAMILY OF COSSIDAE (LEPIDOPTERA)[1]

J.B. Heppner[2, 3]

ABSTRACT: Pseudocossinae, new subfamily, is named and diagnosed for three genera in Cossidae: *Pseudocossus* Kenrick (type-genus), *Chilecomadia* Dyar, and *Rhizocossus* Clench. *Pseudocossus* is from Madagascar and the other genera are from Chile. Pseudocossinae have proto-tympanal organs on the anterior abdominal sternite.

Recent review of Lepidoptera classification for a book to be published soon on Lepidotera families (Heppner, 1984) and for the Atlas of Neotropical Lepidoptera (W. Junk Publ., The Hague, Netherlands) has indicated the need for a new subfamily name for a group of primitive genera in Cossidae. Since the name is needed for these two publications, I propose the new subfamily at this time.

Pseudocossinae, new subfamily

Type-genus: *Pseudocossus* Kenrick, 1914. Trans. Ent. Soc. Lond., 1913: 590.

Diagnosis: Adults medium sized (wingspan ca. 30-45 mm); head somewhat roughened on vertex, antenna filiform (somewhat serrate ventrally), ocelli present (*Pseudocossus*) or absent, compound eye large, labial palpus upturned with small terminal segment; thorax with legs having arolium between tarsal claws; forewing venation typical for family but pterostigma absent, cubital veins connate at base (*Pseudocossus*) or separated, CuP merged with anal veins near tornus (*Pseudocossus*) or nearly so, median vein in discal cell single or forked; hindwing with no crossvein from Sc to Rs at base; abdomen with proto-tympanal organ as a lateroventral invagination on anterior sternite; male genitalia with rounded uncus (slightly bifid), valva simple, saccus reduced; female with setose ovipositor, simple ostium and bursa copulatrix.

Immature Stages: Unknown.

Remarks: The new subfamily is proposed for one Ethiopian and two Neotropical genera of primitive Cossidae, first noted for their unique characteristic by Clench (1957, 1959). These genera are the Madasgascar endemic *Pseudocossus* Kenrick, 1914, with two known species, and the Chilean genera *Chilecomadia* Dyar, 1937, with two species, and *Rhizocossus* Clench, 1957, with one species. The characters demonstrating the primitive nature of these genera in relation to other Cossidae, as well as in definition of Pseudocossinae, primarily involve the so-called proto-tympanal organs

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[3]Contribution No. 580, Bureau of Entomology, FDACS, Division of Plant Industry.

on the anterior abdominal sternite. These proto-tympanal organs are not as developed as the more advanced tympana found in *Dudgeonea* (Dudgeoneidae). *Pseudocossus* additionally has ocelli, but the two Chilean genera do not. The Indian genus *Catopta* and the Australian *Idioses* also have ocelli and may also belong to Pseudocossinae. The remainder of the Cossidae, as well as Metarbeliadae and Dudgeoneidae, do not have ocelli (except as noted above for two genera) and lack proto-tympanal organs, except that Dudgeoneidae have developed enlarged tympanal organs. There may be other Cossidae with a simple abdominal invagination similar to a proto-tympanal organ, but this requires further study.

The three genera here included in Pseudocossinae also have very similar male genitalia, as pointed out by Clench (1959), particularly in lacking the long beak-like uncus characteristic of most Cossidae, as well as Dudgeoneidae. *Pseudocossus* clearly is the more distinct genus of the subfamily and shows more affinities to some proto-Dudgeoneidae stem lineage than do the Chilean genera. The extent of the parameters of Pseudocossinae will undoubtedly continue to change as more cossids are discovered in remote areas of the world, particularly in the Gondwanaland refugia (South Africa, Madagascar, Assam, New Zealand, Chile) that involve the habitats of Pseudocossinae. This fact is likewise true for most higher categories of Lepidoptera. Thus far at least, the three genera herein included in Pseudocossinae clearly demonstrate a set of characters distinctive enough among Cossidae to require a separate higher category to adequately delimit their distinctions within the family.

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ERRATA

In the March-April 1984 issue of ENT. NEWS, an article appeared entitled "A Spate of Glowworms" by Steven R. Wing. In that paper the words Phengodidae and phengodid(s) were misspelled four times: in the title, and on lines 1, 5, and 13. The correct spelling should be Phengodidae and phengodid(s). Both the author and the editor regret these errors.

ADDITIONAL OBSERVATIONS ON THE ASSOCIATION OF *PEDILUS* (PEDILIDAE) WITH *MELOE* (COLEOPTERA: MELOIDAE)[1,2]

Linda Butler[3]

ABSTRACT: Three specimens of *Pedilus collaris* (Say) were observed in association with a male *Meloe angusticollus* Say. Two of the beetles were firmly attached to *Meloe* abdominal tergites but were producing little or no obvious damage.

Recently, LeSage and Bousquet (1983) reviewed reports of *Pedilus* - *Meloe* associations and described their observations of *P. lugubris* (Say) chewing *Meloe* elytra.

On April 27, 1979 I observed an association between *Pedilus* and *Meloe* near the unincorporated community of Triune, 21 km south of Morgantown, West Virginia. The habitat was a steep hillside in a typical Eastern cove of hardwood forest (oak, hickory, maple).

A male *Meloe angusticollis* Say was observed resting on the edge of a fallen dead white oak leaf. Two male *Pedilus collaris* (Say) were firmly attached by their mandibles to the second and third abdominal tergites of the *Meloe* with their legs drawn up below their bodies. A third male *P. collaris,* which was crawling over leaf litter and dead twigs about 23 cm away, oriented to the leaf on which *Meloe* was resting. The leaf was reached by means of an indirect route of about 64 cm utilizing small twigs as "bridges" to the leaf. Once on the leaf, the *Pedilus* walked directly to the *Meloe* and attempted to crawl onto it at the abdominal apex. When touched by the third pedilid, the *Meloe* rapidly jerked forward and began walking over the forest floor directly away from the *Pedilus.*

After observing the blister beetle walk over a distance of about one meter, I collected the *Meloe* and two pedilids and placed them in a plastic bag together with leaves and twigs. The captive *Meloe* moved actively and frequently crawled upside down on the twigs. At these times, the pedilids hung freely by their mandibles. The pedilids detached about 10 hours later and apparently were no longer attracted by the *Meloe.* Examination of the meloid's abdominal tergites showed only very small scratches on their posterior margins.

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These observations gave no indication of pedilid feeding on *Meloe*. *Meloe* specimens in the West Virginia University Collection also show no damage such as that described by LeSage and Bousquet (1983). I agree with these authors that the phenomenon of elytral chewing by pedilids may be uncommon.

The two attached pedilids in the current study held firmly to the *Meloe*, but appeared to be carried passively, generally not even clinging with the legs. This type of behavior is suggestive of that demonstrated by many groups of phoretic arthropods. It is unlikely, however, that beetles as relatively mobile as pedilids would benefit from phoresy on another insect, especially one as sluggish as the flightless *Meloe*.

The behavior of the unattached pedilid indicated that is was detecting *Meloe* from a distance and was strongly attracted to it. While visual orientation may have been important, the possibility of chemical attraction seems more likely. A chemical of obvious consideration is cantharadin, the allomone secreted by meloid beetles when disturbed. Pedilid orientation to *Meloe* chemicals might be for any of a number of purposes: protection from natural enemies by means of *Meloe's* repellant fluid; attraction to the chemical for feeding; or use of *Meloe* as an aggregation site for mating. Another possibility is that pedilids as larvae or adults associate in some fashion with *Meloe* eggs. These suggestions can be only speculative at this point.

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ANNOUNCEMENT

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TRICHOPTERA OF THE CAHABA RIVER SYSTEM IN ALABAMA[1]

S.C. Harris[2], P.K. Lago[3], P.E. O'Neil[2]

ABSTRACT: Distribution records for 146 species of caddisflies collected in the Cahaba River basin are presented and seasonal occurrence and abundance of each are indicated. Annotations include habitat notes and geographical distributions. Seven undescribed species are reported for the river system and two northerly species are newly reported from southeastern United States. Distinct faunas were differentiated on the basis of stream size and physiographic province.

The Cahaba River is one of the largest free-flowing rivers in Alabama. Although there is some municipal and industrial drainage into the river, large stretches remain relatively undisturbed. The biota of the river is considered to be particularly rich and unique, with 32 plants, 23 mollusks, and 9 fishes considered threatened or endangered within Alabama occurring in the river system (Boschung, 1976; Freeman et al., 1979). Studies of the aquatic insect fauna of the river have been few and primarily limited to environmental impact studies in the Birmingham area. This study lists the caddisfly species known to occur in the Cahaba River system and annotates their distribution. Distribution patterns are discussed in more detail in Harris et al. (in press) with which this paper should be considered a companion.

Description of River System

The Cahaba River originates north of Trussville, Alabama (fig. 1) in the Valley and Ridge physiographic province and flows southerly for nearly 245 km before joining the Alabama River near Selma on the East Gulf Coastal Plain. Within the Valley and Ridge, the river flows in the Cahaba Valley flanked by the Cahaba and Coosa Ridges. Soils are typically nonresistant sandstone and shale with some unconsolidated deposits of sand, clay and gravel. North of Centreville, which is situated on the fall line, the river flows through an area rich in limestone and dolomite. This is the most scenic and unique portion of the river, with the limestone outcroppings

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forming extensive shoals. The majority of species considered rare in the river system occur in this small section. South of Centreville the river flows across the Coastal Plain. The soils of this physiographic province are primarily fine to coarse sands and sandy clay with some deposits of gravel. In total, the river drains an area of approximately 4,700 km^2.

Water quality in the river is generally good (Table 1), although some degradation seems to have occurred in those river sections and tributaries in the Birmingham area. Dissolved oxygen levels are lower and nitrate and phosphate levels higher in the river sections near Birmingham, particularly in Shades Creek, a river tributary receiving domestic sewage.

Collecting Sites and Methodology

Adult Trichoptera were collected using UV light traps (BioQuip Universal Trap) at 24 localites in the Cahaba River basin (Fig. 1). Collections were concentrated within five sections of the river: river headwaters above Birmingham (sites 1-4, 6, 7); main river channel between Birmingham and Centreville (sites 8, 11, 12, 17, 18); river tributaries between Birmingham and Centreville (sites 5a, 5b, 10, 13-16, 19); main channel and tributaries in the Coastal Plain physiographic province (sites 20-24); and springs (sites 5c, 5d, 9, 15). Sampling was most intensive in the section of river north of Centreville which is considered the most unique portion faunistically (Chermock, 1977). Collections at sixteen sites were made at approximately monthly intervals, while collections at the remaining eight sites were made irregularly. Light traps were situated on the stream banks and operated for approximately one hour after dusk. Specimens were collected and preserved in 70% ethanol. In all, 81 collections were made in 1981 and 1982. Over 54,000 specimens, primarily males, were examined during the course of the study.

Annotated List of Species

Included with each species is information on distribution and abundance within the Cahaba River watershed. Collecting stations are shown in figure 1. Since collections were made at several dates within each month, seasonal occurrences were broadly defined. Distribution annotations are brief with a more detailed discussion contained in Harris et al. (in press). Number of specimens collected is indicated by ( ). In most cases only males of the species were identified and enumerated. Voucher specimens are deposited at the Geological Survey of Alabama and in the collections of the authors.

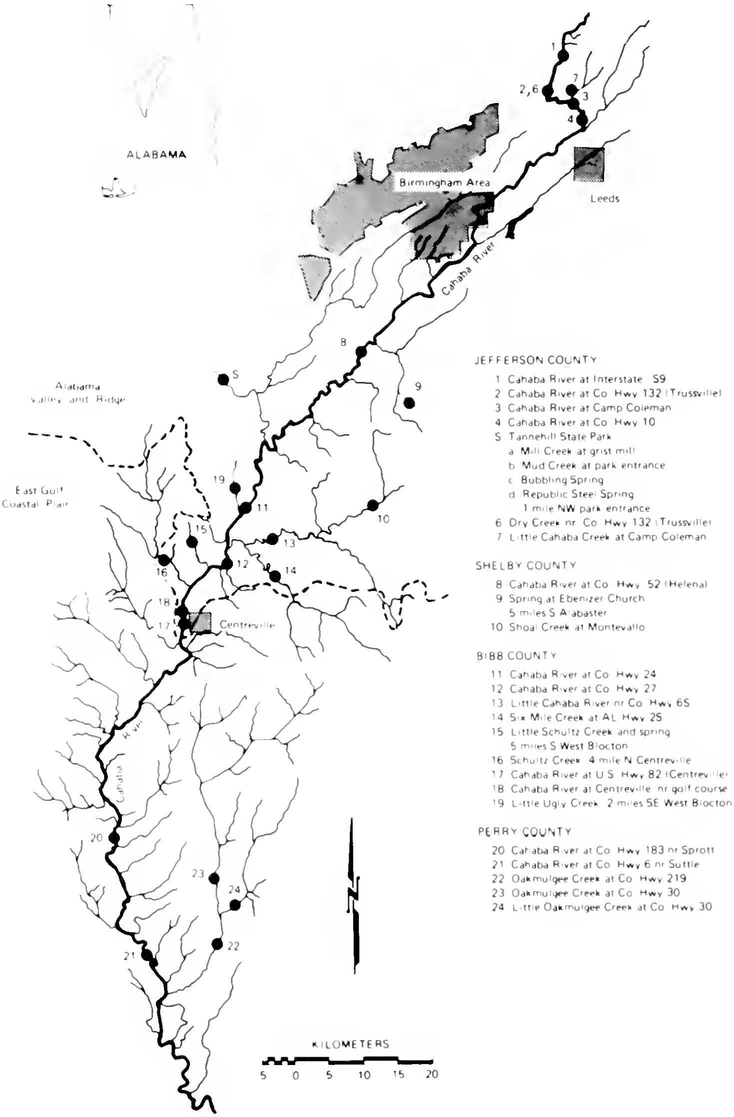

Figure 1. Collecting stations in the Cahaba River basin.

Hydropsychoidea

Philopotamidae

Chimarra aterrima Hagen. Stations 5b, 5d, 6, 13, 16. March-October. (12)

C. moselyi (Denning). 2, 14, 16, 18, 22, 23. Widely collected and common in the basin, but most numerous in Coastal Plain tributaries. April-October. (78)

C. n. sp. 8, 12, 16, 18, 20-23. Collected in large tributaries and main river channel. June-August. (37)

C. obscura (Walker). 1-4, 5b, 5d, 8, 11-13, 15, 16. The most common *Chimarra* collected in the basin, widely distributed north of the fall line. April-October. (145)

Wormaldia moesta (Banks). 5c. May. (1)

Psychomyiidae

Lype diversa (Banks). 1-5c, 6, 8, Collected primarily in small tributaries and headwaters of the main river channel. April-October. (45)

Psychomyia flavida Hagen. 1, 2, 5a, 5b, 12-16, 18. Widespread and common in basin north of the fall line. (175)

Polycentropodidae

Cernotina calcea Ross. 4, 11-14, 18. Collected in large tributaries and main river channel. May-September. (71)

C. spicata Ross. 2, 11-13, 15, 20, 22, 23. Widely distributed in the basin. May-June, September. (56)

Cyrnellus fraternus (Banks). 3, 4, 5d, 8, 11-13, 16, 18, 20, 22. Widely distributed and common in the basin. May-October. (457)

Neureclipsis crepuscularis (Walker). 3, 11, 13, 16, 20. Collected in large tributaries and main river channel. April-October. (78)

N. melco Ross. 13, 23. June, September. (2)

Nyctiophylax affinis (Banks). 15, 16, 20. April, June, October. (6)

N. banksi Morse. 6. May. (1)

N. celta Denning. 1, 2, 12-14, 16, 18, 21-23. Widely distributed and abundant in the basin. May-October. (1527)

N. denningi Morse. 6. May. (2)

N. moestus Banks. 5a, 15. Only collected in two small tributaries during the spring and fall. (6)

Phylocentropus carolinus Carpenter. 14, 16. April, August (3)

P. placidus (Banks). 7, 8, 23, 24. Primarily collected in small tributaries. April, June, September. (13)

Polycentropus cinereus Hagen. 1, 2, 5c, 6, 13, 14, 16. Collected in small tributaries and river headwaters north of the fall line. April-June, September. (60)

P. confusus Hagen. 1-6, 14-16, 19. Primarily collected at the river headwaters and in small tributaries north of the fall line. April-October. (134)

P. crassicornis Walker. 5b. May. (1)

P. n. sp. (nr. *elarus*). 6. May. (2)

Hydropsychidae

Cheumatopsyche burksi Ross. 23. June. (1)

C. campyla Ross. 1, 3, 4, 5d, 7, 11, 12. Primarily collected in the main river channel north of the fall line. May-October. (616)

C. edista Gordon. 12. Primarily a Coastal Plain inhabitant. October. (1)

C. ela Denning. 3, 4, 5d, 8, 10-12, 14. Collected primarily in the main river channel north of the fall line. April-October. (43)

C. geora Denning. 16, 19. Rare in the basin but common in small central Alabama streams. August-October. (10)

C. gracilis (Banks). 1, 2, 5a, 13, 14. Collected in large tributaries, primarily station 13, and headwaters of the Cahaba. May-September. (66)

C. minuscula (Banks). 3, 5c, 8, 11-15, 18, 19. The most common Hydropsychidae collected, widespread in basin north of fall line. April-October. (2919)

C. n. sp. 1. July. (1)

C. nr. *wabasha.* 12. Probably represents a new species since *C. wabasha* Denning is only known from the Pacific northwest. October. (1)

C. oxa Ross. 1-3, 5a, 5b, 5d, 9, 15. Collected in springs and at the headwaters of the Cahaba. May-October. (89)

C. pasella Ross. 4, 8, 11-17. Widespread in basin north of the fall line. April-October. (721)

C. pettiti (Banks). 2-5a, 5d, 6-8, 12, 15, 16, 23. Widespread in basin although never collected in large numbers. April-October. (138)

C. sordida (Hagen). 14, 20-23. Primarily restricted to the Coastal Plain. April, June-September. (52)

Ceratopsyche cheilonis (Ross). 1-5a, 8, 10-16. Widespread in basin north of the fall line but most abundant at station 13. April-October. (345)

C. sparna (Ross). 1, 2, 5a, 5b, 14. Primarily occurring in small tributaries and headwaters of the Cahaba. May, October. (9)

Diplectrona modesta Banks. 21. September. (1)

Hydropsyche alvata Denning. 14, 20-23. Except for a single specimen taken at station 14, restricted to the Coastal Plain, primarily in the main river channel. May-June. (547)

H. betteni Ross. 11. May. (5)

H. depravata Hagen. 1, 3, 5a, 5b, 8, 10, 13-16. Widespread in river tributaries north of the fall line. April-October. (123)

H. dicantha Ross. 15, 19. April-May. (2)

H. elissoma Ross. 23. June. (2)

H. frisoni Ross. 1, 3, 4, 5a, 7, 8, 11-16, 19. Widespread in the basin north of the fall line but most abundant at station 13. (765)

H. hageni Banks. 3, 5d, 8, 11-14, 16, 18, 19. The most common *Hydropsyche* taken in the watershed; most abundant in the main river channel at station 12. April-October. (1089)

H. incommoda Hagen. 4, 14. May, August-September. (4)

H. mississippiensis Flint. 3, 14, 20, 22-24. Primarily collected in Coastal Plain tributaries to the river. April-July. (73)

H. orris Ross. 11-14, 17, 20-23. Primarily collected on the Coastal Plain. April-October. (296)

H. rossi Flint, Voshell and Parker. 1, 4, 5d, 8, 11, 12, 14, 16, 20-23. Widespread in the basin, but most common on the Coastal Plain. April-October. (179)

H. scalaris Hagen. 13, 14. May, September. (6)

H. venularis Banks. 3, 4, 8, 11, 14. Collected in large tributaries and main river channel north of the fall line. May-June, October. (9)

Macrostemum carolina (Banks). 8, 11-14, 17, 18, 20-23. Widespread in the basin, but most common on the Coastal Plain. June-August. (208)

M. transversum (Walker). 20, 21. Only collected on the Coastal Plain in the main river channel. June. (58)

M. zebratum (Hagen). 14. May. (3)

Potamyia flava (Hagen). 11, 12, 14, 20-23. Collected in large tributaries and main channel throughout the basin, but most numerous on the Coastal Plain. April-September. (515)

Rhyacophiloidea

Rhyacophilidae

Rhyacophila carolina Banks. 2, 5c, 6, 15. Collected in small tributaries and the headwaters of the Cahaba. May-September. (7)

R. ledra Ross. 1, 2. Restricted to the headwaters of the Cahaba. May, October. (8)

R. vuphipes. 13. Record tentative on the basis of larvae collected by D.A. Etnier. April.

Glossosomatidae

Agapetus hessi Leonard and Leonard. 14. May. (8)

A. rossi Denning. 14. This species and *A. hessi* only known in Alabama from this locality. May. (3)

A. tomus Ross. 1, 2, 13. May. (8)

Glossosoma nigrior Banks. 1, 2. Only collected at the headwaters of the Cahaba. May. (5)

Matrioptila jeanae (Ross). 14. May. (2)

Protoptila lega Ross. 2, 4, 5a, 8, 12-18. Widespread in basin north of the fall line, but most abundant at station 13. April-October. (1599)

Hydroptilidae

Dibusa angata Ross. 16. Many immatures collected at site in April from red algae (*Lemanea*). April. (16)

Hydroptila alabama Harris and Kelley. 2, 3, 14-16. Collected in small tributaries and at the headwaters of the Cahaba. May, August-October. (10)

H. amoena Ross. 14, 16. April-October. (24)

H. angusta Ross. 5d. July. (1)

H. armata Ross. 1-6, 8, 9, 11-16, 19. Widespread in basin north of the fall line, but most common in the main river channel at station 11. April-October. (4320)

H. callia Denning. 2. Only known Alabama locality for this species which had not been reported south of Kentucky previously. September. (2)

H. delineata Morton. 5d, 11-13, 15, 16, 18. Primarily collected in main river channel north of the fall line. April-October. (1490)

H. gunda Milne. 1-5a, 7, 8, 11-16, 18, 19, 21. Widespread in the basin primarily occurring above the fall line. April-October. (1889)

H. hamata Morton. 1-5a, 7, 8, 11-16. Widespread in basin north of the fall line, but most abundant at station 13. May-October. (903)

H. n. sp. (nr. *amoena*) 2, 5a-5c, 15, 19. Collected in small tributaries and at the headwaters of the Cahaba. April-October. (73)

H. n. sp. (nr. *eramosa*). 15. May, October. (2)

H. n. sp. (nr. *molsonae*). 22-24. Collected in Coastal Plain tributaries to the river. April, June. (225)

H. novicola Blickle and Morse. 15, 23, 24. Collected primarily in Coastal Plain tributaries. April-June, October. (13)

H. quinola Ross. 3, 4, 5b, 8, 11-16, 19, 21-23. Widespread in the basin. April-October. (260)

H. spatulata Morton. 3, 4, 5d, 11, 12, 15, 18. Widespread in basin north of the fall line, but most common in the main river channel. April-October. (33)

H. waskesia Ross. 1, 2. Only known Alabama locality for this species. May. (3)

H. waubesiana Betten. 2-5b, 7, 8, 11-16, 18-20, 22, 23. Most frequently collected caddisfly in the basin, widespread in watershed. April-October. (6608)

Mayatrichia ayama Mosely. 16. August. (13)

Neotrichia alabamensis Kelley and Harris. 22, 23. June, September. (3)

N. minutisimella (Chambers). 20, 23. As was *N. alabamensis*, only collected in the Coastal Plain. June, September. (4)

N. vibrans Ross. 4, 15, 16. July-October. (30)
Ochrotrichia graysoni Parker and Voshell. 1-3, 12, 13. Previously only known from Virginia, most abundant at station 13. May-October. (2466)
O. riesi Ross. 5b. October. (1)
O. tarsalis (Hagen). 2, 5d, 11, 12, 16-18, 20, 21. Widespread in basin. May-October. (309)
Orthotrichia aegerfasciella (Chambers). 1-5a, 5d, 7, 8, 12, 14-16, 18-23. May-October. (146)
O. cristata Morton. 1-4, 8, 13, 15, 16, 18, 22. As was *O. aegerfasciella,* widespread in the basin. June-October. (51)
Oxyethria coercens Morton. 12-14, 16, 19. Primarily a northeastern species; this record represents the southermost extension of its range. April-May, August-October. (45)
O. forcipata Mosely. 1. October. (1)
O. janella Denning. 11, 12, 22. September-October. (8)
O. lumipollex Kelley and Harris. 22. April. (2)
O. novasota Ross. 4, 5d, 13, 15, 16, 23. May-August. (14)
O. pallida (Banks). 1-4, 5d, 8, 11-15, 19-23. Widespread in the basin. April-September. (171)
O. zeronia Ross. 1-3, 5b, 5d, 14-16. Widespread, but uncommon, in basin north of the fall line. May-October. (20)
Stactobiella martynovi Blickle and Denning. 2, 4-5b, 11-14, 16, 19. Primarily collected in small tributaries north of the fall line. April-May. (208)
S. n. sp. 16. April. (4)

Limnephiloidea

Phryganeidae
Agrypnia vestita (Walker). 16. October. (1)
Ptilostomis ocellifera (Walker). 9. July. (1)
P. postica (Walker). 21. April. (1)

Brachycentridae
Brachycentrus numerosus (Say). 16. Record from a single larva identified by O.S. Flint. March.
Micrasema rusticum (Hagen). 16. April. (114)
M. wataga Ross. 1-3, 5a, 5c-6, 14-16. Widespread in tributaries to the river north of the fall line. August-October. (32)

Limnephilidae
Goera calcarata Banks. 15. May, September. (9)
Ironoquia punctatissima (Walker) 4, 13, 15, 20. September-October. (8)
Neophylax sp. 13. Record from larva collected by D.A. Etnier. April.
Pycnopsyche indiana (Ross). 1, 3, 4, 15, 16. Collected in small tributaries and headwaters of the river. October. (14)
P. luculenta (Betten). 16. October. (1)
P. scabripennis (Rambur). 5b, 15, 16. October. (5)

Lepidostomatidae
Lepidostoma latipenne (Banks). 15 May. (1)

Helicopsychidae
Helicopsyche borealis (Hagen). 1, 2, 4, 5a, 6, 13, 15, 16. Primarily collected in small tributaries and headwaters of the river. May-October. (224)

Leptoceridae
Ceraclea ancylus (Vorhies). 5a, 11, 13. Primarily collected in the main river channel at station 11. May-June. (224)

C. cancellata (Betten). 3-5a, 8, 11-14, 20-23. Widespread in the basin but most commonly collected in the main river channel. May-August. (892)

C. flava (Banks). 4, 8, 11-13, 20-23. Distribution similar to that of *C. cancellata*. May-June. (395)

C. maculata (Banks). 1, 3, 4, 5d, 8, 11-15, 18, 20-23. Widespread and abundant in the basin. May-October. (2713)

C. nepha (Ross). 1-5c, 13, 14. Primarily collected at the headwaters of the river. May. (128)

C. ophioderus (Ross). 8, 11, 13, 20-23. Primarily collected in the main river channel on the Coastal Plain. June, September. (775)

C. protonepha Morse and Ross. 1-5c, 8, 11, 13, 14, 19. Widespread in basin north of the fall line, but most commonly collected at the river headwaters. April-June. (325)

C. resurgens (Walker). 12, 14, 23. April. (7)

C. tarsipunctata (Vorhies). 1, 3, 4, 8, 11-16, 20-23. Widespread in the basin, but most numerous in the main river channel. April-June. (631)

C. transversa (Hagen). 5a-5d, 11-14. May-July. (78)

Mystacides sepulchralis (Walker). 1-3, 5b, 14-16. Collected in small tributaries and at the river headwaters. May-October. (28)

Nectopsyche candida (Hagen). Within the watershed, only collected in the Coastal Plain. June. (21)

N. exquisita (Walker). 8, 11-13, 20, 23. May-September. (78)

N. pavida (Hagen). 2-4, 8, 11, 12, 14, 16, 21, 23. As was *N. exquisita*, widespread in the basin. May-October. (42)

N. spiloma (Ross). 11, 12, 21. Only collected in the main river channel, easternmost range extension of this species. June-October. (25)

Oecetis avara (Banks). 3, 11-13, 16-18, 20-23. Widespread in the basin, but most abundant in the main channel and larger tributaries. May-September. (1814)

O. cinerascens (Hagen). 3, 11, 15, 20, 23. May-June, September. (28)

O. ditissa Ross. 1-4, 5b, 5d, 8, 12, 13, 15, 16, 18, 20-23. Widespread in the basin. May-October. (90)

O. inconspicua (Walker). 1-5d, 8, 10-16, 18, 20-23. More common than *O. ditissa*, but with a similar distribution within the basin. May-October. (736)

O. morsei Bueno-Soria. 13, 16, 22. June-October. (14)

O. nocturna Ross. 1-4, 8, 11-14, 16, 21-23. Widespread in the basin, with distribution similar to that of *O. ditissa* and *O. inconspicua*. May-October. (234)

O. osteni Milne. 1, 16. September-October. (2)

O. persimilis (Banks). 1-5a, 5d, 8, 11-14, 16, 18. Widespread in the basin, north of the fall line, but most numerous in large tributaries and main river channel. May-October. (429)

O. scala Milne. 11-13, 16, 18. Most commonly collected at station 16. June-October. (385)

O. sphyra Ross. 13, 16, 20-23. Primarily collected in river tributaries on the Coastal Plain. June-August. (224)

Setodes dixiensis Holzenthal. 11, 13, 15, 16, 22. Most common in large tributaries, particularly station 13, and main river channel. May-June, September-October. (482)

S. guttatus (Banks). 14. Previously only known from the northeastern United States. This species has also been collected in southern Alabama. August. (1)

Triaenodes ignitus (Walker). 1-4, 5b-6, 9, 18, 22. Widespread but uncommon in the basin. May-October. (21)

T. injusta (Hagen). 1, 2, 8, 11, 12, 14. Primarily collected in the main channel north of the fall line. May-June, September. (33)

T. perna Ross. 2, 5a, 12. May. (4)

T. smithi Ross. 23. June. (1)

T. tarda Milne. 22. June. (1)

SUMMARY

The Cahaba River yielded 146 species of caddisflies in 45 genera and 13 families. Hydroptilidae (35 species), Hydropsychidae (34 species), and Leptoceridae (32 species) were the dominant families. In comparison to the few caddisfly studies conducted on other large southeastern rivers (Resh et al., 1975; Gordon and Wallace, 1975), the Cahaba River seems to support a particularly rich fauna. The wide diversity of habitat in the river, including the rocky, swift waters of the headwaters, the shoal areas north of the fall line, and the slow, sandy waters of the Coastal Plain, probably accounts for the rich fauna.

The majority of species and individuals were collected during May and June (112 species, 36,647 specimens), but a diverse fauna was also present during September and October (90 species, 3,134 specimens). While most species were collected throughout the study period, including *Cheumatopsyche minuscula, Hydropsyche hageni,* and *Hydroptila armata,* others had more restricted emergence patterns. *Stactobiella* n.sp., *Dibusa angata,* and *Ceraclea resurgens,* for example, were collected only during early April, while others such as *Pycnopsyche* spp. and *Ironquia punctatissima* only occurred during early October.

Cluster analysis, using Jaccard's coefficient and based on species presence or absence at a station, indicated that the caddisfly fauna of the Cahaba basin also displayed geographical distribution patterns (Harris et al., in press). In general, three areas of the river system were recognized on the basis of a similar caddisfly fauna: a main river and large tributary fauna of the Valley and Ridge region (97 species); a headwater and small tributary fauna of the Valley and Ridge region (101 species); and a Coastal Plain fauna (58 species). Although many species were widely distributed within the basin, several were more restricted. *Hydropsyche betteni* was only collected in the main river channel above the fall line; eight species including *Macrostemum transversum* and *Nectopsyche candida* only occurred on the Coastal Plain; and 43 species, including *Agapetus* spp. and *Rhyacophla* spp., were collected only in tributaries and at the river headwaters.

These distribution patterns appear to be influenced primarily by physical parameters, including stream size, flow regimes, and substrate. Water quality within the watershed seemed to have a limited impact on species abundance and distribution. Of those parameters measured and compiled over a 35-year period, only dissolved oxygen levels were noticeably lower in some sections of the river (O'Neil, 1983). Water quality deterioration in the basin appears to be primarily limited to Birmingham and the surrounding area.

Table 1. Ranges of physiochemical water parameters in the Cahaba River basin (1976-1981)

Parameters	River sections				
	Upper Cahaba River	Upper Cahaba River (Shades Creek)	Middle Cahaba River (Birmingham area)	Middle Cahaba River (Centreville area)	Lower Cahaba River
Dissolved oxygen (mg/l)	4.8-13.0	1.4-12.0	1.1-13.0	2.9-15.0	7.1-14.1
Temperature (°C)	1.0-29.0	3.0-31.0	4.0-30.0	5.0-32.0	6.0-29.5
pH (units)	5.2-8.7	5.7-9.2	5.7-8.6	6.4-8.9	6.7-8.2
Hardness (mg/l)	14-180	20-230	17-120	24-140	26-97
Specific conductance (μmhos/cm)	55-680	139-657	104-315	24-380	76-228
Alkalinity (mg/l)	5-123	10-189	9-169	18-140	24-90
Sulfate (mg/l)	1.0-220	6.0-60	10-39	3.0-46	3.0-17
Nitrate (mg/l NO_3-N)	0-9.8	.03-35	0-6.5	0-2.3	0-1.0
Phosphate (mg/l)	.02-3.0	.05-4.2	.01-2.1	1.0-2.1	---
Discharge (cfs)	---	11-7,220	0.39-1,440	90-83,600	224-83,400

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A CHECKLIST OF THE STONEFLIES (PLECOPTERA) OF KENTUCKY[1]

Donald C. Tarter, Dean A. Adkins[2], Charles V. Covell, Jr.[3]

ABSTRACT: Examination of numerous collections and published records has resulted in a summary of the stoneflies of Kentucky. A total of 77 species representing nine families and 30 genera is found in the state. Five state records are added to the plecopteran fauna of Kentucky. Fifteen additional species which occur in nearby states, but which have not yet been found in Kentucky, are also noted.

Prior to 1982, little detailed work had been focused on the identification of stoneflies from Kentucky. Some investigators, including Ross and Ricker (1964), Illies (1966), Ricker and Ross (1968), Zwick (1973), White (1974), James (1976), Stark and Baumann (1978), Harker et al. (1979, 1980) and Picazo and DeMoss (1980), have published plecopteran records for the state. In a preliminary checklist, Tarter et al. (1982) recorded 70 species of stoneflies for Kentucky. The classification system of Illies (1966) and Zwick (1973) is followed in this study.

The following numbers of species have been recorded from nearby states: Illinois - 49 species (Frison, 1942); Ohio - 42 species (Gaufin, 1956); Indiana - 61 species (Bednarik and McCafferty, 1977); Virginia - 116 species (Kondratieff and Voshell, 1979); and West Virginia - 106 species (Tarter and Kirchner, 1980).

Fifteen additional species should eventually be collected in Kentucky. The folowing list includes species which occur in nearby states: *Acroneuria mela* Frison (IN, IL), *Allocapnia illinoensis* Frison (VA, IN, IL), *Alloperla banksi* Frison (VA, IL), *A. caudata* Frison (IL, IN, OH, VA), *Attaneuria ruralis* Hagen) (IL, VA, OH), *Hydroperla crosbyi* (Needham and Claassen) (IN, IL), *Isogenoides varians* (Walsh) (IN, IL, TN, VA), *Isoperla decepta* Frison (IN, OH, IL), *I. dicala* Frison (WV, VA, IN), *I. orata* Frison (WV, VA, OH), *Leuctra tenuis* (Pictet), WV, IN, VA, OH), *Paracapnia angulata* Hanson (WV, VA, IN), *Paragnetina kansensis* (Banks) (IN, IL), *Prostoia completa* (Walker) (WV, IN, VA) and *Talloperla maria* (Needham and Smith) (VA, TN, WV).

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Order **Plecoptera**
Suborder **Arctoperlaria**
Group **Euholognatha**
Superfamily **Neumouroidea**
Family **Leuctridae**
Subfamily **Leuctrinae**

Leuctra alexanderi Hanson
L. ferruginea (Walker)
L. sibleyi Claassen
Paraleuctra sara (Claassen)
Zealeuctra claasseni (Frison)
Z. fraxina Ricker and Ross

Family **Taeniopterygidae**
Subfamily **Brachypterinae**

**Oemopteryx contorta* (Needham and Claassen)
Taenionema atlanticum Ricker and Ross
Strophopteryx fasciata (Burmeister)

Subfamily **Taeniopteryginae**

Taeniopteryx burski Ricker and Ross
T. lita Frison
T. maura (Pictet)
T. metequi Ricker and Ross
T. parvula Banks

Family **Nemouridae**
Subfamily **Amphinemurinae**

Amphinemura delosa (Ricker)
A. nigritta (Provancher)
A. varshava (Ricker)
A. wui (Claassen)

Subfamily **Nemourinae**

Prostoia similis (Hagen)
Soyedina vallicularia (Wu)

Family **Capniidae**

Allocapnia cunninghami Ross and Ricker
A. curiosa Frison
A. forbesi Frison
A. frisoni Ross and Ricker
A. granulata (Claassen)
A. indianae Ricker
A. mystica Frison
A. mystica Frison
A. nivicola (Fitch)
A. ohioensis Ross and Ricker
A. pygmaea (Burmeister)
A. recta (Claassen)
A. rickeri Frison
A. smithi Ross and Ricker
A. vivipara (Claassen)
A. vivipara (Claassen)
A. zola Ricker

Group **Systellognata**
Superfamily **Pteronarcyoidea**
Family **Pteronarcyidae**

Allonarcys proteus (Newman)
**Pteronarcys dorsata* (Say)
**P. pictetii* Hagen

Family **Peltoperlidae**
Subfamily **Peltoperlinae**

Peltoperla arcuata Needham

Superfamily **Perloidea**
Family **Perlodidae**
Subfamily **Isoperlinae**

Isoperla bilineata (Say)
I. burski Frison
I. clio (Newman)
**I. holochlora* (Klapalek)
I. marlynia Needham and Claassen
I. namata Frison
I. nana (Walsh)
I. richardsoni Frison
I. similis (Hagen)
I. transmarina (Newman)

Subfamily **Perlodinae**

Cultus dicisus (Walker)
Diploperla robusta Stark and Gaufin
Helopicus subvarians (Banks)
Malirekus hastatus (Banks)
Remenus bilobatus (Needham and Claassen)

Family **Chloroperlidae**
Subfamily **Chloroperlinae**

Alloperla chloris Frison
A. idei (Ricker)
A. imbecilla (Say)
Hastaperla brevis (Banks)
Sweltsa onkos (Ricker)

Family **Perlidae**
Subfamily **Acroneuriinae**

Acroneuria abnormis Newman)
A. carolinensis (Banks)
A. evoluta Klapalek
A. filicis Frison
A. internata (Walker)
A. lycorias (Newman)
A. perplexa Frison
Eccoptera xanthenes (Newman)
Perlesta placida (Hagen)
P. frisoni Banks
**Perlinella drymo* (Newman)
P. ephyre (Newman)

Subfamily **Perlinae**

Neoperla freytagi Stark and Bauman
N. gaufini Stark and Baumann
N. stewarti Stark and Baumann
Paragnetina media (Walker)
Phasganophora capitata (Pictet)

*state record

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INSECT MARKING TECHNIQUES: DURABILITY OF MATERIALS[1,2]

Susan A. Wineriter, Thomas J. Walker[3]

ABSTRACT: Durability of 26 marking materials was tested on three species of insects for usefulness in studies requiring long-term recognition of individual insects. The three — chosen for their differences in size, cuticular surface, and habitat — were a field cricket, *Gryllus rubens*; a mole cricket, *Scapteriscus acletus* (pubescent, burrowing); and a flour beetle, *Tribolium castaneum* (small, oily). Non-water-soluble paints proved most suitable. One of these, Tech-Pen Ink, remained on all three species of test insects throughout their adult lives. The nature of the surface to which the marks were applied and marking conditions influenced how long a material adhered.

Recognition of individuals is important in many studies of insects, such as those dealing with territoriality or reproductive success. This generally requires a marking material that lasts the lifetime of the adult insect. Many art, hobby, and industrial products might serve this purpose. In most studies, whatever material is tried and works at all is used from then on. Generally no time can be spared for finding an optimal marking material. Although Walker and Wineriter (1981) tested the durability of three highly-rated materials, this study is the first extensive survey of the performance of candidate marking materials in long-term studies. We report here the durability of 26 marking materials on the pronata of three species of insects.

MATERIALS AND METHODS

Test insects were southeastern field crickets, *Gryllus rubens,* southern mole crickets, *Scapteriscus acletus,* and red flour beetles, *Tribolium castaneum.* These species were chosen because of their differences in size, cuticular surface, and habitat, and their ease of rearing. Southeastern field crickets are insects of moderate size, have smooth, shiny pronota, and live in leaf litter; southern mole crickets are larger-than-average, have pubescent pronota, and live in subterranean tunnels; red flour beetles are small, have shiny, oily pronota, and inhabit grain products.

Marking materials were selected by perusing art, hobby shop, and office supply stores, talking with students and colleagues, and corresponding with companies that might make suitable materials. The 26 materials chosen are listed in Table 1. If the product was known or suspected to be particularly

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durable, more than one color of the product, if available, was tested (viz. Tech-Pen Ink and Liquid Paper Correction Fluid).

Insects were marked as follows. A dot (mark) of each material was applied to each quadrant of the pronotum of five young adult individuals of each species (N = 20 dots/material/species). A marking system using dots was selected because the marks are easy to apply and read (Walker and Wineriter 1981). More elaborate marks, e.g. numbers or letters, can be used only on insects with large writing surfaces and have the disadvantage of making the insect highly conspicuous. Materials were applied in several ways. The bent tip of a minutin pin was used to apply dots to red flour beetles. The broken sharp tip of a wooden applicator stick was used to mark field crickets and the blunt end of a wooden applicator stick was used to mark mole crickets, except that the applicator brush was used for Liquid Paper Correction Fluid, and the marker tip was used for Pentel White Marker.

Each set of marked individuals (5 insects with 20 marks of one material) was placed in a container with the appropriate food. Mole crickets were allowed to burrow in damp sand, and flour beetles in flour. At one-week intervals food was replenished, and insects were checked for partially or wholly missing marks and or mortality. Checks continued until more than 50% of the marks were lost on living insects in a container (i.e. until the median mark was lost), or until all insects were dead.

The data were analyzed using two ranking systems. The first system determined which materials were likely to stay on throughout the adult life expectancies of the insects; the second, if marks were lost, whether marks disappeared gradually or all at once. These systems are explained fully in footnote "a" of Table 1.

RESULTS

Results are detailed in Table 1. Materials that were water-soluble when applied, though water-resistant or waterproof when dry, generally adhered poorly. Of eight such materials tested, six did not last well on any of the three insects used. A seventh material, Stroblite Daybrite Tempera, stayed on mole crickets and field crickets but not on flour beetles. The remaining material, Dupont Latex Enamel, was not durable on field crickets or flour beetles, but our data suggests it would adhere to mole crickets.

Non-water-soluble materials were more durable. Only one material, Tech-Pen Ink, was successful in marking all three insect species. For flour beetles it was not consistent, but no other material was successful in marking flour beetles, according to the criteria of this study. Two materials, Liquid Paper Correction Fluid and Nissen Metal Marker, dried before they could be applied to the flour beetles and could not be evaluated. (The amount of material needed for a mark was small, and these paints were fast-drying.) For Creme L'Oreal Nail Accents, the results on flour beetles were inconclusive because the experiment was inadvertently terminated early; however, almost 50% of the marks were lost by the sixth week, indicating this material would not be highly rated. For mole crickets, in contrast to flour beetles, 16 of 18 non-water-soluble materials adhered well. Phosphorescent Ink PB412 did not adhere well and Pentel White Marker stayed on only two out of three times. Where more than one color of a material was used, as in Tech-Pen Ink and Liquid Paper Correction Fluid, or repetitions of the same color, as in Tech-Pen Ink orange, results were consistent for mole crickets (except for Pentel Pen as mentioned above).

Only 9 of 18 non-water-soluble materials adhered well to field crickets, 5 materials did not, and the data for 3, though inconclusive because the crickets died too soon, suggest these materials would have worked well. When more than one color of a material was used Tech-Pen Ink was consistent in results while Liquid Paper Correction Fluid was not.

Of those materials that were durable throughout the life expentancy of the three insects, evidence of peeling, chipping or flaking was rare (see Table 1). Most partial loss of marks occurred in materials used on mole crickets, fewer on field crickets, and almost none on flour beetles. Liquid Paper Correction Fluid was the only material that gradually disappeared on both mole crickets and field crickets.

Non-water-soluble materials had varying qualities that affected their ease of application and "scorability" over time. Most of these materials, except some colors of Tech-Pen Ink, had to be mixed well before application because the pigment tended to separate from the base. If this was not done, the marks made with these paints were less pigmented and more difficult to score. Many materials, such as Gams Printer's Ink, were very fluid and bled when applied, sometimes forming irregular and poorly pigmented marks that were difficult to score. A few materials, such as Tech-Pen Ink and Pactra Hi-Glo, were more viscous and formed regular, easy-to-score marks. Two materials, Liquid Paper Correction Fluid and Pentel Pen, faded over time. Buff, a color of Liquid Paper Correction Fluid, lost its distinctiveness after two weeks on mole crickets and appeared white. Some materials like Tech-Pen Ink and Pactra Hi-Glo were particularly easy to score because of their bright and heavily pigmented colors. Other colors such as Creme L'Oreal Nail Accents and Stroblite Paint were less intense and required bright or UV light to be viewed easily.

DISCUSSION

Although the use of many marking materials has been reported in the literature, this is the first extensive, comparative study. Many materials used by earlier workers have been discontinued or chemically altered. We have attempted to test and compare a large number of materials currently available. However, those using materials reported here should be cautioned that these too may be discontinued or chemically altered without the user's knowledge.

Our ultimate goal in this study was to find marking materials that would be useful for marking a variety of adult insects of different sizes, surface qualities, and habitats for long-term studies. Walker and Wineriter (1981) describe the perfect marking material as one that does not peel, chip or flake, and is durable, non-toxic, easy to apply, quick-drying, light-weight, and available in several easy-to-distinquish colors.

We found that in almost all situations non-water-soluble materials adhered better than water-soluble materials to our test insects. Our results suggest, however, that the nature of the surface being marked affects the durability of the material and whether the results are repeatable. The non-water-soluble materials adhered much better and more consistently to the pubescent pronotum of mole crickets than to the smooth shiny surface of field crickets or the oily surface of flour beetles. However, the more abrasion a material received, as in mole crickets continually tunneling through soil, the more likely the material was to chip, flake, or peel.

The best material for marking insects in long-term studies, according to our tests, is Tech-Pen Ink. Only Tech-Pen Ink stayed on all three species of insects as long as adults are expected to live under field conditions — although the durability of marks on flour beetles varied. We attribute this inconsistency to variation in the oiliness of the beetle pronotum or to slight alteration in the marking conditions or materials. Tech-Pen Ink is available in 11 colors. All are easily distinguishable in daylight, and most are distinguishable by flashlight at night. The inks are not usually available locally and must be ordered from scientific suppliers or the manufacturer in New Jersey (see Appendix). The material comes in a tube without an applicator. Application can be tricky especially when the ink starts to dry and becomes stringy; fresh paint should alway be used for best results. For larger insects, this inconvenience can be overcome by using a paint pot similar to one designed by W.D. Hamilton (Walker and Wineriter 1981). For insects the size of flour beetles, application is painstaking; small amounts of the material dry rapidly and the ink must be applied as quickly as possible.

In searching for an optimal marking material, several considerations must be made: the size and habitat of the insect, the nature of the surface to be marked, and the duration of the study. Materials that are water-soluble when wet even though water-resistant or waterproof when dry should be avoided. Non-water-soluble materials will probably work best and a number will probably work well in short-term studies (4 weeks or less), but the number of durable materials useful for long-term studies, especially on small insects or insects having smooth, shiny or oily surfaces, seems limited. Of eighteen non-water-soluble materials compared in this study, only one, Tech-Pen Ink, was durable on all three insects.

Table 1. Durability[a] of 26 marking materials[b] applied as a dot on each quadrant of the pronotum of 5 individuals of each of three species of insects (N = 20 dots/paint/species).

Non-water-soluble Materials	*G rubens*	*S. acletus*	*T. castaneum*
1) Tech-Pen Ink			
yellow	A,B (> 7, > 7; 2, > 6[h]	A (> 18, > 18)	F (< 1, 2)
orange	2A,B (> 5, > 5; > 5, > 5; 1, > 7)[c]	4A,B, B* (> 23, >23; > 18, > 18; > 10, > 10; > 10, > 10; 9, > 15; 6, > 10)[c]	B,2F (5, 29; < 1, 4; 3, 6[i])[c]
white	A (> 7, > 7)	A (> 15, > 15)	F (< 1, 6)
red	B (3, > 8)	? (> 9, > 9,)	2B (< 1, 20; 5, > 53)[h]
green	B (< 1, > 5)	A (> 14, > 14)	—
blue	—	—	F (1, 7)
2) Liquid Paper C.F.			
white	B* (< 1, > 6)	A (> 19, > 19; > 18, > 18)[h]	Could not be applied[e]
buff	F (< 1, 4)	A (> 15, > 15)	Could not be applied[e]
green	F (< 1, < 1)	A (> 15, > 15)	Could not be applied[e]
goldenrod	B** (2, > 8)	A,A*(> 15, > 15; > 11, > 11)[h]	Could not be applied[e]
blue	A* (> 7, > 7)	? (> 7, > 7,)	Could not be applied[e]
3) Gams Printer's Ink			
dayglo rocket red	B** ,2, > 7)	A (> 17, > 17)	F (< 1, 2)
4) Glo-in-the-Dark P.P	F (< 1, <)	A (> 17, > 17)	F (< 1, < 1)
5) Pactra 'Namel			
gloss white X-2	B (2, > 5)	A (> 15, > 15)	F (1, 8)
6) Pactra Scale Model F.			
brick red M8	? (> 4, > 4)	A (> 14, > 14)	F (< 1, 2)
7) Lumikwik 566			
daylt.-fluorescent			
red-orange	F (< 1, 3)	A (> 14, > 14)	F (< 1, 1)
8) Pentel White Marker	F (< 1, < 1)	2A*, F(> 11, > 11; 10, > 20; 3, 8)[h]	2F (< 1, < 1; 1, 1[i])
9) Nissen Metal Marker			
red	B (2, > 5)	B (8, > 15)	Could not be applied[e]
10) Pactra Aero Gloss Dope			
swift white 64-1	F (< 1, < 1)	2B** (< 1, > 15; < 1, > 22)[h]	F (< 1, < 1)
11) Naz-Dar Screen Ink			
daylt.-fluorescent			
5593 crimson red	B (2, > 5)	A* (12, > 14)	F (<1, 3)
12) Pactra Hi-Glo			
orange	B (2, > 6)	—	F (≤ 2, 5)[f]
yellow	—	B (9, > 14)	—
13) Stroblite Paint			
yellow-orange	A (> 6, > 6)	B,B*(1, 16; 5, > 12)[h]	F (< 1, 2)
14) Pactra Formula U Poly			
20073 aviation yellow	? (< 1, > 3)	B (5, 15)	F (< 1, 2)
15) Testors Pla Enamel			
1145 white	? (> 4, > 4)	A (> 12, > 12)	F (<1 , 2)
16) Creme L'Oreal Nail A			
British redcoat	F (< 1, 2)	A (> 11, > 11)	? (≤ 1, ≥ 6)[g]
17) Sam 100 white	B (2, > 8)	A (> 12, > 12)	F (< 1, 3)
18) Phosphorescent Ink	? (< 1, > 4)	F (< 1, 2)	F (≤ 2, 4)[f]
Water soluble Materials (waterproof or water resistant when dry)			
19) Stroblite Tempera			
Chartreuse VL	B (< 1, > 7)	B** (3, > 14)	F (< 1, < 1)
20) Dupont Latex Enamel			
gloss white, 1800C	F (<1, < 1)	? (4, > 9)	F (< 1, < 1)
21) Speedball Opaque Ink			
red	F (< 1, < 1)	—	F (< 1, < 1)
yellow	—	F (1, 8)	—

	G. rubens		S. acletus		T. castaneum	
22) Hyplar Acrylic Titanium white H212	F	$(<1, <1)$	F	$(\leq 1, \leq 2)^d$	F	$(<1, <1)$
23) Liquitex Acrylic Titanium white #432	F	$(<1, <1)$	F	$(<1, <1)$	F	$(<1, <1)$
24) Rich Glo Daylight Fluorescent Paint D43 red-orange	F	$(<1, <1)$	F	$(<1, 1)$	F	$(<1, <1)$
25) Designer's Gouache 536 zinc white	F	$(<1, <1)$	F	$(<1, <1)$	Would not adhere	
26) Speedball Water-Soluble Fluorescent Block Printing Ink magenta 3428	F	$(<1, <1)$	F	$(<1, <1)$	F	$(<1, <1)$

[a]Durability scoring system.

A = likely to last as long as adult live under field conditions. A paint received an "A" if 100% of the marks stayed on greater than or equal to the following life expectancies: *G. rubens*, 5 weeks; *S. acletus*, 10 weeks, and *T. castaneum*, 20 weeks. The numbers in parenthesis are the data (n_1, n_2). n_1 is the number of weeks before the first mark was lost; n_2 is the number of weeks before the median mark was lost. $> n_1$, $> n_2$ means all insects died before any marks were lost. n_1, $> n_2$ means one or more marks were lost but the median mark was not lost before all insects died. Thus, if n_1 is $\geq$ the life expectancy, the paint is given an "A." (Note that loss of one mark can determine that a marking material does not earn an "A.")

B = some marks likely to be lost, at least in long-term studies. A paint received a "B" if < 100% but > 50% of the marks stayed on for the life expectancy of the insects. Thus, for *G. rubens* $n_1 < 5$, $n_2 \geq 5$.

F = should not be used. A paint received an "F" if < 50% of the marks stayed on for the life expectancy of the insects. For *G. rubens* $n_2 < 5$.

? = insects died too soon to evaluate paint using the above criteria.

If a material stayed on as long as the life expectancy of the insects, i.e. 5 weeks in *G. rubens*, 10 weeks in *S. acletus* and 20 weeks in *T. castaneum*, the material was scored for its adhesive property as well.

A or B - marks rarely peeled, chipped, or flaked. In every week during the life expectancy of the insects, the number of partial marks on living insects was < 10%.

A* or B* - marks sometimes peeled, chipped, or flaked. In at least one week during the life expectancy of the insects, the number of partial marks on living insects exceeded 10% but never 50%.

B** - marks often peeled, chipped, or flaked. In at least one week during the life expectancy of the insect, the number of partial marks on living insects was 50%.

[b]For more information on materials see Appendix.

[c]Since all sets of insects could not be marked on the same day, one set of insects was marked with Tech-Pen Ink, orange, every time insects were marked.

[d]Marks not scored first week, thus $n_1 \leq 1$, $n_2 \leq 2$.

[e]Liquid Paper Correction Fluid and Nissen Metal Marker dried too fast to be applied as very small dots.

[f]Marks were not scored the second week, thus $n_1 \leq 2$ weeks.

[g]Marks were difficult to score (color not very opaque) and were not successfully scored until the second week using a brighter light, thus $n_1 \leq 1$; insects were terminated by mistake before the median mark was lost, thus $n_2 \geq 6$.

[h]More than one set of insects was marked if there was some question about how they were marked or reared.

[i]Data from Walker and Wineriter 1981.

APPENDIX

Listed below is additional information about marking materials that were highly rated on at least one of the test insects. The materials are in the same order as in Table 1.

1) **Tech-Pen Ink,** developed for marking laboratory glassware, 11 colors; Mark-Tex Corp., 161 Coolidge Ave., Englewood, NJ 07631.

2) **Liquid Paper Correction Fluid,** 9 colors, also useful as a background material on which a number can be written with a technical pen (see Walker and Wineriter 1981); Liquid Paper Corp., 9130 Markville Dr., Dallas, TX 75243.

3) **Gams Printer's Ink,** reported as successful marking material on ants (S.D. Porter and B.M. Glancey, pers. comm. 1980), available in 10 daylight-fluorescent colors, appears thick but when applied bleeds gradually, marks near one another merge together; Gams Ink, 1919 W. 2300 South, Salt Lake City, UT 84119.

4) **Glo-in-the-Dark Phosphorescent Paint,** Series P-5100, pale in daylight, glows brightly in dark or under UV light, pigment separates from base readily, must be repeatedly mixed for best results; Conrad-Hanovia, Inc., 100 Chestnut St., Newark, NJ 07105.

5) **Pactra 'Namel,** available in 38 colors (17 flat, 21 gloss), hobby paint, bleeds when

applied, color remains bright over time; Pactra Industries, Hobby Div., 16946 Sherman Way, Suite 300, Van Nuys, CA 90028.

6) **Pactra Scale Model Flats**, available in 24 colors (flat), hobby paint, thin, bleeds when applied, marks become different sizes; Pactra Industries, Hobby Div., 16946 Sherman Way, Suite 300, Van Nuys, CA 90028.

7) **Lumikwik 566**, daylight-fluorescent poster ink, available in 6 colors, thick, easy to apply; Advance Process Supply Co., 400 Noble St., Chicago, IL 60622.

8) **Pental White Marker**, delivers a fine line of opaque-white, oil base ink that dries quickly, fades over time, must be mixed well for best results; Pentel of America, 1100 Arthur Ave., Elk Grove Village, IL 60007.

9) **Nissen Metal Marker**, ball point (not used, material squeezed through puncture in side of tube), bright opaque ink available in 12 colors; John P. Nissen, Jr., Co., Glenside, PA 19038.

10) **Pactra Aero Gloss Fuel Proof Dope**, hobby paint, available in 25 colors, thin; Pactra Industries, Hobby Div., 16946 Sherman Way, Suite 300, Van Nuys, CA 90028.

11) **Naz-Dar Screen Process Ink**, No. 5500 series silk screen ink, available in 10 daylight-fluorescent colors; Naz-Dar Co., 1087 N. Northbranch, Chicago, IL 60622.

12) **Pactra Hi-Glo**, daylight-fluorescent poster paint available in 6 colors, thick, easy to apply; Pactra Industries, Hobby Div., 16946 Sherman Way, Suite 300, Van Nuys, CA 90028.

13) **Stroblite Daybrite Bulletin Paint**, poster paint, brightest on light surface or on dark surface under UV light, available in at least 4 colors; Stroblite Co., Inc. 10 E. 23rd St., New York, NY 10010.

14) **Pactra Formula U Polyurethane**, hobby paint, available in 18 colors (15 gloss, 3 flat); Pactra Industries, Hobby Div., 16946 Sherman Way, Suite 300, Van Nuys, CA 90028.

15) **Testors Pla Enamel**, hobby paint, available in 100 colors, 6 fluorescent; The Testor Corp., 620 Buckbee St., Rockford, IL 61101.

16) **Creme L'Oreal Nail Accents**, nail polish, thin, not very opaque; Cosmair, Inc., Dist., New York, NY 10036.

17) **Sam 100**, flat poster ink, available in 22 colors, thick, easy to apply; Advance Process Supply Co., 400 N. Noble St., Chicago, IL 60622.

ACKNOWLEDGMENTS

We are grateful to personnel from the following companies for supplying information and marking materials for use in this study: Mark-Tex Corp.; Liquid Paper Corp.; Gams Ink; Conrad-Hanovia, Inc.; Pactra Industries; Advance Process Supply Co.; Pentel of America; John P. Nissen, Jr. Co.; Naz-Dar Co.; The Testor Corp.; Shannon Luminous Materials Co.; Litelab Corp.; Stroblite Co., Inc.; Berol USA; Eberhard Faber, Inc.; Somay Products, Inc.; Day-Glo Color Corp.: U.S. Radium Corp.; Independent Ink Co.; Radiant Color of Ciba-Geigy Corp.; and The Joseph Dixon Crucible Co.

We are also indebted to these colleagues: D.W. Hagstrum provided information on rearing flour beetles and laboratory facilities; B.M. Glancey gave us samples of Gam's Printer's Ink; T.G. Forrest collected insects and recorded data; D.K. Simon provided information on Pactra paints; S.A. Jungreis assisted in contacting companies.

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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.) 129 30 March 1984

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 41, part 1, on 29 March, 1984 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.

1759 *Heliconius erato* Aurivillius, 1882 (Insecta, Lepidoptera): proposed conservation under the plenary powers.

2266 *Curculio picirostris* Fabricius, 1787 and *Tychius stephensi* Schönherr, 1836 (Coleoptera, Curculionidae): proposed conservation under the plenary powers.

2312 *Dapsilarthra* Foerster, 1862 (Insecta, Hymenoptera): proposed conservation under the plenary powers.

R.V. MELVILLE, Secretary

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

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

The following Opinions have been published by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature,* volume 41, part 1, on 29 March, 1984:

ITZN 59 30 March, 1984

Opinion No.

1264 (p. 8) *Oscinis plumigera* Loew, 1860 (Insecta, Diptera): suppression by use of the plenary powers.

1269 (p. 19) METRIDIIDAE Carlgren, 1893 (Anthozoa) and METRIDIIDAE Sars, 1902 (Copepoda): a ruling to eliminate the homonymy.

1270 (p. 22) *Chrysomela flavicornis* and *C. tibialis* Suffrian, 1851 (Insecta, Coleoptera): conserved..

1273 (p. 28) *Anaspis, Luperus, Lampyris* and *Clerus* (Insecta, Coleoptera): determination of authorship and fixation of type species.

1274 (p. 32) *Notonecta striata* Linnaeus, 1758 (Insecta, Hemiptera): neotype designated under the plenary powers.

1276 (p. 36) *Semblis marginata* Panzer, 1799 (Insecta, Plecoptera): 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 may 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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ENTOMOLOGICAL NEWS

125th ANNIVERSARY ISSUE

THE AMERICAN ENTOMOLOGICAL SOCIETY

ENTOMOLOGICAL NEWS is published bi-monthly except July-August by The American Entomological Society at the Academy of Natural Sciences, 1900 Race St., Philadelphia, Pa., 19103, U.S.A.

The American Entomological Society holds regular membership meetings on the third Wednesday in October, November, February, March, and April. The November and February meetings are held at the Academy of Natural Sciences in Philadelphia, Pa. The October, March and April meetings are held at the Department of Entomology, University of Delaware, Newark, Delaware.

Society Members who reside outside the local eastern Pennsylvania, southern New Jersey, and Delaware area are urged to attend society meetings whenever they may be in the vicinity. Guests always are cordially invited and welcomed.

Officers for 1983-1984: President: Charles E. Mason; Vice-President: Joseph K. Sheldon; Recording Secretary: Roger W. Fuester; Corresponding Secretary: Harold B. White; Treasurer: Jesse J. Freese.

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Back issues of most numbers may be obtained by writing to the office of The American Entomological Society, 1900 Race St., Philadelphia, Pa., 19103, U.S.A.

Membership dues: $7.00 per year (regular); $4.00 per year (student).

Manuscripts and all communications concerning same should be addressed to the editor: Howard P. Boyd, 232 Oak Shade Road, Tabernacle Twp., Vincentown, New Jersey 08088, U.S.A. Manuscripts will be considered from any authors, but papers from members of the American Entomological Society are given priority. It is suggested that all prospective authors join the society. All manuscripts should follow the format recommended in the AIBS *Style Manual for Biological Journals* and should follow the style used in recent issues of ENTOMOLOGICAL NEWS. Three doublespaced, typed copies of each manuscript are needed on 8½ x 11 paper. The receipt of all papers will be acknowledged and, if accepted, they will be published as soon as possible. Articles longer than eight printed pages may be published in two or more installments, unless the author is willing to pay the entire costs of a sufficient number of additional pages in any one issue to enable such an article to appear without division.

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(Continued on inside of back cover)

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THE 125th ANNIVERSARY OF THE AMERICAN ENTOMOLOGICAL SOCIETY[1]

Charles E. Mason[2]

ABSTRACT: The American Entomological Society (AES) recently celebrated its 125th anniversary with a commemorative meeting held February 15, 1984, at The Academy of Natural Sciences of Philadelphia. The AES is the oldest entomological society that has been in continuous existence in the western hemisphere. It has a rich history and was instrumental in the development of entomology as a science in the United States. This paper, which was presented at the meeting, gives a brief overview of the history of the AES and its impact on the development of American entomology. The paper also serves as an introduction to other papers presented at the commemorative meeting on key aspects of the history of the society. These other papers are published in this issue of *Entomological News,* in the sequence in which they were presented.

It is particularly fitting that The American Entomological Society have its 125th anniversary commemorative meeting on February 15, 1984. For it was just the day before this day, 125 years ago on February 14, 1859, that Ezra T. Cresson, James Ridings and George Newman got together and decided to form an entomological society. On February 15, 1859, an invitation was sent from these three gentlemen to 16 other persons asking them to attend a meeting on February 22 to discuss establishing a society for the purpose of advancing the study of insects. It is noteworthy that the fiftieth anniversary commemorative meeting was held February 15, 1909, which featured a talk on the history of The American Entomological Society presented by one of the founders, Ezra T. Cresson.

The society was originally named The Entomological Society of Philadelpha. After eight years, on February 23, 1867, its name was changed to The American Entomological Society. The name was changed because at the time it was the only society in the United States devoted entirely to the study of entomology and it had published the *Proceedings* since 1861 which was one of the earliest publications devoted to insects. Also, this publication had received wide recognition. Upon changing the society name, the *Proceedings* was changed to *Transactions of The American Entomological Society,* and was first published under this title in June 1867. It has continued without interruption in publication to the present.

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[2] President, The American Entomological Society, Associate Professor, Department of Entomology and Applied Ecology, University of Delaware, Newark DE 19717-1303.

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It is believed that The American Entomological Society is the oldest entomological society that has been in continuous existence in the Western Hemisphere. The Society serves as the American birth place for the cultural development of entomology as a science. In many ways The American Entomological Society has contributed a great deal to the heritage of entomology in the United States. For many years it was the only entomological society in the United States that had interests continental in scope.

From the very beginning its founders were committed to the advancement of entomology as a science. They saw the need for publication of observations and new knowledge about insects; they saw the value of a good insect collection, especially representing insects of North America; they saw the need for a complete library of entomological literature; and finally they saw the importance of having financial stability in the form of contributions and endowments to ensure that these goals would be carried out. The society today still maintains these commitments. It has three publications, the *Transactions, Entomological News* and *Memoirs,* all well known throughout the world. The insect collection is also well known. It is maintained by The Academy of Natural Sciences of Philadelphia and is well represented with Orthoptera, Coleoptera, Hymenoptera and other specific insect taxa. The library, also maintained by the Academy, has over 15,000 volumes on entomology. Because of several bequests made to the society throughout its history, the capital assets now exceed $350,000. The income from these endowments is used to supplement the cost of publications, to purchase entomological books and periodicals for its library and to cover general operating expenses of the society's office located in the academy building at 19th and Race Streets.

The American Entomological Society was the first to publish a journal devoted to economic entomology. *The Practical Entomologist* was initiated as the second journal of the society in 1865. This publication included short papers of popular aspects of entomology and was distributed among farmers and other agriculturalists. However, it was started before a need for this type of publication was fully recognized and appreciated by the public. Due to lack of support *The Practical Entomologist* was not published after 1867.

During the period following 1867, the emphasis of interest by members and the types of articles in the publications of The American Entomological Society were in the basic rather than applied aspects of entomology. Much was published in its journals in the areas of systematics, morphology, biology and ecology. As the field of entomology advanced, new subdivisions developed in the discipline, particularly in the applied areas. These included chemical control, biological control and insects as vectors of disease, just to name a few. Because of the growth throughout the field of entomology, other entomological societies developed along the way, some with the encouragement of The American Entomological Society.

The formation of the Entomological Society of America, currently the largest entomological society located in North America, had its roots in Philadelphia in conjunction with The American Entomological Society. Several members of The American Entomological Society were instrumental in the early stages of organizing the Entomological Society of America. There was a joint meeting held December 19, 1904, at The Academy of Natural Sciences of Philadelphia. The meeting included members of The American Entomological Society, the Association of Economic Entomologists, the Entomological Section of the Academy and The Feldman Collecting Social. Dr. P.P. Calvert, then president of The American Entomological Society, was made chairman of the joint meeting and Dr. Henry Skinner, then recording secretary of the Society, was made secretary of the joint meeting. Dr. Calvert led the discussion at this meeting on the need for having a national entomological society that would be truly American in nature and which would represent the interests of all aspects of entomological science. Dr. J. Chester Bradley, a resident member of The American Entomological Society, moved that a committee be appointed to consider the organization of an American society in which all branches of entomology would be represented. The committee, consisting of J.C. Bradley, H.T. Fernald and E.D. Sanderson, was selected to pursue the matter. Dr. Bradley reported in the Nov. 1906 issue of *Entomological News* on the formation of the Entomological Society of America.

The relationship between The American Entomological Society and The Academy of Natural Sciences of Philadelphia has been germain to the survival of the society. Without the support of the academy in providing office space, curatorial services, library facilities and meeting rooms, The American Entomological Society would have had difficulty in maintaining a continued existence. The society owes a great deal of gratitude to the academy for the support received. In turn the academy has benefited from its association with The American Entomological Society through contributions to the library and insect collections and through the publication of articles in journals of the society.

It is gratifying to be a member of The American Entomological Society and realize its rich history. Its founders were on the right track in establishing a society in 1859 for the purpose of advancing knowledge about insects. Before that time, little was known about insects other than that there were a lot of them. Now, 125 years later, we have thousands of volumes of information on insects. This is a short period of time when you think of it in terms of two times the age of a 62.5 year old person, which is a little less than the average life span. Without a doubt, The American Entomological

Society has played a major role in the advancement of entomology as a science during the past 125 years.

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COMMUNICATION

February 8, 1984

Dr. Charles Mason, President
The American Entomological Society

Dear Dr. Mason,

Congratulations to you and The American Entomological Society on its 125th Anniversary. I regret that a previous commitment prevents me from attending.

The Academy recognizes the crucial role that The American Entomological Society has played in the development of entomological study at this institution. We are particularly grateful for the donation of the society's entire collection and for the use of your library, which is the finest in the world.

We are proud of our association during these 125 years. The American Entomological Society has reflected credit and favor on the Academy.

Sincerely,

Howard P. Brokaw
Chairman of the Board
The Academy of Natural Sciences
of Philadelphia

SOCIETY MEETING OF FEBRUARY 15, 1984

The 125th Anniversary of the founding of The American Entomological Society was celebrated at The Academy of Natural Sciences of Philadelphia on Wednesday evening, February 15, 1984. Twenty members and twelve guests attended the special program devoted to the history of the society. The American Entomological Society is the oldest continuously-operating entomological society in the Western Hemisphere.

President Charles E. Mason called the ceremonies to order and had each member of the audience introduce himself. He then read several letters of congratulations from members and dignitaries who were unable to attend. Most fitting was a $125 contribution from Dr. Charles Hodge IV to be used for the purchase of a book or something of lasting value. Dr. Mason continued with an account of the founding of the society.

The society's library of approximately 15,000 volumes is integrated with the library of The Academy of Natural Sciences. This collection of entomological works is one of the finest such collections in the country and is particularly noted for its many rare 19th century volumes. Howard P. Boyd, editor of *Entomological News* and former president of the society, recounted how the library began its growth with the founding of the society and eventually became so large and valuable that it was moved to the academy in 1876. The long and sometimes rocky association between the society and academy was told with irony and humor.

About the time of the transfer of the USDA Beneficial Insects Laboratory to the University of Delaware in 1973, the society began to hold some of its meetings in Newark, Delaware. To many this was thought to be the first Newark-Philadelphia connection in the society. Dr. William H. Day, chairman of the society's finance committee and former president dispelled that illusion. Thomas B. Wilson, M.D. (1807-1865), a founder of The American Entomological Society, was a resident of Newark, Delaware. In addition to being a major benefactor of the society and the academy, contributing thousands of volumes to their libraries and financing major expansions to house his donated collections, he was also intimately associated with the development of what was to become the University of Delaware. His brother, with whom he lived, was president of that fledgling academic institution for 11 years. It is a quirk of fate that T.B. Wilson died from typhus, a disease which was later found to be tranmitted by insects.

Another founder of the society was Ezra Townsend Cresson. He served the society in a variety of important positions for 67 years. In that he married Mary Ann Ridings, daughter of another of the society's founders, it is understandable that his two sons E.T., Jr. and George B. Cresson were entomologists associated with the society. Roger W. Fuester, recording secretary of the society, discussed the contributions of the Cresson family. Although the family was involved with the society for 89 years, none ever served as president. It is reported that the elder Cresson actively discouraged nomination to that position.

The *Transactions* of the The American Entomological Society is one of three periodicals published by the society. The current editor, Dr. Daniel Otte, presented an analysis of the importance of the *Transactions* in describing the diversity of insect life. Over 16,000 species and 1000 genera have been described in this publication. A curious dip in the descriptions of new taxa in the *Transactions* during the 1950's prompted considerable discussion and speculation among society's members.

Philip P. Calvert, long-time editor of *Entomological News,* first attended an American Entomological Society meeting at the age of 16 in 1887. He was president in 1909 when the society celebrated its 50th anniversary and he lived to participate in the 100th anniversary. His 74-year association with the society is probably a record. Dr. Harold B. White, corresponding secretary of the society, spoke about the important role the society and the academy played in the preprofessional development of Philip Calvert. He suggested that we should learn from our history and in the future realize our potential for exciting and sustaining the interest of budding entomologists.

The final presentation of the evening was about James A.G. Rehn by Dr. Selwyn S. Roback, editor of the *Memoirs* of The American Entomological Society. Dr. Roback, a personal friend of Mr. Rehn, cited Rehn's many contributions and great dedication to the society. This presentation and others commemorating the 125th anniversary are published in extended form in this issue of *Entomological News.*

In addition to the formal presentations, there were displays of many early photographs, publications and memorabilia from the archives of The Academy of Natural Sciences. These were expertly presented by Mrs. Carol Spawn, academy archivist with the assistance of Mrs. Mildred Morgan, society secretary. Mrs. Morgan capped the delightful meeting by presenting President Mason with a new gavel to replace the one that apparently has been lost.

Harold B. White,
Corresponding Secretary

COMMUNICATION

February 15, 1984

To The President and Council of The American Entomological Society:

On the occasion of the American Entomological Society's 125th anniversary, The Academy of Natural Sciences, and its staff, Board of Trustees, and membership, send greetings and best wishes.

We congratulate the American Entomological Society for 125 years of uninterrupted contributions of research and scholarship in the science of entomology; for a distinguished record of publication; for its continuing efforts in fostering interest in and dedication to the science of entomology among many generations of scientists of America.

The ties between The American Entomological Society and The Academy of Natural Sciences are long-standing. May this historic association continue to flourish throughout this century and the next.

Thomas Peter Bennett
President
The Academy of Natural Sciences
of Philadelphia

THE LIBRARY OF THE AMERICAN ENTOMOLOGICAL SOCIETY AND A BRIEF REVIEW OF THE SOCIETY'S ASSOCIATION WITH THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

Howard P. Boyd[1]

ABSTRACT: Histories of the library of The American Entomological Society and the society's association with The Academy of Natural Sciences of Philadelphia are reviewed.

It is not the intent of this paper to retell the history of The American Entomological Society. That story has been told adequately in at least three recorded histories. Nevertheless, in order to trace the story of our society's *library* holdings, on the occasion of this 125th anniversary meeting, it will be necessary to infringe, to some extent, upon history.

The Entomological Society of Philadelphia, later, in 1867, to become The American Entomological Society, was organized on February 22, 1859. Less than one year later, at a meeting on December 12, 1859, it was resolved "to establish a library of entomological literature for the use of members, and a committee was appointed to take charge of such books and pamphlets as may be contributed." Thus the importance of a good entomological library was recognized from the very beginning and, over the past century and a quarter, the library of The American Entomological Society has proven to be one of its' most useful and valuable possessions.

The first contribution to the library was a copy of Melsheimer's Catalogue of the Coleoptera of North America, contributed by Dr. S.S. Haldeman at the meeting of January 9, 1860 held in the society's new large, second-floor meeting room in the home of Charles Wilt at 1308-10 South St. The next donation was made later that same month, on January 23rd, when Dr. Ezra T. Cresson presented twelve volumes and four pamphlets. Next month, on February 13, Dr. Thomas B. Wilson donated eight volumes to the library. This latter was only the beginning of a series of donations of rare works by Dr. Wilson during the last five years of his life.

The society continued to meet in Mr. Wilt's house for about two and a half years during which time the library continued to grow rapidly. The annual report of the recording secretary made at the meeting in December 1862 includes the statement that "there has been an increase of 344 volumes during the year, making a total of 473 volumes now on the shelves,

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[1]Immediate past president, The American Entomological Society; Editor, *Entomological News;* Honorary associate, Department of Entomology, The Academy of Natural Sciences, Philadelphia.

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including a number of rare and valuable works, whereby the student of entomology may have opportunities of research hitherto unattainable except at considerable expense."

Two short years later, at the close of 1864, according to Dr. Cresson in his 1909 history, the library contained 1,083 volumes and pamphlets, including a large number of valuable books on entomology contributed by Dr. Wilson and, following his death early in 1865, by his brother and executor, Rathmell Wilson. In total, according to Dr. E.T. Cresson, Jr., in 1909, Dr, Wilson contributed about 1500 volumes.

When, in 1862, the rapid increase in the library and collections made it necessary to obtain larger quarters, these were provided by James Ridings who constructed, for the sole use of the Society, a two story building at 518 South 13th St., on the northwest corner of 13th and Rodman Sts., to which the Society moved in August 1862. The Society continued to occupy this facility for thirteen and one half years, until January 1876.

The office of society librarian was created on September 9, 1867, with G.B. Dixon as the first librarian. In his first report, he credited the library with 1262 volumes and 849 pamphlets.

During the period when the society occupied its' own building on South 13th St., from 1862 to 1876, the library and collections of the society grew to such large proportions and were of such great value that the possibility of destruction of all this material by fire gave the members much concern, and possibilities of obtaining safer quarters were seriously considered. Efforts were even made to interest persons of wealth to provide a fireproof building for the society, but without success.

So, at a meeting held on April 12, 1875, Dr. George H. Horn suggested the possibility of securing "apartments" in the new building of The Academy of Natural Sciences at 19th and Race Sts. and a committee was appointed to determine the possibility and feasibility of an arrangement with the academy. After a number of conference meetings, the first of a series of agreements with the academy was reached on December 17, 1875 whereby the society has been permitted over all these succeeding years to occupy rooms within the academy building. The first meeting of the society in its' new quarters at the academy was held on February 14, 1876.

During this brief portrayal of library history and development up to this point, it is quite apparent that the various early moves of the society were dictated largely, at first, by the need for ever greater space for the society's library and collections holdings, and, later, by growing concerns for its' safety and protection. It was this latter concern that was the principal motivating factor in the society's decision to move to the academy's new facilities.

Contributions continued to play an important role in library acquisitions. Proof of this is contained in early catalogues of library holdings. Three early catalogues exist of works in the library of the society. These are: 1. a handwritten listing consisting of 35 5½ x 8½" pages and containing over 250 entries. This listing is undated but clearly was compiled early in 1864. 2. a printed catalogue dated "up to January 1st, 1868" consists of 32 6½ x 10" pages and contains 325 entries of more than 585 volumes, plus 45 serial journals and 13 miscellaneous publications. An interesting feature of these two early catalogues is that the contributor or other source of each entry is noted by "presented by" or "deposited by." In the 1868 listing, at least 265 or 45% of these were donated by Dr. Thomas B. Wilson or his executor brother, Rathmell Wilson. Another major contributor was Dr. Ezra T. Cresson who donated over 40 volumes. Other substantial contributors were J.C. Brevoort, A.R. Grote, S.S. Haldeman, Baron Osten-Sacken, and J.O. Westwood. 3. the third catalogue, a handwritten listing dated 1885, consists of 83 8½ x 11" pages, contains 582 entries, and shows the case, by capital letters, to which each was assigned.

In 1897, by his will, the entire library on Coleoptera of Dr. George H. Horn was donated to the society's library. As a result of all these contributions, the library in 1909, according to Dr. Cresson in his 1909 history, contained nearly 1300 titles, consisting of over 4100 volumes, of which over 2000 volumes represented journals of 190 societies.

In 1907, the society was bequeathed a one half interest in a tract of land in Texas by a member, Henry Shimer. The realization from the sale of this land, nearly $7,700, was invested in the library fund.

On November 2, 1936, an agreement was made with the academy for the removal of the society's library from the proximity of its collections and study rooms, where it had been for the previous sixty years, to the stack of the academy's library. Although this was only a change in physical location, it really was the forerunner of a new agreement to come eleven years later.

Until 1947, the society maintained and added to its' library without any outside assistance. However, the ever increasing size of the library, the complexitites of its' operation, and the increasing use(s) being made of it by researchers both within and outside the society, called for an operational change. Under terms of an agreement made on December 17, 1947, the society deposited its library with that of the academy, while retaining title and absolute ownership of it. The academy agreed to catalog the library, maintain it, and supervise its' circulation among members of both the society and the academy. The society continues to purchase, with restricted endowment funds, or exchange its' periodicals for, entomological books, periodicals, and serials, to the best of its' financial ability. In addition, the costs of binding all its' entomological literature are borne by the society's Cresson fund. The continuing objective of the society is the acquisition of all entomological literature pertinent to the pursuit of research in systematics, taxonomy, zoogeography, morphology, physiology and other non-applied entomological disciplines.

In the one hundred and twenty five years since the founding of the society's library, it has grown into one of the most important collections of systematic literature in America, particularly in the older and rarer categories. It now contains well over 15,000 volumes and many thousands of pamphlets, reprints, and separata, and it is still growing. In addition, many valuable journals have been and continue to be acquired through exchanges of society publications with those of other organizations.

Turning more, now, to the society's associations with The Academy of Natural Sciences, by the terms of the initial agreement of December 17, 1875, all members of the society became life members of the academy, but it was further agreed that no person could become a member of the society who was not also a member of the academy. This prevented membership in the society by anyone who, although an active entomologist, felt unable or unwilling to afford the additional annual dues of the academy. In consequence, membership in the society gradually declined to the point that many business meetings could not be held for lack of a quorum.

Another stipulation in this first agreement was that the members of the society would form and constitute the entomological section of the academy. In compliance with this, application was made to the academy for admission as an entomological section. This was granted by the academy and the section was duly organized and officers elected on May 12, 1876. For all practical purposes, this entomological section of the academy, comprising active and associate members of the society, carried out all the *scientific* activities of the society, while the society itself held its' meetings only twice a year, in June and December, for the transaction of business and election of officers and committees.

An interesting side-light of this society arrangement to become the entomological section of the academy is that in the year 1889, it was agreed that the section would "publish its proceedings, and such short notes as may be offered" at or near the first of each month. It was further agreed this publication would consist of at least 160 pages annually, to be published in ten monthly parts, except July and August, with the title *ENTOMOLOGICAL NEWS and Proceedings of the Entomological Section of the Academy of Natural Sciences of Philadelphia.* This new serial commenced publication in 1890. The interest here is that whereas the society's *Transactions* serial and *Memoirs* series both originated as and always have been society publications, in the case of *Entomological News,* although probably the same people were involved, whether society members or academy personnel, technically, at least, this really was an academy publication for the first thirty-five years of its' existence, from the time of its' first issue in 1890, until the sectional organization of the academy was abolished in 1924, following which it became a society publication.

A third major point in this early agreement with the academy required that all bequests, gifts, or donations of any property then possessed by, or acquired in the future by, the society, shall be considered and treated as the property of the academy during the continuance of the agreement. This, the members felt, was not the intent of the society so, in 1894, they submitted a revision to the effect that all such acquisitions shall remain the property of the society. However, this was not agreeable to the academy and considerable discontent was fostered, to the extent that there were discussions as to the advisability of withdrawing from the association with the academy. Finally, however, a new or second agreement was reached on June 17, 1895 which allowed the society to retain possession of its' collections and library in its' own name, but that "each specimen hereafter received by the Academy or the Society shall bear a label indicating its' ownership, in case of dissolution."

When, in 1914, there were insufficient funds to provide for the necessary curatorial service the society's collections demanded, the society proposed a new agreement under which the academy would assume the full salary of at least two curators, thus allowing the society to devote its' funds to its' library and publications. To this the academy would not agree, but a new, now third agreement was reached on December 7, 1915, in which the society agreed to deposit its' collections with the academy in perpetuity, the academy agreeing "to forever care for said collections of insects, along with all its' other collections, to the best of its' ability," the society "to continue its library" and publications "in such space as may be set apart, suitably heated and made convenient."

With the adoption of a new code of by-laws by the academy, on October 14, 1924, all former sections of the academy were abolished and the requirements in the agreement with the society regarding restrictions of membership were nullified. Thereafter, members of the society no longer were required also to be members of the academy. At the same time, the associates of the academy's former entomological section were invited to become members of the society and several availed themselves of this opportunity.

Current relationships between the society and the academy are governed by the basic agreement of December 7, 1915, supplemented by the library agreement of December 17, 1947. From this brief review of the society's library, collections, meeting facilities, *Entomological News* publication, and relationships with the academy, it is clear that these two organizations have had a very close working relationship for well over 100 years. It is hoped that the society and the academy believe that each has had, and will continue to receive, mutual benefits from the present arrangement.

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SOCIETY MEETING OF MARCH 21, 1984

The fourth regular meeting of The American Entomological Society was held on Wednesday evening March 21, 1984, in Townsend Hall on the University of Delaware campus. Seven members and ten guests attended a fascinating talk on "Forsenic Entomology" by Dr. Wayne D. Lord from the Walter Reed Army Medical Center.

Dr. Lord's thesis at the University of New Hampshire dealt with the succession of insect populations that decompose vertebrate carcasses. A knowledge of the species of insects present, their developmental stage, and their distribution on a carcass can provide a great deal of information about the time of death and in some cases the circumstances of death. Although Dr. Lord's interests were in the ecology of decomposition, it became apparent that this systematic approch to decomposition provides critical pieces of information that are sometimes difficult for law enforcement officers to obtain on decomposing bodies.

Within hours and sometimes minutes after death, calliphorid and sarcophagid flies will lay eggs on exposed facial and urogenital openings and on flesh wounds. Thus colonization of carcasses by new life practically coincides with death. Determination of the developmental stages of the various species on a carcass, combined with a knowledge of their developmental rates at different temperatures, allows one to deduce when the first eggs were laid and in turn the time of death. Staphylinid and silphid beetles arrive when their prey, the fly larvae, are well established. Still later, dermestid and trogid beetles consume connective tissue that was resistant to the initial decomposition. Dr. Lord discussed several homicide cases where knowledge of this type provided critical clues for the criminal investigators.

In notes of local entomological interest, Hal White reported that the dragon fly, *Gomphus (Stylurus) plagiatus* had been discovered in Delaware. This species, which had been expected in the state, was identified in a student insect collection by Robert Lake. Garnet Nye reported that a male promethea moth had emerged last week from a cocoon collected two years ago. This was considered rather unusual by those present.

Harold B. White
Corresponding Secretary

T.B. WILSON, MD., A FOUNDER AND BENEFACTOR OF THE AMERICAN ENTOMOLOGICAL SOCIETY, AND HIS FAMILY: OUR FIRST NEWARK, DELAWARE-PHILADELPHIA CONNECTION

W.H. Day[a]

ABSTRACT: Thomas B. Wilson (1807-1865) was one of 15 founders of The American Entomological Society (AES) in 1859. He contributed large sums of money, complete reference libraries, and comprehensive insect collections to the AES, and also helped guide this society in its early years. Several other Philadelphia organizations benefited from his generosity, especially The Academy of Natural Sciences. His contributions were so large and diverse that they greatly advanced the development of entomology and other natural sciences in the United States during their formative years in the 19th century.

Important contributions to science were also made by his brothers, Edward and William S. Wilson. Another brother, Rathmell, served on the Board of Trustees of Delaware College (now University of Delaware) in Newark for 41 years, and was acting president of the college for 11 years. Thomas' living quarters, private museum, and library were in a private wing of Rathmell's mansion, "Oaklands," southwest of Newark. Details on other Newark connections, and additional Wilson family members, are also included.

Throughout its 125 years of existence, The American Entomological Society (AES) has had members and subscribing libraries nationwide, as well as in many foreign countries. However, until recently, most members who attended regular meetings and those who managed the society (the governing "council") lived or worked within a 20-mile radius of the AES headquarters in Philadelphia.

From its founding in 1859, regular meetings of the society had always been held in Philadelphia. However, when the several U.S. Department of Agriculture laboratories in Moorestown, NJ, were closed (1971-73), most of the personnel were transferred to Newark, DE, joining staff and student entomologists at the University of Delaware. As a result, there were more AES members in the Newark area than in Philadelphia, so in recent years part of the society's business and regular meetings each year have been held in Newark.

The objectives of this paper are to: briefly review[1] the contributions of Thomas B. Wilson to the AES and other organizations; outline the little-known contributions of other members of his family to education and the

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[1]Details have already been published in Ennis et al. (1865).

sciences; and document the first connection between Newark, DE, and the AES in Philadelphia, which occurred more than 110 years before the recent one described above.

T.B. WILSON

Thomas B. Wilson was born in 1807 in Philadelphia, of wealthy British parents (Ennis et al. 1865) who lived in America for 20-30 years (W-D)[2]. He was well educated in sciences, pharmacy, and medicine in Philadelphia, PA, England, and Paris (W-D, W-A[3], Ennis et al. 1865). Although he earned the M.D. at the University of Pennsylvania at age 23 (W-A, Sharf 1888), he never maintained a medical practice (Ennis et al. 1865). His pursuits in the natural sciences may have begun when Thomas was temporarily in poor health (as asserted by Sharf 1888), but they were probably maintained by the great interest Thomas had in the natural sciences, and his financial independence. He and his brothers and sister probably did not need regular employment: for example, when Thomas was 33, his father gave each son nearly 11,500 English pounds, and each inherited a larger sum when the father died three years later (W-D).

T.B. Wilson lived in Philadelphia (except when on his extensive travels) until he was 26, when he moved to a farm in rural Chester County, PA, in New London Township, and lived with his brother Rathmell (Ennis et al. 1865, W-D, 1840 Census). A few years later (perhaps when Rathmell married in 1836) T.B. purchased and moved to his own farm, nearby, in East Nottingham Twp. (1840 Census). In about 1841, Rathmell moved to near Newark, DE with this wife and two children, and Thomas joined them (W-D). A third brother, William S., also lived with them during much of the 1839-1843 period (W-D).

Newark remained Thomas' principal residence for the rest of his life (W-D). He regularly traveled on the train to Philadelphia, and maintained rooms there (Ennis et al. 1865), for use when he was in the city to attend AES and other society meetings, for his large book purchases, and perhaps for managing his investments.

T.B. Wilson made many distant trips on horseback to collect birds, minerals, shells, reptiles, fish, and fossils — in addition to insects (Ennis et al. 1865). He also purchased entire collections of these groups, and of pertinent reference books, by mail and during his five trips to Europe (Ennis et al. 1865, W-D).

[2]Wilson papers (University of Delaware special collections, Morris Library, Newark DE): to save space this source is referred to in the text as "W-D."

[3]Wilson papers, The Academy of Natural Sciences archives, Philadelphia, PA: referred to as "W-A" hereafter.

Available information (W-D, Ennis et al. 1865) suggests that Thomas invested his inheritance wisely, mainly in transportation stocks and bonds (railroads and a few canals). His generosity is well-documented. During his membership (1832-1865) in The Academy of Natural Sciences in Philadelphia (the first institution of its kind in the United States), T.B.'s total gifts to this one scientific organization totaled $200,000 (my estimate, based on data in Ennis et al. 1865). This sum was a very large fortune at that time, making Thomas a principal benefactor of this organization. Not all of this amount was in cash; T.B. gave 12,000 books to the academy, and was co-donor of 26,000 worldwide birds (Ennis et al. 1865). The latter gift was made necessary when Thomas was poisoned a second time, while curating his collection, by the arsenic then used to protect birds from insect and fungus attack (Ennis et al. 1865). This massive collection was far too large for the academy's original building at Broad and Sansom Sts., so T.B. financed construction of a large addition (Ennis et al. 1865). He also donated excellent collections of minerals, fossils, shells, reptiles, and fish to the academy (Ennis et al. 1865).

Thomas B. Wilson was one of 15 founders of The American Entomological Society in 1859 (Cresson 1909). During the next six years, he gave about $26,000 to launch and sustain it (Ennis et al. 1865, Cresson 1909); some of these funds are still intact, as the "Wilson Fund," and help support the *Transactions of The AES.* He also donated to the AES at least 20,000 insects, and many now priceless books. For example, after his death, his 71 books on the Diptera were given to the AES. This was considered a complete collection of all known works on this order (Ennis et al. 1865). An oil painting of Thomas, apparently based on an engraving (in Cresson 1909) circa 1863, portrays his appearance during this period (Fig. 1).

Other known beneficiaries of his generosity were the Historical Society of Philadelphia, the Philadelphia Medical Society (Ennis et al. 1865), and Fairmount Park (W-D).

Despite his large and frequent gifts, T.B. Wilson was genuinely modest. His donations were always made on the condition that if his anonymity were not maintained, he would not contribute further in the future (Ennis et al. 1865).

Ennis et al. (1865) also credited Wilson with exceptional wisdom in guiding the AES in its early years. They state that he recognized that the academy could never be a strong advocate for the field of entomology alone, and that a separate organization was needed to advance this field. They also indicate that T.B. concluded that an independent journal was needed to ensure the publication of entomological studies, and that he was instrumental in establishing such a periodical in 1862. This publication continued for 6 years, then was superseded by the *Transactions of The AES,* now in its 118th year.

THE WILSON FAMILY

Thomas' father was Edward[4], a Quaker iron merchant (Ennis et al. 1865) who established the fortune that eventually enabled several of his children to contribute generously to science and education (W-D). He operated his successful business in Philadelphia from approximately 1795-1830 (my estimate). According to Lewis (1961), Edward owned a large townhouse on Chestnut St., which stood until ca. 1900. He returned to his estate, "Elm Farm"[5], in Lancashire (county) near Liverpool in about 1830 (W-D). His portrait (Fig. 2), in the University of Delaware Library, is evidently one of four copied from the original after his death, for distribution to his four sons[6] who lived elsewhere (W-D, W-A). The scene visible through the window on the left shows a train crossing a high bridge, probably a reference to Edward's investments in railroads (many family members purchased rail stocks (W-D)).

Edward and his wife Rebecca[7] (Bellerby) had five (known) sons, three of whom lived most or all of their lives in America (Thomas, Rathmell, and William S.). Details on the Wilson family were compiled to allow identification of various family members and determine their relationships for this paper, from fragmentary data in W-D and other sources, and these will be recorded in Day (198-, in prep).

William S. Wilson[8] lived in the U.S. until he was about 40, and is known to have made extensive collections of minerals (W-D)[9]. He moved to Paris in about 1843, and often assisted Thomas in obtaining and shipping specimens and books back to America. The limited information that I've seen suggests that he earned his living by careful investments (W-D).

In about 1853, William returned to America with his family and may have constructed a large mansion for himself, four row homes on property he already owned (all probably in Philadelphia), and a large commercial building[10].

The remaining two sons, Edward (Jr.)[11] and Charles[11], were probably younger, because they returned to England with their parents (W-D). I have

[4]ca. 1772-1843 (W-D).

[5]Erroneously referred to in Ennis et al. (1865) as "Elmwood."

[6]When donated by Wilson descendents in ca. 1956, they believed that this portrait was of T.B. Wilson (W-A).

[7]Ca. 1776-after 1855. Listed as "Elizabeth" in Ennis et al. (1865), but her letters to Thomas (W-D) are signed "R. Wilson," indicating that Elizabeth is either a middle name or an error (she had a daughter named Elizabeth).

[8]Ca. 1803/05-1870 (LHCR, see references for full citation).

[9]Complete examination of the W-D papers may bring other contributions to light.

[10]Architect's plans (by Charles A. Rubicam) for these buildings are in W-D.

[11]1812?-after 1866 (W-D).

Fig. 1. Thomas B. Wilson, M.D. (Courtesy The Academy of Natural Sciences of Philadelphia). Painted by Henry Ulke in 1881. Ulke was a well-known artist, photographer, and coleopterist (Banks et al. 1910), and was one of the first two members to join the AES after it was organized in 1859 (Cresson 1909).

Fig. 2. Edward Wilson, father of Thomas B. and Rathmell Wilson (Courtesy University of Delaware).

found nothing to indicate that they ever returned to America. However, both accompanied Thomas on some of his European trips, and assisted him in shipping his acquisitions to the U.S. (W-D). In addition, Edward is listed (Ennis et al. 1865) as a donor of 3,660 books and co-donor with Thomas of the immense Wilson bird collection (mentioned earlier) to The Academy of Natural Sciences.

There were also two (known) daughters of Edward Sr. and Rebecca. Helen Eliza died young[12] in Philadelphia, and Elizabeth[11] returned with her parents and two brothers to live in England (W-D). She later married Henry Crosfield (W-D).

Thomas' brother Rathmell[13] actually initiated the first Newark, DE-Philadelphia, PA connection, by moving to Newark in 1841 (W-D). As mentioned earlier, T.B. and William followed. Rathmell was listed as a "farmer" in the 1850 census, but was also a civic leader and businessman, with investments in an insurance company (Sharf 1888), a coal mine in Bedford Co., Pennsylvania, and its associated short-line railroad (W-D). He evidently was a careful steward of his inheritance, for at age 50, he listed his net worth (1860 census) as $250,000, and his occupation as "retired farmer."

Rathmell became a member of the Delaware College[14] Board of Trustees in 1848, and served for 41 years (Viale 1968). He was president of this board twice, for a total of 11 years (1851-59, 1870-71). In addition, Rathmell was acting president of the college from 1859-1870 (Viale 1968), while it was closed due to low enrollment. The latter was the result of an unfortunate murder of a student, followed by the disruption caused by the Civil War (Handy and Vallandigham 1882). Rathmell's portrait (Fig. 3) is in the University of Delaware archives.

Rathmell was listed as a member of the AES in 1867, and contributed $6,000 to the Society in that year. He also saw that Thomas' books and insects were given to the AES, after his brother's death (Cresson 1909).

The extended Wilson family first lived in a new house, constructed by Rathmell on his farm just southwest of Newark in 1841 (W-D). This home was referred to as "The Hermitage" (W-D). A large brick mansion was then built close by in 1845-1846 (Lewis 1961). Thomas financed the north wing (right side, in Fig. 4) for his private bachelor quarters (Lewis 1961). This was connected inside to the main house by only one door (Lewis 1961), and contained living rooms, a study , library, and museum. This house was named "Oaklands," for a large grove of oaks on the farm. The

[12]1803?-1808 (memorial inscription on Rathmell's stone in Laurel Hill Cemetary).

[13]1810-1890 (LHCR, W-D, 1850 and 1860 censuses). His name is incorrectly spelled (as "Rathmel") in several publications.

[14]Now University of Delaware.

Fig. 3. Rathmell Wilson (Courtesy University of Delaware).

Fig. 4. "Oaklands," home of Rathmell and Thomas B. Wilson (Courtesy University Archives). Exact location is shown in Fig. 5.

exterior was covered with stucco, and a mansard roof was added, in about 1890 (my estimate, based on Fig. 4). The house was well-known locally for its solid walnut interior trim (Cooch 1936) and many antiques (Hossinger 192?).

"Oaklands" was the home of the Wilson family for three generations, over a span of 110 years, and was a principal social center of Newark for at least 55 years (Gallagher 1983[15], Hossinger, 192?).

The town of Newark in Rathmell and Thomas' time is shown in Fig. 5. The arrows indicate the single large Delaware College building (Fig. 6), and the "Oaklands" estate. The major streets are in the same locations as today. There were about 1,300 residents then (1860 census), compared to about 25,000 now (the city limits have been expanded over the years). The Philadelphia, Wilmington, and Baltimore railroad ("P, W & B") just south of town was used by Thomas and Rathmell on their many trips to Philadelphia, and was probably the reason for their relocation from the New London area which, despite its auspicious name, was destined to remain rural and thus lack the convenient schedules and speed that the "main line" at Newark offered.

The "Oaklands" estate was purchased in 1955 by Hugh F. Gallagher, Jr., a Newark developer, after the last of the three granddaughters (none ever married) of Rathmell died[15]. The mansion[16], in need of many repairs, was torn down ca. 1962[15], when new homes were being built nearby, but many of the oaks were intentionally left untouched. Mr. Gallagher, a graduate of the university, named the development "Oaklands" and one of the streets "Wilson Road." The mansion's access lane was relocated to the north in 1886, due to construction of the B & O railroad south of "Oaklands." This lane was eventually transferred to the city, and is now known as "Old Oak Road."

As far as I can determine, the last direct descendants of Rathmell Wilson in Newark were the three daughters (Martha R.[17], Elizabeth E.[18], and Alice[19]) of his son, Edward R. Wilson[20]. Edward's family lived in "Oaklands" from about 1870, when Rathmell began to spend more of his time in his other residence, at 1712 Walnut St. in Philadelphia (W-D, LHCR).

Two other significant reminders of the Wilson family remain in Newark. The former St. Thomas Episcopal Church at Delaware Ave. and

[15] Personal communication.

[16] Former site just NE of intersection of Old Oak Rd. and Hullihen Dr.

[17] 1864-1947 (W-D; personal communication from Mrs. Marilyn Mathias).

[18] 1865-1955 (W-D; personal communication from Mrs. Marilyn Mathias).

[19] 1868-1948 (W-D; personal communication from Mrs. Marilyn Mathias).

[20] 1839/41-1894 (no two birthdate sources agree: WCCCR; U.S. Census of 1850, 1860).

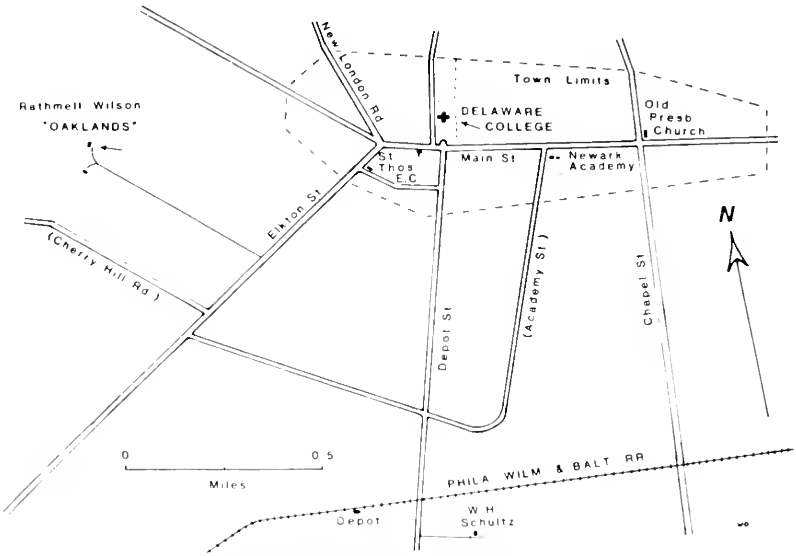

Fig. 5. Newark, DE and vicinity, ca. 1867 (adapted from Beers, 1868).

Fig. 6. Delaware College, as it appeared in Rathmell Wilson's time (courtesy University Archives).

Elkton "St.," (see Fig. 5) was constructed in 1844-45; 40% of the costs were subscribed by Thomas, Rathmell, and William Wilson (Handy and Vallandigham 1882). This church served from 1846 to the 1950's, when a new, larger building was erected a half mile away (Lewis 1961). Edward R. Wilson[21] owned what is now the "university farmhouse" (previously the W.H. Schultz house, see Fig. 5) and considerable farm land for 22 years; unfortunately, he lost much of the family fortune purchasing unsuccessful race horses (Lewis 1961), and the farm was sold by the sheriff in 1889[22]. Edward died only five years later.

CONCLUSION

Thomas B. Wilson died after a short illness at age 58 (1865) in Newark, DE. As his condition worsened, it was finally recognized as typhus (Ennis et al. 1865), a disease that is frequently epidemic during wars (at the time, the Civil War had been raging for four years). Unfortunately, it was not until 1909 (James and Harwood 1969) that the transmitting agent of this rickettsial disease was identified as an insect, and more years passed before some preventive measures could be devised. It seems harshly ironic that his man, who had given so much of his time and funds to advance man's knowledge in entomology, was indirectly killed by a small insect. However, as entomologists well know, this unfortunate occurrence is just a small indication of the immense importance of insects to mankind, then and now.

Thomas' motto, "Res non Verba" (actions, not words), is engraved on his granite gravestone, located on the side of a high hill[23] overlooking the Schuylkill River, in Philadelphia. It is fair to conclude that he lived by his motto, and in so doing, he, with the assistance of others in his family, greatly advanced both the natural sciences and entomology, during their critical formative years in the United States.

ACKNOWLEDGMENTS

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[21]Edward R. was also elected a trustee of the college in 1869 (Sharf 1888; Viale 1968).

[22]Title search by John Clayton (personal communication).

[23]South Laurel Hill Cemetary.

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Wilson papers ("W-D"). In Special Collections, Morris Library, Univ. Delaware, Newark, DE 19711[26].

[24]Available on microfilm in National Archives Branches and many libraries; should be used in conjunction with recent indices by Jackson and Teeples (Accelerated Indexing Systems, Bountiful, UT; 1972-78). Helpful information is also in Trumbore, 1979.

[25]This reference is best used after consulting the detailed index to it compiled by Coughlin and Fields in 1976.

[26]Contains a large quantity of uncollated and unindexed material, mostly correspondence; a lesser quantity of Wilson material is filed separately in the "Evans collection," which has been indexed; the two collections are very similar in content, and are both included here under "W-D."

125th ANNIVERSARY SCENES

Fig. 1. Members of Executive Council. L. to R. Harold B. White, Charles E. Mason, Jesse J. Freese, Howard P. Boyd, Selwyn S. Roback, Roger W. Fuester, Joseph K. Sheldon, Lewis P.Kelsey, William H. Day.
Fig. 2. L. to R. Kenneth Frank, Karla Ritter, Sam Roback, Joe Sheldon.
Fig. 3. L. to R. William Day, Sam Roback, Roger Fuester, Howard Boyd, Daniel Otte.
Fig. 4. Mildren Morgan cutting birthday cake.
Fig. 5. L. to R. Lew Kelsey, Dan Otte, Charles Mason.
Fig. 6. Charter (center, on table) and old photographs on and behind display table.
Fig. 7. L. to R. Roger Fuester, Kenneth Frank, Dan Otte.

All photographs by Harold White.

THE CRESSONS AND THE AMERICAN ENTOMOLOGICAL SOCIETY

Roger W. Fuester[1]

ABSTRACT: A brief history is presented summarizing the contributions of Ezra T. Cresson, Sr., hymenopterist (1838-1925), and his two sons, George B. Cresson, general naturalist and formicidologist (1859-1919) and Ezra T. Cresson, Jr., dipterist (1876-1948), to the science of entomology and to The American Entomological Society. This talk was given at the society's 125th anniversary meeting on February 15, 1984.

If there were ever to be a "first family" of The American Entomological Society, it most certainly would have to be the Cresson family, because Ezra Townsend Cresson, Sr. and his two sons, George Bringhurst Cresson and Ezra Townsend Cresson, Jr., contributed a great deal to the society.

Logically, the story begins with E.T. Cresson, Sr., who, according to his biographer, the reknowned odonatist Philip P. Calvert (1928), was born at Byberry, Bucks Co., Pennsylvania on June 18, 1838. Little is known of his childhood other than that he attended Philadelphia public schools through grammar school (eighth grade), but didn't go to high school. Evidently, he was obliged to work for the support of his mother, and during the late 1850's, was employed as a clerk for the Pennsylvania Railroad.

The year 1859 was an important one for the young (21-yr.-old) Cresson for several reasons. To begin with, in February of that year, together with James Ridings and George Newman, he founded The Entomological Society of Philadelphia, the name of which was changed to The American Entomological Society in 1867. He was also elected its first recording secretary.

In March of the same year, he married Mary Ann Ridings, daughter of one of the society's co-founders. They later had five children, one girl and four boys, two of which had an active interest in entomology and became valued members of the society.

On May 8, still in 1859, Ezra Cresson resigned from the society and with his young wife, his brothers John, Elliott, and Jacob and their families, left for New Braunfels, Comal County, Texas, where they pooled their resources in a cattle ranch. This venture did not work out, however, and Cresson returned to Philadelphia and appeared again at the society on October 24. That day marked the beginning of 65 years of continuous service to The American Entomological Society. One final note concerning 1859: he was also elected corresponding secretary of the society, in which capacity he served for 16 years (1859-1874).

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In 1861, he began the series of publications on the Hymenoptera of North America which was to earn him international recognition as a specialist on that order. This series, consisting of catalogs, synopses, and monographs, numbered 66 papers and was summarized in a comprehensive publication entitled *Synopsis of the Families and Genera of the Hymenoptera of America North of Mexico* in 1887.

Throughout his association with the society, Cresson played a significant role in the publication of the society's journals. From August 1865, to October 1866, he edited *The Practical Entomologist* which was the first journal dealing with economic entomology published in the United States. Unfortunately, the journal was only published for two years because of insufficient financial support. (It was distributed gratuitously and could not attract sufficient advertisers.) In Cresson's (1909) history of the society (which incidently was read 75 years ago tonight at the society's 50th anniversary meeting), he expressed the opinion that "The time had not yet come for the agricultural public to realize the value of such knowledge."

In 1871, he became editor of the *Transactions of The American Entomological Society.* He served as editor of this, the Society's longest running serial publication, until 1912, a period of 42 years. In 1889, working in conjunction with the Entomological Section of the Academy, he was instrumental in the establishment of the journal *Entomological News.* Finally, in 1916, he published, as the first number of the *Memoirs of The American Entomological Society,* a paper entitled *The Cresson Types of Hymenoptera.* This paper, which listed 2737 species, gave a list of Cresson's entomological writings arranged chronologically and numbered consecutively so as to facilitate location of a paper in which a given type was described. Thus we see that he contributed, in one way or another, to all of the society's publications.

From 1866 to 1874, Cresson served as curator of the society. Basically, this job included conducting the day-to-day business of the society, serving as custodian of society property, and performing much of the press work and composition of publications. In 1901, Cresson donated his own extensive collection (2367 types, 3511 species, and 87,775 specimens) of Hymenoptera to the society.

It should be noted that Ezra T. Cresson, Sr. never worked professionally as a scientist, curator, or teacher, but that his entomological studies were pursued as an avocation, while he was engaged in a full-time business career, the greater part of which was spent at Franklin Fire Insurance Company, where he worked for 41 years (1869-1910). This fact, coupled with his lack of formal training in biology, makes his long and laborious service to our society and his contributions to the taxonomy of Hymenoptera all the more noteworthy. Because Cresson was obliged to do his taxonomic work at night under gas-light, it led to partial failure of his eyesight, which prematurely ended his taxonomic work in 1887 at the age of 49. This unfortunate event did not appear to diminish his enthusiasm for the work of the society because in addition to continuing on as editor of *Transactions,* he also served as treasurer of the society from 1874 to 1924, a period of 50 years. When his letter requesting that he be relieved of his duties as treasurer was read at the society meeting held October 23, 1924, the following resolution carried unanimously:

> "The American Entomological Society hears, with deep regret, the letter from the Treasurer, Mr. E.T. Cresson, . . . requesting that he be relieved of his office. This Society looks on Mr. Cresson as its founder. It recalls the sixty-five years which he devoted to its welfare as a member of its Publications Committee, as Editor of its *Transactions* and as Treasurer, the last for fifty consecutive years. His services have been given without salary or pecuniary reward. In acceding to Mr. Cresson's request, this Society desires to place upon record its appreciation of his unselfish and untiring labors in its behalf, its pride in his long connection with the Society and in his numerous contributions to entomology and its best wishes that he may long remain with us as our most honored member."

On March 26, 1925, he was selected the first honorary member of The American Entomological Society. He continued to visit the society's rooms up until a few months before his death. He passed away on April 19, 1925, in his 88th year, at the home of his son, E.T. Cresson, Jr., in Swarthmore, Pennsylvania.

George B. Cresson, first-born child of Ezra T. and Mary Ann Cresson, was the second Cresson to be associated with The American Entomological Society. He was born in Philadelphia on November 15, 1859. There is not much information available on G.B. Cresson, and most of my material was obtained from minutes of society meetings and the obituary written by Calvert (1920). His name first appeared in the minutes for the meeting held December 8, 1879, as part of a marginal insertion reading, "George B. Cresson, proposed for Resident Membership of the Society at the meeting June 9, 1879, was duly elected." He was also elected society curator for 1880 at that same December meeting. From 1880 to 1881 and from 1886 to 1889, he was also the conservator of the entomology section of the academy. According to Calvert (1920), George B. Cresson resigned from the society in 1883 but was re-elected "to full membership" at the meeting held December 12, 1887. During the intervening years, 1883-1886, he printed volumes XI-XII of the society's *Transactions* and was listed frequently as a visitor at society meetings. It was at his recommendation that the society purchased a press "sufficiently large to print four (4) pages of the *Transactions* (sic) at one impression" (AES minutes XII-8-1884). Apparently, Mr. Cresson was being reimbursed for his services as printer and resigned so as to preclude any possibility of a conflict of interest arising. In any case, upon re-election to the society, he was elected society curator and served in that capacity for two years (1888-89).

According to Calvert (1920), it was during 1886-87 that G.B. Cresson aided him (Calvert) in his early entomological pursuits and advised him to specialize in some order other than Lepidoptera or Coleoptera.

G.B. Cresson was a general naturalist, but was especially interested in ants of which he formed a representative collection. However, he apparently never published any entomological papers.

After leaving the custodial position with the academy in 1889, he also went to work in the insurance business, first at Franklin Fire Insurance Company (where his father worked) and later at People's National Fire Insurance Company. He served as society librarian from 1892 to 1896 and remained a member of the society until his death on October 18, 1919.

Ezra T. Cresson, Jr., the third member of the family to work in entomology, was born in Philadelphia on December 18, 1876. From 1896 to 1898, he attended the Drexel Institute of Technology where he took courses in mechanical drawing, mechanics, shop work, and machine construction, but did not receive a degree or diploma. Upon leaving school, he was employed by the George T. Cresson Company, the Morse Elevator Works, and the Otis Brothers and Company (following their takeover of Morse).

He joined the Society in 1905 and became a member of The Academy of Natural Sciences in the same year. In 1906, he became librarian of the society, a position he held for 42 years (until 1947) and also published his first entomological paper entitled *Some North American Diptera from the Southwest. Paper I. Ortalidae.*

Late in 1907, E.T. Cresson, Jr. went to California and was admitted to the University of California in January, 1908, as a special student in the College of Natural Sciences. He attended for one semester taking courses "primarily in entomology."

He returned from the west later that year, and took up residence in Swarthmore, Pennsylvania, where he lived the rest of his life. During the same year, he took a position with the academy as an assistant to the board of curators. In 1925, he was promoted to assistant curator of entomology and remained in that position until he retired in 1945. Thus, we see that E.T. Cresson, Jr. was the only member of the family to receive any formal training in entomology and to work as an entomologist for his livelihood.

During his productive career, he published widely (144 titles) on the Diptera, but was most interested in the family Ephydridae, the shore flies.

In his biography of E.T. Cresson, Jr., Calvert (1949) published the following excerpt from a memorandum prepared by Cresson several years before his death, giving a summary of his work on the Ephydridae:

> "When the study began, 1908, the Academy's collection contained 5 species, 12 specimens. At the present it contains about 600 species, 340 of which have been described as new, (and) over 8,000 specimens. The North American series contains over 275 species. Over 26,000 specimens have been examined and determined during this study. This collection is the largest in the world and contains about 75% of the known species."

Dr. Calvert (1949) also noted that Cresson "devoted much time and thought to doing all sorts of things, accumulating many devices for rapid mechanical manipulation." Cresson wrote two papers on mounting micro-Diptera and designed the very useful pinning forceps which bear his name.

In addition to serving the society as librarian, E.T. Cresson, Jr. was also corresponding secretary for 19 years (1909-11, 1932-47), treasurer for three years (1926-28), and vice-president for one year (1947). Like his father, he played an important role in the society's publications. He was elected associate editor of *Ent. News* in 1910, and remained on its editorial staff until his death. Moreover, he edited both *Transactions* and the *Memoirs* from 1927 to 1945 (19 years.)

In recognition of his more than 40 years of service to the society, he was elected an honorary member in 1947. E.T. Cresson, Jr. died at Swarthmore, Pennsylvania, on April 8, 1948. In his will, he left the society the sum of $1,000 "to establish an Ezra T. Cresson Library Fund, the income from which is to be used for binding, repairs, and other preservation of the entomological books and pamphlets owned by the society." (The present balance of this fund is ca. $25,000.)

In summing up, it is clear that the Cressons provided indispensable services to The American Entomological Society during its first 100 years. It is curious that none of the Cressons ever served as president of the society, especially in view of their obvious abilities and devotion to AES. In his biography of E.T. Cresson, Sr., Calvert (1928) remarks that "He steadfastly declined nomination as president, to which office his fellow members would gladly have elected him." Perhaps E.T. Cresson, Sr. and his sons were merely modest gentlemen. In any case, their industry and dedication stand as examples to all of us.

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SOCIETY MEETING OF APRIL 18, 1984

Dr. Veronica Dougherty, research associate in the Department of Entomology and Applied Ecology at the University of Delaware, was the speaker at the fifth regular meeting of The American Entomological Society. Eleven members and two guests attended her talk entitled "Systematics of Ectrichodiinae: a subfamily of Reduviid Bugs."

In the New World there are about 30 genera and 150 species of Ectrichodiinae. These large and colorful bugs are largely restricted to the tropics with only two species, *Rhiginia cinctiventris* and *R. cruciata,* known this far north. The subfamily is characterized by a bifurcated posterior margin of the scutellum in all but a few species, and fused abdominal segments. The presence of scent glands, sexual dimorphism, apparent aposematic mimicry complexes, and a variety of head morphologies suggest an interesting biology. The example of one African species that has been observed to track down and feed on millipedes seems to be one of the few observations of behavior made on the group. Old World Ectrichodiinae include a number of iridescent species, some species where males are brachypterous, and other species where females have hairy basal antenna segments. These characteristics are unknown in New World species of the group. Other comparisons indicate that New World Ectrichodiinae are polyphyletic.

In notes of local entomological interest, Charles Mason reported his recent discovery in northern Delaware of a full-grown, overwintering, black cutworm larva, *Agrotis ipsilon.* In the midwest this species usually does not overwinter.

Harold B. White
Corresponding Secretary

PHILIP POWELL CALVERT: STUDENT, TEACHER, AND ODONATOLOGIST

Harold B. White, III[1]

Seventy-five years ago Philip Powell Calvert was president of The American Entomological Society when it celebrated its 50th anniversary. He lived to participate in the 100th anniversary of the society in 1959. During Dr. Calvert's 74-year association with the society, he served on its council for nearly 60 years. In addition to being president from 1900-15, he was vice president (1894-98), corresponding secretary (1895), associate editor (1893-1910) and editor (1911-43) of *Entomological News*, and member and chairman of the finance committee for many years. It is therefore fitting that the society on the occasion of its 125th anniversary should commemorate Dr. Philip P. Calvert.

With the exception of a postdoctoral year (1895-96) at the Universities of Berlin and Jena and a sabbatical year (1909-10) in Costa Rica, Dr. Calvert was a resident of the Philadelphia area. He was born on January 29, 1871, near the University of Pennsylvania, the oldest of three sons of Mary Sophia Powell Calvert and Graham Calvert, a Philadelphia lawyer. After graduating from Central High School in 1888, he went to the University of Pennsylvania where he obtained his certificate in biology in 1892 and his Ph.D. in 1895. Calvert's student career at the University of Pennsylvania blends with his professional career there. Successively his appointments were assistant instructor (1892-97), instructor (1897-1907), assistant professor (1907-12) and professor (1912-39). He married Amelia Catherine Smith in 1901. They had no children. Throughout his career and until his death on August 23, 1961, Dr. Philip Calvert was a recognized authority on the Odonata.

The foregoing list of milestones and accomplishments serves to impress upon us his distinguished career, but it conveys little of the personality of the man, the impact he had on other people, and the influences that led him to a career in entomology. After his death, Amelia Calvert bequeathed Dr. Calvert's personal and professional letters to The Academy of Natural Sciences of Philadelphia (see list at end). This accumulation of over 70 years, numbering over 12,000 items, contains among other things his high school notebooks, early field notes, and his lengthy correspondence with entomologists. Due to Dr. Calvert's long association with *Entomological News* and his stature as an odonatologist, this collection in the academy

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archives traces the history of *Entomological News* and the field of odonatology for over half a century. It also documents Calvert the person and provides glimpses of his early development as an entomologist. Rather than repeat Dr. Calvert's accomplishments and contributions to entomology that have already been published (see list at end), this tribute will focus on his early interests in Odonata and the role of The American Entomological Society in his development.

As is often the case with professional biologists, Calvert's career is rooted in a childhood interest in natural history. At the age of 12, in 1883, he had assembled a botanical dictionary of native and exotic plants which included field notes and a few drawings. The dictionary is extensive with common and Latin names interspersed. In its later versions it appears as if Calvert may have intended to publish it. Clearly he was an accomplished botanist at an early age. Letters from his mother years later indicate she was knowledgeable about plants and thus may have inspired his early botanical interests.

When Louis Agassiz died in 1873, America lost its most popular and influential scientist (Lurie, 1960). In the spirit of the Swiss-born naturalist who had advocated, "study nature, not books," Harland H. Ballard founded the Agassiz Association in 1875 (Ballard, 1888). This organization grew rapidly and boasted hundreds of chapters and over 20,000 members by the early 1890's. Although the organization attracted many adults, its original intent was to promote natural history interests among young people. The first general convention of the Agassiz Association was held in Philadelphia in September 1884 in conjunction with the meeting of the American Association for the Advancement of Science. It seems likely that this event directly or indirectly affected Calvert for in January 1885 he was curator of an informal Agassiz Association group. In the fall of 1886 Frank G. Jones, George L. Bahl, J. Lee Patton, and Philip P. Calvert, all students at Central High School, founded Chapter 242 of the Agassiz Association. Calvert was chapter secretary until the group discontinued activities in 1890.

As curator for the Agassiz Chapter, Calvert's annual report for 1885 was exuberant, noting the collections had been more than doubled. The report listed all the additions which ranged from minerals and skulls to birds and insects. Many of the additions were from Calvert himself. At this time there is little indication of a specialization in insects. A diary from a family trip to visit relatives in South Carolina in the summer of 1885 reveals a typical boyhood fascination with snakes and details an amusing episode where he offered a reward to obtain a much sought specimen of a water moccasin. The specimen, though small, was obtained eventually and added to the Agassiz collection. On later inspection the specimen turned out to be a less interesting nonpoisonous species.

It is evident that Calvert's parents not only tolerated but encouraged his interests in natural history. Their Christmas present to the Agassiz Association in 1885 was a microscope with slides. Earlier they had contributed a butterfly case. As treasurer of the chapter's scientific fund from 1885-88, Calvert meticulously detailed the cash flow of an annual budget of less than $11. His father's semiregular monthly contribution of 50¢ and occasional smaller contributions from his mother accounted for most of the income. An interest in coins is suggested by the "numismatical" withdrawals from the fund. Such were the financial roots of the future long-term member and chairman of The American Entomological Society's finance committee.

By 1886 Calvert was an accomplished illustrator. His attention to details in color and form are remarkably displayed in a series of beautiful illustrations of local butterflies. One of these is accompanied by an equally detailed description of the life cycle of the monarch butterfly as he had observed it. These observations and illustrations of butterflies at the age of 15 seem to be the first indications of what would become a lifelong interest in insects.

Late in 1886 Calvert began to visit the library and insect collections of The Academy of Natural Sciences. There he read journal articles on Lepidoptera and studied specimens. At that time George B. Cresson was conservator of the entomological section of the academy and a member of The American Entomological Society. As noted by Calvert (1920) in his obituary of Cresson, Cresson told him he would do well to study some group of insects other than Lepidoptera and Coleoptera since there were many people already interested in those groups. Since he had a few dragonflies, he took Cresson's advice and began to study the Odonata seriously.

Although he was not to publish his first entomological paper until 1890, Calvert's increasing interest in the Odonata is documented in the records of the Agassiz Association. As secretary of Chapter 242, Calvert submitted annual reports of the chapter's activities to the national Agassiz Association. These were published in the April 1887, 1888, and 1889 issues of *Swiss Cross,* a monthly magazine published by the Agassiz Association. He reported in 1887, "The secretary has also paid some attention to Lepidoptera, but is now prepared to devote his time and energies to dragonflies."

In 1887 most of the Odonata fauna of the northeastern United States had been described but very little was known about geographic distribution, seasonal distribution, habitat preference, or behavior of the species and certainly there were no good guides. Nevertheless, the young Calvert became knowledgeable about the local species and within a short time became the local expert. As his interest grew, so did his horizons. The June

1887 and 1888 issues of *Swiss Cross* contain requests from Calvert to exchange Odonata. It is worth noting that this high school student listed his return address as The Academy of Natural Sciences.

Respondents to the 1888 requests were sent forms on which to record their observations and detailed instructions on how their observations should be made. Data obtained from respondents in Maine, New York, and Illinois provided the basis for Calvert's first manuscript. It was submitted to *Swiss Cross* in the fall of 1888. The manuscript was accepted by H.H. Ballard, set in type, and then rejected by the editor because it was "too technical." A brief summary was published in the January 1889 issue. The college freshman accepted the setback and went on to publish many articles on the Odonata in other journals. (*Swiss Cross* ceased publication later in 1889.)

The founders of the Philadelphia Chapter of the Agassiz Association went on to college leaving no younger members with the enthusiasm to carry on the activities. Calvert's last entry in the minutes record an abrupt end to the waning chapter: "Francis Gilmore Jones, President of Chapter 242, died March 19, 1891." Although the rise and fall of the chapter was tied to the careers of the founders, it also seems to be related to the publication of *Swiss Cross*. This magazine served to stimulate the formation of the chapter and link it with numerous local chapters around the country. When publication ceased, communication ceased.

When the Agassiz Association chapter disbanded, Calvert already had strong ties to other local organizations. The minutes of the entomological section of The Academy of Natural Sciences show that Calvert attended its meeting on January 27, 1887, and was nominated for associate membership. He was elected at the March 24th meeting and regularly attended subsequent meetings. Then as now there was a close association of the academy and The American Entomological Society. The society met semiannually and dealt mostly with business rather than science. The society minutes record Calvert as a visitor at their June 13, 1887 meeting. It is apparent that George B. Cresson, an entomologist who never published, not only promoted Calvert's interest in the Odonata but also brought him into the company of adult entomologists of the academy and The American Entomological Society.

Calvert attended and participated regularly in the meetings of the society and the academy for six years before he formally became a full member of both. In 1889 a report by him on the Odonata fauna of Philadelphia was noted in the *Transactions of The American Entomological Society and the Proceedings of the Entomological Section of the Academy of Natural Sciences.* The inaugural issue of *Entomological News* issued shortly before Calvert's 19th birthday contains a review by him and lists him as a member of the publication's advisory board. By 1893 he was associate editor of *Entomological News.* Apparently he was not considered for full membership in the academy or the society until he graduated from college despite his many contributions.

The premier American odonatologist in the 1880's was Dr. Hermann Hagen. He had described more than one hundred of the North American species of Odonata. In 1861 he had published his *Synopsis of the Neuroptera of North America.* This had been translated from Latin to English by P.R. Uhler. When Uhler moved from the Museum of Comparative Zoology at Harvard in 1867, Louis Agassiz, the director of the museum, selected Dr. Hagen from Konigsberg in East Prussia as the successor. As might be expected, the first odonatologist with whom Calvert corresponded was Hagen. The correspondence which began in 1888 culminated in July of 1890 with a several day visit by the 19 year old Calvert with the ailing 74 year old Hagen at the Museum of Comparative Zoology. In September 1890 Hagen was stricken with paralysis and he died in November 1893.

Clearly Hagen accepted and greatly encouraged Calvert's interests in Odonata. It was almost as if the baton of Americn odonatology was passed from Hagen to Calvert at their meeting in Cambridge. The news of Hagen's death travelled quickly, for the December 1893 issue of *Entomological News* carries an obituary of Hagen written by Calvert. It is notable that Hagen's obituary was the very first of over 200 entomological obituaries that Calvert was to write for *Entomological News.* Calvert (1893b) wrote of Hagen, "In February, 1890, he (Hagen) sent me his unpublished notes on *Leucorrhinia,* giving me permission to publish them, and when I wrote him for a title he wrote 'Synopsis of *Leucorrhinia'* with my name as author, although the work was all his own." This exchange was precipitated by a January 1890 publication by Calvert describing three species of *Leucorrhinia.* Embarrassingly the one he named in honor of Hagen was identified as a synonym by Hagen in his February letter to Calvert. Calvert responded to Hagen, "I regret it very much if I have created a synonym in the case of *L. hageni,* the more especially because I had named the species after you." In future years Calvert was noted for his careful work. Mrs. Leonora K. Gloyd recalls that Calvert routinely shared his observations and new species descriptions with E.B. Williamson and F. Ris so as to compare opinions and to avoid publishing prematurely.

Throughout his college years Calvert published notes and commentary relevant to the Odonata and in 1893 he published his first major work, *Catalogue of the Odonata (dragonflies) of the Vicinity of Philadelphia, with an Introduction to the Study of this Group.* This served as a model for regional insect study and was the first major attempt at a guide to the order. Calvert went on to publish over 300 notes and articles on the Odonata, mostly in *Entomological News.*

In addition to his career as an entomologist, Calvert was also a first-class educator. Dr. Arnold Clark, former professor of biology at the University of Delaware and a graduate student in Dr. Calvert's entomology course in 1937-38, described Dr. Calvert's six-hour oral final examination as the best learning experience he ever had. Dr. Clark distinctly remembers Calvert's retirement party in 1939 where Calvert described his teaching philosophy, "I never taught anyone anything. I only tried to stimulate them to learn for themselves and to edit the literature for them." In a way this is a statement of the way Calvert himself had been taught by members of The Academy of Natural Sciences and The American Entomological Society.

Calvert's contributions to the academy and the society are enormous. Yet it was the members of these organizations who stimulated and guided Calvert's interest in insects. Calvert was a precocious teenager whose abilities could have led him into many successful careers. He was fortunate to have the experts available when he needed them to answer his questions or to point the way. There is a lesson to be learned in the long association of Philip P. Calvert with The American Entomological Society and The Academy of Natural Sciences of Philadelphia., In the future we should realize our potential for exciting and sustaining the interests of budding entomologists.

COLLECTIONS RELATING TO PHILIP POWELL CALVERT IN THE ARCHIVES OF THE ACADEMY OF NATURAL SCIENCES, PHILADELPHIA

Coll. No. 48 Minutes of Chapter 242 of the Agassiz Association, Philip P. Calvert, Secretary 1887-1891.

Coll. No. 198 Certificates of Achievement and Honors awarded Philip P. Calvert.

Coll. No. 290 Biographical papers and records.

Coll. No. 492 Correspondence of Philip P. Calvert, Editor of Entomological News, 1910-1943.

Coll. No. 633 Itinerary, field notes, notebooks, photographs and diary from sabbatical leave in Costa Rica, 1909-1910.

Coll. No. 634 Material relating to professional matters kept at Dr. Calvert's home office until his death.

Coll. No. 635 A bibliography (1895-1958) on seasonal distribution of organic life in the tropics.

Coll. No. 695 Calvert's diary of his postdoctoral year in Europe, 1895-1896.

Coll. No. 902 Bibliographic Catalog of the Odonata of the World 1891-1943.

Coll. No. 926 Dictionary of Plants compiled in 1883 by Philip P. Calvert.

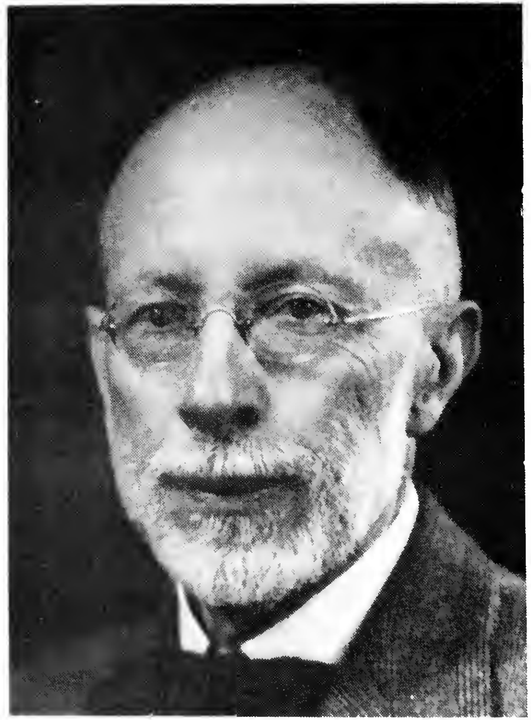
Coll. No. 929 Family letters, 1895-1910.

Coll. No. 933 Early observations and field notes, 1885-1888.

Coll. No. 939 Correspondence, scientific and general, 1887-1960.

Coll. No. 965 Final drafts of papers for publication 1899-1912.

Coll. No. 966 Annotations on the Odonata, 1901-1908.



Philip Powell Calvert at the age of seventeen when he graduated from Central High School in Philadelphia (February 1888). Philip P. Calvert in retirement (no date). Both photographs reproduced with the permission of the Library, The Academy of Natural Sciences of Philadelphia.

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ACKNOWLEDGMENTS

I thank Mrs. Leonora K. Gloyd and Dr. Arnold M. Clark for sharing their personal recollections of Dr. Calvert presented in this article. I thank Mrs. Carol M. Spawn for her help in locating material on Dr. Calvert in the archives of The Academy of Natural Sciences of Philadelphia.

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JAMES A.G. REHN AND THE AMERICAN ENTOMOLOGICAL SOCIETY

Selwyn S. Roback[1]

The association of Mr. Rehn with The American Entomological Society is long and intertwined — it would be only a slight exercise in hyperbole to say that for a great deal of that period he was The American Entomological Society.

Mr. Rehn was born in 1881 and joined The Academy of Natural Sciences of Philadelphia, as a Jessup student in 1900. The minutes of the meeting of December 23, 1909 record his nomination for membership in The American Entomological Society. He was elected in 1910 and obviously at once became very active in the affairs of the society. At the end of 1911 he was nominated as corresponding secretary, a post he apparently held to 1929. At the end of 1913 he was appointed a member of the publication committee and served on this committee, with some small breaks until 1965. He was chairman of this committee, from 1914? through 1923? and again in 1940? through 1964.

I might mention, parenthetically, that the reason for the question regarding some of the dates given is that the minutes of the society do not always clearly indicate the composition of the committees nor do they always indicate the chairmanship of the committee in question. Sometimes this has to be inferred from the reports in the minutes of the regular meetings by noting who gave the report for the committee. The same is true for the editorship of the *Transactions,* with the volumes before 1917 and 1925, 1926, not clearly indicating who was editor.

The inside front cover of the *Transactions* indicates that Mr. Rehn was editor from 1917-1924 though he may have taken over the editorship in 1914 when he became chairman of the publication committee. As mentioned above, the 1925, 1926 volumes do not indicate the editor and the last number of the 1927 volume gives E.T. Cresson, Jr. as editor. Mr. Cresson may have taken over the editorship at the end of 1924 when he became chairman of the publication committee.

In addition to his obvious service to the publications of the society, Mr. Rehn published extensively in the society's journals. Almost half (47%) of the papers he published under his name alone were printed in the *Transactions* or *Entomological News,* the division being 25% to *Ent.*

[1]Curator, Department of Entomology, The Academy of Natural Sciences of Philadelphia; Past President, The American Entomological Society.

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Fig. 1. Mr. Rehn at his desk in 1959.

News and 22% to the *Transactions.* If the papers he published with Morgan Hebard and other authors are added, the figures remain about the same — 46% in the *Transactions and Ent. News* (22% *Ent. News,* 24% *Transactions*).

Mr. Rehn's greatest contribution to the society was undoubtedly in the field of finance. We owe our current strong financial underpinnings to his lengthy stewardship in this area. He became a member of the finance committee at the end of 1914 and is recorded as chairman at the end of 1916. He apparently was chairman through 1920? and 1960?-1964. He remained part of the committee and active in its work until his death. He became treasurer of the society in 1930 and served in this post for 29 years. He was a very meticulous person and his financial reports are a model of detail and accuracy. The amount of labor he performed must have been prodigious when one considers that most of his financial statements were prepared before the age of computers or even electronic adding machines.

While serving on both the finance and publication committees Mr. Rehn found time to serve the society in several other offices. In 1916 he became vice president of the society and held this office through 1922. He served as president from 1942 through 1946 and again in 1952-53. He was corresponding secretary from 1911 through 1929? and also served on the committee on corresponding (honorary) members.

The following list will summarize Mr. Rehn's services to the American Entomological Society.

President 1942-1946, 1952-1953
Vice President 1916-1922
Treasurer 1930-1959
Corresponding secretary 1911-1929?
Editor, Transactions 1917?-1924?
Finance committee 1914-1964
Publication committee 1913-1964

It was my privilege to have known Mr. Rehn from 1951 until his death in 1965 and while he was not, at all times, the easiest person to deal with, his efforts on behalf of the society were unstinting and his dedication to the welfare of The American Entomological Society was unquestionable. For more detail on Mr. Rehn's life, the reader is referred to the 1965 obituary by Maurice Phillips in *Ent. News* 76(3): 57-61.

NAMES OF OFFICERS AND THEIR TERMS OF OFFICE FROM 1960 TO 1984[1]

PRESIDENT

	Years
Dr. Neal A. Weber, 1960	1
Dr. Murray I. Cooper, 1961-1962	2
Dr. Selwyn S. Roback, 1963-1964	2
Dr. Harold J. Grant, Jr., 1965-27/II/1966*	1+
Mr. Marvin H. Brunson, 1967-1968	2
Dr. Ellery French, 1969-1970	2
Dr. William H. Day, 1971-1972	2
Dr. David C. Rentz, 1973-1974	2
Dr. Lewis P. Kelsey, 1975-1976	2
Mr. Howard P. Boyd, 1977-1981	5
Dr. Charles E. Mason, 1982-1984	3

*Dr. Grant died in office. Vice-President Brunson took over for the balance of 1966, but continued to serve in his official capacity as Vice-President.

VICE-PRESIDENT

Dr. Murray I. Cooper, 1960	1
Dr. Selwyn S. Roback, 1961-1962	2
Dr. Harold J. Grant, Jr., 1963-1964	2
Mr. Marvin H. Brunson, 1965-1966	2
Dr. Ellery French, 1967-1968	2
Mr. Edward G. Warner, 1969-1971	3
Dr. David C. Rentz, 1972	1
Dr. Lewis P. Kelsey, 1973-1974	2
Mr. Howard P. Boyd, 1975-1976	2
Dr. Daniel Otte, 1977-1980	4
Dr. Charles E. Mason, 1981	1
Dr. Joseph K. Sheldon, 1982-1984	3

[1]The names of officers of the Society from 1859-1908, incl. were published in "A History of The American Entomological Society," 1909, and those from 1909-1959, incl., in the Centennial number of the TRANSACTIONS, Dec. 1959 (4): 275-276.

CORRESPONDING SECRETARY

Dr. Selwyn S. Roback, 1960	1
Dr. Harold J. Grant, Jr., 1961-1962	2
Mr. Benjamin Puttler, 1963-1964	2
Dr. Ellery French, 1965-1966	2
Mr. Edward G. Warner, 1967-1968	2
Dr. John J. Drea, Jr., 1969	1
Dr. William H. Day, 1970	1
Dr. David C. Rentz, 1971	1
Mr. Frank E. Boys, 1972-1976	5
Dr. Charles E. Mason, 1977-1980	4
Dr. Joseph K. Sheldon, 1981	1
Dr. Harold B. White, 1982-1984	3

RECORDING SECRETARY

Mr. Richard P. Sivel, 1960-1974	15
Dr. Richard W. Rust, 1975-1978	4
Mr. Roger W. Fuester, 1979-1984	6

TREASURER

Mr. Raymond Q. Bliss, 1960	1
Mr. Vernon A. Bell, 1961-1968	8
Mr. Jesse J. Freese, 1969-1984	16

ANNOUNCEMENT

PAGE CHARGES TO BE REDUCED

As a benefit of the recent Dr. Charles P. Alexander bequest, coupled with a favorable financial operating experience in recent years, and current good budget control procedures, ENT. NEWS is pleased to announce a reduction in page charges down to $22 per page, effective with papers received after January 1, 1985. It is hoped further reductions may become possible in the future.

In addition, the editor now has a somewhat greater number of pages available for granting reduced page charges for students, unemployed amateurs, and retired entomologists who are without benefit of institutional or grant funds and who apply for such reductions at the time they submit their papers.

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July 31, 1984

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DeLong, D.M.	Ohio
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Linsley, E.G.	California
Michener, C.D.	Kansas
Sabrosky, C.W.	D.C.
Salmon, J.T.	New Zealand
Timberlake, P.H.	California
Townes, H.K.	Michigan
Weber, N.A.	Florida
Wigglesworth, V.B.	England
Yarrow, I.H.H.	Australia

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Brunson, M.H.	New Jersey

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Arbogast, R.T.	Georgia
Arduser, M.S.	Michigan
Armitage, B.J.	Alabama
Arnett, Jr., R.H.	Florida
Baker, C.W.	Idaho
Ball, G.E.	Alberta
Barbour, K.	California
Barksdale, C.M.	Wisconsin
Barnum, A.H.	Utah
Bartow, D.H.	Pennsylvania
Bath, J.L.	California
Baumann, R.W.	Utah
Baxter, J.E.	Kansas
Beal, Jr., R.S.	Arizona
Bechtel, R.C.	Nevada
Beckemeyer, R.J.	Kansas
Berté, S.B.	Pennsylvania
Blenderman, M.I.	New York
Bohart, R.M.	California
Bouseman, J.K.	Illinois
Boyd, H.P.	New Jersey
Boys, F.E.	Delaware
Brigham, A.R.	Illinois
Brousek, S.A.	Australia
Brown, F.M.	Colorado
Brown, H.P.	Oklahoma
Brown, Jr., K.S.	Brazil
Brown, K.W.	California
Brown, Jr., W.L.	New York
Burbutis, P.P.	Maryland
Burger, J.F.	New Hampshire
Burke, H.R.	Texas
Burks, B.D.	Arizona
Burrows, W.L.	West Virginia
Butler, L.	West Virginia
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Cancellare, J.A.	Illinois
Canterbury, L.E.	Ohio
Canton, S.P.	Colorado
Carle, F.L.	New Jersey
Caron, D.M.	Delaware
Carter, M.R.	Virginia
Casdorph, D.G.	California
Ciborowski, J.J.H.	Alberta
Clausen, P.J.	Minnesota
Clifford, H.F.	Alberta
Cokendolpher, J.C.	Texas
Collins, J.A.	Maine
Connell, W.A.	Delaware
Conway, P.J.	Illinois
Cooper, K.W.	California
Corpus, L.D.	Kansas
Cournea, P.A.	Pennsylvania
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Daggy, T.	North Carolina
Dakin, Jr., M.E.	Louisiana
Davis, H.G.	Washington
Day, W.H.	Delaware
Deschka, G.	Austria
Deyrup, M.A.	Florida

Dougherty, V.M.	Maryland
Dozier, H.L.	South Carolina
Drake, B.	Colorado
Drea, J.J.	Maryland
Drecktrah, H.G.	Wisconsin
Duncan, P.M.	Pennsylvania
Dunkle, S.W.	Florida
Dunn, G.A.	Michigan
Dysart, R.J.	Delaware
Edmunds, Jr., G.F.	Utah
Elliott, D.E.	Kansas
Enns, W.R.	Missouri
Epler, J.H.	Florida
Faber, B.L.	New Jersey
Fee, F.D.	Pennsylvania
Fink, T.J.	Utah
Fischer, R.L.	Michigan
Fisher, E.G.	Maryland
Fisher, J.R.	South Dakota
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Frank, S.E.	Pennsylvania
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French, E.W.	Pennsylvania
Froeschner, R.C.	D.C.
Fuester, R.W.	Delaware
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Graves, R.C.	Ohio
Green, S.G.	Pennsylvania
Groothuis, D.R.	Illinois
Guidry, L.F.	California
Gunther, R.G.	Illinois
Gurney, A.B.	Virginia
Hafele, R.E.	Oregon
Hagen, K.S.	California
Hall, J.C.	California
Hall, R.L.	Ohio
Harmston, F.C.	Utah
Harris, S.C.	Alabama
Harrison, J.M.	Pennsylvania
Hartman, H.	California
Havranek, D.	Venezuela
Helwig, E.R.	Colorado
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Kelsey, L.P.	Pennsylvania
Kevan, D.K.McE.	Quebec
Kingsolver, J.M.	D.C.
Kirchner, R.F.	West Virginia
Kissileff, A.	Pennsylvania
Kiteley, E.J.	Quebec
Klostermeyer, L.E.	Tennessee
Knisley, C.B.	Virginia
Kondratieff, B.C.	South Carolina
Kornberg, H.	Florida
Koski, J.T.	New Jersey
Krainacker, D.A.	New Jersey
Kramer, J.P.	D.C.
Kritsky, G.	Ohio
Krysan, J.L.	South Dakota
LeBerge, W.E.	Illinois
Lago, P.K.	Mississippi
Lampert, L.L.	North Carolina
Lange, Jr., W.H.	California
Larson, O.R.	North Dakota
LaRue, D.A.	California
LaSalle, M.W.	Mississippi

Lavigne, R.	Wyoming
Lewis, R.E.	Iowa
Linam, J.E.	Oklahoma
Lippert, G.E.	Kansas
Little, R.G.	California
Loerch, C.R.	West Virginia
Lordier, M.K.	Wyoming
Loring, S.J.	Michigan
Maddox, B.G.	Maryland
Mallis, A.	Maryland
Manley, G.V.	Michigan
Manuel, K.L.	North Carolina
Martin, P.J.S.	California
Mason, C.E.	Delaware
Mason, Jr., T.L.	West Virginia
Mathis, W.N.	D.C.
Matta, J.F.	Virginia
McDaniel, B.	South Dakota
Miller, L.D.	Florida
Monica, M.L.	New Jersey
Moore, E.	California
Morgan, M.T.	Colorado
Morse, J.C.	South Carolina
Naczi, R.F.C.	Delaware
Nantel, F.	Quebec
Narf, R.P.	Wisconsin
Nelson, C.H.	Tennessee
Nelson, C.R.	Utah
Nelson, H.G.	Illinois
Nolfo, S.	North Carolina
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ITZN 11/4 A.N.(S.) 130 2 July, 1984

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 41, part 2, on 29 June, 1984 and would welcome comments and advance 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

2442 *Zygaena anthyllidis* Boisduval, [1828] (Insecta, Lepidoptera): proposed conservation.

1456 GOERIDAE Ulmer, 1903 versus TRICHOSTOMATIDAE Rambur, 1842 (Insecta, Trichoptera request for a ruling under Article 23d(ii).

2393 *Atractocera latipes* Meigen, 1804 (Insecta, Diptera, Simuliidae): proposed conservation in the common usage with rejection of the presumed holotype under the plenary powers.

2448 *Leucaspis* Signoret, 1869 (Insecta, Homoptera, Diaspididae): proposed conservation by the suppression of *Leucaspis* Burmeister, 1835 (Insecta, Hymenoptera, Leucospidae).

2333 CAECILIDAE in Amphibia and Insecta (Psocoptera): alternative proposals to remove the homonymy.

2421 *Laspeyresia* Hübner, [1825], (Insecta, Lepidoptera): proposed conservation by the suppression of *Cydia* Hübner, [1825].

.2314 *Byrrhus murinus* Fabricius, 1794 (Coleoptera, Byrrhidae): proposed conservation by the suppression of *Byrrhus undulatus* and *Byrrhus rubidus* Kugelann, 1792.

2456 *Rhopalocerus* W. Redtenbacher, 1842 (Coleoptera, Colydidae): proposed conservation by the suppression of *Spartycerus* Motschulsky, 1837.

1748 *Capys* Hewitson (1856), (Lepidoptera, Lycaenidae), proposed conservation under the plenary powers: a restatement of the case.

707 *Cochliomyia* Townsend, 1915 (Diptera, Calliphoridae): proposed conservation by the suppression of *Callitroga* Brauer, 1883.

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(Continued on inside of back cover)

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THE FIRST ADULT OF *SPINADIS* (EPHEMEROPTERA: HEPTAGENIIDAE)[1,2]

W. P. McCafferty, A. V. Provonsha[3]

ABSTRACT: An adult female of the aberrant mayfly genus *Spinadis* was reared from a larva collected from the White River, Indiana. Head, prothoracic, hind wing, and hing leg characters are of particular diagnostic value and may be applicable to the adult male also. Comparisons with all other genera of Heptageniidae revealed that in detail, the adult is as unusual for the family as is the larva. Its closest generic affinity is with *Anepeorus*. Both sexes of adults of the light-colored sympatric heptageniids *Macdunnoa persimplex, Nixe flowersi, Stenomena integrum*, and *Anepeorus simplex* should be distinguishable from *Spinadis*. A relatively small number of eggs were contained in the female.

The unusual and distinctive North American genus *Spinadis* was described by Edmunds and Jensen (1974) on the basis of small samples of larvae taken in 1973 and 1974, by different workers, from the Altamaha River, Georgia, the Wisconsin River, Wisconsin, and the White River, Indiana. One of the Indiana larvae collected by us was illustrated by Edmunds et al. (1976). The sudden and independent discoveries of this previously unknown mayfly from three disjunct locations in the eastern half of the U.S. is probably attributable to the increased emphasis on large river surveys and water quality studies during the 1970's.

We have continued to search comprehensively for additional larvae of *Spinadis* in the White River, but have been able to collect only one or two specimens at a time. Each time the larvae have been taken from different habitats and substrates of driftwood, gravel, and silt-sand. Since other collections of larval *Spinadis* have been as drift, including the most recently reported collection by Sanders and Bingham (1981) from the lower Mississippi River, the exact microhabitat of *Spinadis* remains unknown. Its scarcity in collections is, however, typical of some other "big river" mayflies. The most obvious comparison is with *Anepeorus* in the Midwest, which also happens to be an aberrant, carnivorous heptageniid. These similarities, although evidently considered fortuitous ecological parallelisms by certain workers, may possibly reflect some phyletic relationships as will be discussed below.

Spinadis is so strickingly unusual as a larva that Edmunds and Jensen (1974) erected an exclusive subfamily of Heptageniidae, Spinadinae, for it. They also indicated that, except for incipient wing venation apparent in larvae, it would be difficult to place these mayflies to family. The adult

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[2]Purdue Agricultural Experiment Station Journal No. 9852.

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stage, when discovered, would seemingly resolve questions about relationships of this genus, and thus we have assiduously attempted to rear it.

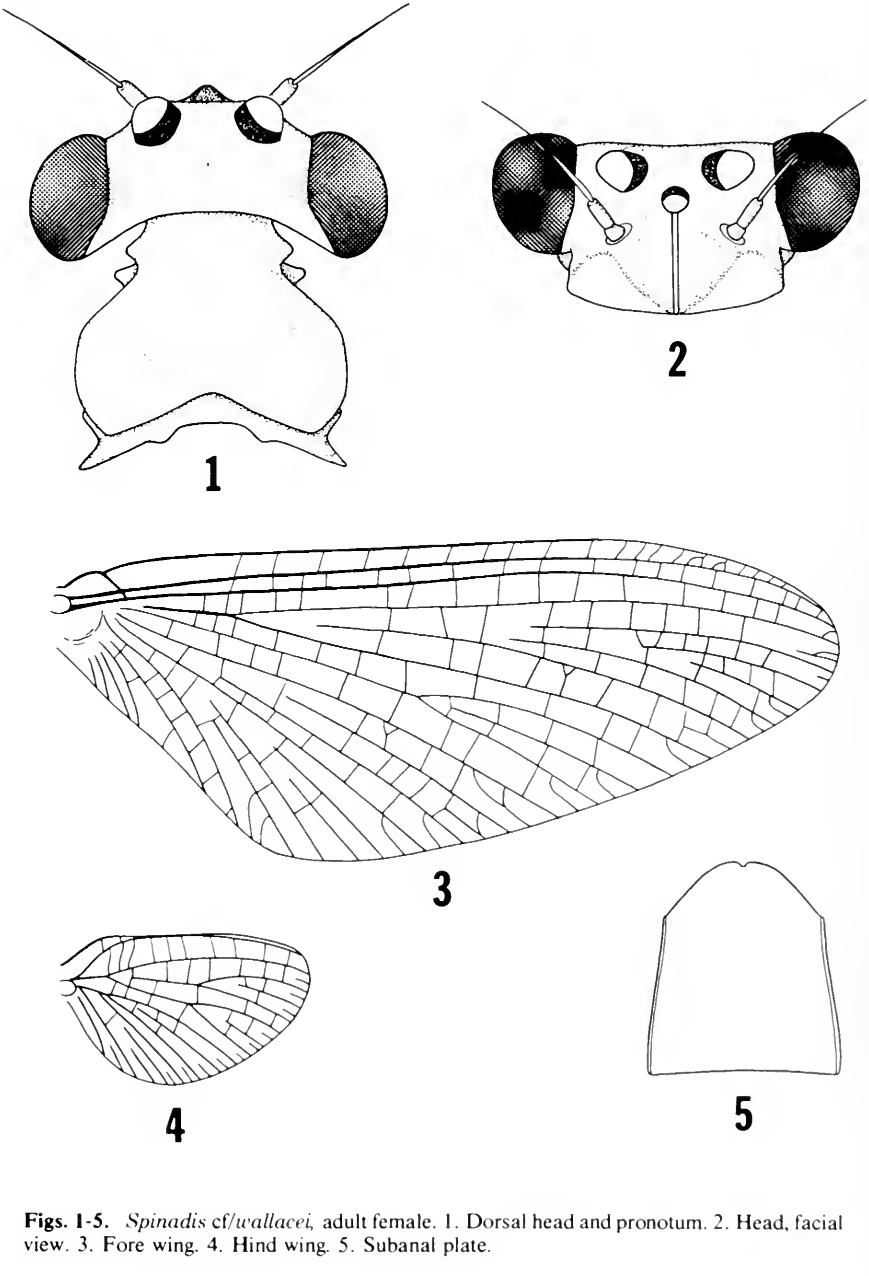
In 1982, we succeeded in rearing one adult female in our laboratory. Because it is very difficult to secure live larvae for rearing, and because our past experiences make us less than optimistic about rearing males in the near future, we now make the description of this female available. We do this cognizant that historically females of Heptageniidae have not yielded many reliable taxonomic characters; however, it appears that many times females are not studied closely by workers simply because of this reputation and so useful characters often are missed. In any case, a description may lead to further recognition of adults, including males, that may be unnoticed or misidentified, and any clues to the relationships of this anomalous taxon would appear justified. The described female is only tentatively assignable to the species *S. wallacei* Edmunds and Jensen, the only species described in the genus, and the following description and comparisons involve primarily generic rather than specific characterization.

Description

Adult female. Body 10.55 mm, white and unmarked except for charcoal bases of ocelli and very faint penciling appearing on some thoracic ridges. Compound eyes light, unicolorous externally, each with dark internal nucleus, dorsal median margins of eyes parallel in anterior half (Fig. 1); frontal shelf of head (Fig. 2) produced ventrally below level of eyes, truncate (ventral margin more-or-less straight) with well-developed ventro-lateral areas, unnotched medially along ventral margin. Prothorax (Fig. 1) large, broadly triangular; cervical region narrow and with two pairs of lateral obtuse projections as seen in dorsal view; posterior pair of projections representing more ventral supracoxal flanges; longitudinal midline of sclerotized pronotum ca. 1.75 x dorsal midlength of head. Fore legs 6.3 mm; tarsus .31 x tibia length; tibia 1.32 x femur length. Hind legs 6.1 mm, .58 x body length; tibia 1.16 x femur length; tarsus .33 x femur length, .29 x tibia length. Fore wings (Fig. 3) 9 mm; membrane transparent and unpigmented except stigmatic area translucent; longitudinal veins white; crossveins white and numerous; basal costal crossveins developed, attached, and straight to nearly straight; stigmatic crossveins not forming cellules, not anastomosed, slightly curving, some forked; bullar crossveins not crowded; MA symmetrically forked; base of MP_2 attached to MP_1 by crossvein; two pairs of cubital intercalaries between CuA and CuP, veins of second pair subequal in length. Hind wings (Fig. 4) 3 mm, .33 x fore wing length; costal projection reduced and rounded; membrane transparent and unpigmented; longitudinal veins and crossveins white; short, unattached intercalaries present in almost all major-vein interspaces; Rs forks attached to stem; MA forked; three intercalaries (one short, two long) between CuA and CuP. Subanal plate (Fig. 5) roundly produced posteriorly, with small median notch on posterior margin. Cerci 11 mm, unmarked.

Egg and Fecundity. Eggs round and similar to those of *Ecdyonurus insignis* (Eaton) as described and figured by Koss and Edmunds (1974). Knob-terminated coiled attachment threads concentrated at one pole, and chorion tuberculate. Only 311 eggs were found contained in the female; no eggs had been lost; and they were located in abdominal segments 1-6. This is a relatively small number of eggs for a mayfly (Clifford and Boerger (1974).

Material Examined. Adult female in alcohol, reared, dissected, with a fore and hind wing dry



Figs. 1-5. *Spinadis* cf/*wallacei*, adult female. 1. Dorsal head and pronotum. 2. Head, facial view. 3. Fore wing. 4. Hind wing. 5. Subanal plate.

slide-mounted and some eggs mounted in Hoyer's. Indiana: Martin Co., West Fork White River at Hindostan Falls Public Fishing Site, VII-26-1982, A. V. Provonsha and M. Doub. Deposited in the Purdue Entomological Research Collections.

DISCUSSION

Several character states are of use in distinguishing the female adults of *Spinadis* from females of other heptageniid genera, particularly when characters are used in combination. Perhaps even more importantly, character states have been found that have good potential for diagnosing males as well because they involve characters that are not sexually dimorphic among other known Heptageniidae. The following comparisons should still be viewed as provisional since the study of only one adult specimen of *Spinadis* precludes any accounting of possible individual variability, although most characters examined were selected because they are not known to be particularly prone to vary. Also, because there remains a paucity of information on adult female morphology, our comparisons are based on what can be gleaned from the literature on foreign genera and the study of females in our possession, which are limited to North American genera.

Two characters of the head appear to be of diagnostic value. The ventral margin of the frontal shelf (Fig. 2) is quadrately produced. We have not seen this exact character state in other Heptageniidae females, where instead there tends to be a medial production only and often a small notch or emargination on this ventrally produced region. If this facial character state is consistent for males (the ventral margin is not affected by sex in adults we have examined) it would either be similarly produced in the male of *Spinadis* if the male eyes exhibit primarily a dorsally oriented enlargement, as is the case in most genera, or it would at least appear as an unproduced, more-or-less straight margin between the eyes if the male eyes exhibit ventral enlargement, as is the case with some *Anepeorus*. Such an unproduced, straight margin is found in *Anepeorus, Pseudiron,* and possibly *Rhithrogeniella* (Ulmer 1939). The medial dorsal margins of the compound eyes (Fig. 1) are parallel with each other in the anterior half. In other female heptageniids we have examined, these margins are distinctly convergent posteriorly.

The relatively large prothorax of *Spinadis* (Fig. 1) appears to be of diagnostic value. In other heptageniid adults we know, including both males and females, the longitudinal midline of the pronotum is rarely much longer than the dorsal midlength of the head. In *Spinadis* it is nearly twice as long. Also, the posterior margin of the pronotum of *Spinadis* is not as deeply emarginate as in other genera (except *Anepeorus*), and the lateral projections in the cervical region are quite possibly unique. We cautiously presume that the male of *Spinadis* will exhibit a similar relative size of the prothorax, although we are aware of sexually dimorphic pronota in the palingeniid genus *Pentagenia* (McCafferty 1972). In examining this character care should be taken so that only sclerotized terga are measured. If the head or prothorax is pulled or telescoped, intersegmental membranous integument will appear between the head and pronotum and between the pronotum and mesonotum and possibly obscure length measurements.

Fore wing venation (Fig. 3) reveals no features that would be of value in distinguishing *Spinadis* from most other heptageniid genera, being describable as generalized for the family. The hind wing (Fig. 4), however, may be of some value for this purpose and should apply to males as well as females. There are three cubital intercalaries present, but at least eight other heptageniid genera can possess this number. North American genera that notably vary from this are *Leucrocuta* and *Nixe* (Flowers 1980), *Macdunnoa* (Flowers 1982), *Cinygma, Arthroplea,* and *Anepeorus.* The costal projection of the hind wing of *Spinadis* is very reduced and rounded. A similar costal projection is found in *Pseudiron* and *Anepeorus.* Other heptageniid hind wings exhibit an acute, subacute, or obtuse costal projection.

Fore leg segment proportions of adult female Heptageniidae genera are poorly known. Nevertheless, at least some valid diagnostic comparisons can be drawn with females of certain other North American genera. The fore tibia of *Spinadis* is atypically long relative to both the fore tarsus and the fore femur (it is approximately three times the length of the tarsus and one and one-third the length of the femur). As far as we know, only some *Rhithrogena* and possibly some *Epeorus* females (Traver 1935) approach these proportions. In most other genera the fore tarsus is almost as long as or longer than the tibia, and the tibia is seldom as long as or much longer than the femur. These characters require further study, and they are not usable for adult males.

Traver (1935) described the adult hind legs of several heptageniid genera and indicated that the characteristics applied to both males and females. We have also compared hind legs of many genera and found that character states dealing with segment proportions are consistent between sexes. It is therefore likely that the hind legs of *Spinadis* will prove to be highly valuable since they are essentially different from other genera. The hind tibia is relatively long, and the tarsus is relatively short, and these are also somewhat indicated in the larva of *Spinadis.* The adult hind tibia is 1.16 times the hind femur length. Only in the Asian genus *Bleptus* (Eaton 1885) is the hind tibia found that is as long as this (actually longer) in comparison to the femur. In North America, some *Epeorus, Rhithrogena,* and *Macdunnoa* have a tibia that is subequal to the femur. All other genera and other members of the latter three genera have a tibia that is shorter than the femur to various degrees. The hind tarsus of *Spinadis* is .29 times the hind tibia length. Some *Ironodes* and *Epeorus* exhibit the same proportions, and the hind tarsus of *Bleptus* (Eaton 1885), *Rhithrogena, Heptagenia,* and *Afronurus* (Schoonbee 1968) very closely approach this tarsus to tibia relationship. Other genera have a hind tarsus that ranges anywhere from .4 to 1.4 (greatest in *Pseudiron*) times the hind tibia length.

The shape of the subanal plate of the female was used to key groups of heptageniid genera by Edmunds et al. (1976). Its value remains questionable, however, because it is highly variable in some genera such as *Stenonema* (Bednarik and McCafferty 1979). The subanal plate (Fig. 5) of *Spinadis* is similar to those of some *Epeorus* and *Stenonema.*

Spinadis females should be distinguishable from other unmarked and relatively unpigmented females of heptageniid species that are found sympatrically from midwestern and eastern North America in the vicinity of larger rivers. These species include *Macdunnoa persimplex* (McDunnough), *Stenonema integrum* (McDunnough), *Nixe flowersi* McCafferty (see respectively Flowers 1982, Bednarik and McCafferty 1979, and McCafferty 1982 for treatments of these species), and presumably *Anepeorus simplex* (Walsh). *Spinadis* may be longer in body length than these species by as much as 4 mm, the hind tibia of *Spinadis* is proportionately longer, and the prothorax is proportionately larger in *Spinadis.* The costal projection of the hind wing, shape of the frontal shelf of the head, and the dorsal margination of the eyes should allow further discrimination between *Spinadis* and *Stenonema, Macdunnoa,* and *Nixe.*

Although only males of *Anepeorus* and females of *Spinadis* can presently be compared, there are some basic similarities. General wing venation, shape of the costal projection of the hind wing, and hind tarsus to hind tibia ratio are quite similar in the two genera. The ventral margin of the frontal shelf of the head, margination of the eyes dorsally, and general shape of the pronotum are similar in *Spinadis* and *A. simplex.* The macrohabitat, carnivorous habit, and gill structure of the larvae of the two genera are also similar. All these data suggest some relationship between the two genera (and subfamilies), particularly since many of these characteristics are not found in other heptageniids. Edmunds and Jensen (1974) did not feel that the two were closely related based on knowledge of larvae only. This possible relationship should now be reevaluated.

From adult morphology, *Spinadis* appears more closely related (at least phenetically) to *Anepeorus* than any other genus, although admittedly there are many aberrant structural differences between the larvae. (If the involved shared adult traits are of a primitive nature relative to the Heptageniidae they will not yield pertinent phyletic information.) Adult characteristics indicate a lesser affinity with *Pseudiron,* another unusual North American genus that has been placed in its own subfamily. The larvae of *Spinadis* lack the median terminal filament as do those of *Belptus* (Ueno 1931), *Ironodes,* and *Epeorus.* Adult hind leg character states are also similar in these genera, and some relationship among these four genera may also be indicated. Character state polarity in adult heptageniids needs to be reasonably understood before synapomorphies can be determined and the relative phyletic position of *Spinadis* theorized.

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NEW STATE MAYFLY (EPHEMEROPTERA) RECORDS FROM PENNSYLVANIA[1]

Peter M. Grant[2], Edwin C. Masteller[3]

ABSTRACT: Seven species of Ephemeroptera are reported from Pennsylvania for the first time: *Ameletus lineatus* Traver, *Epeorus fragilis* (Morgan), *Leucrocuta thetis* (Traver), *Leucrocuta umbratica* (McDunnough), *Nixe perfida* (McDunnough), *Paraleptophlebia moerens* (McDunnough) and *Paraleptophlebia ontario* (McDunnough). No male specimens of *A. lineatus* were collected. Known distributions of *L. thetis, L. umbratica* and *N. perfida* are widely disjunct.

An exhaustive search of the literature is required to compile the distribution records of most North American mayfly species. This is not always sufficient, though, as all scientific names in a particular publication are not necessarily indexed. Few checklists of Ephemeroptera exist for the states, provinces and regions of North America and no recently published lists exist for the northeastern United States including Pennsylvania.

Eighteen species of mayflies were collected in a study of mayfly emergence phenology in a first order Pennsylvania stream. The purpose of this paper is to report seven of these species from Pennsylvania for the first time: *Ameletus lineatus* Traver, *Epeorus fragilis* (Morgan), *Leucrocuta thetis* (Traver), *Leucrocuta umbratica* (McDunnough), *Nixe perfida* (McDunnough), *Paraleptophlebia moerens* (McDunnough) and *Paraleptophlebia ontario* (McDunnough).

All specimens were collected in a small, first order tributary of Sixmile Creek, Erie County, Pennsylvania (79° 57′ 18″, 42° 07′ 02″) in an emergence trap. A detailed site description has been published in Masteller and Flint (1980) and the trap design in Masteller (1977).

The following are reported for each species: emergence period in Roman numerals (months); year of capture; total number of male and female adults (subimagos and imagos) collected during that period; and pertinent anecdotal information.

Siphlonuridae

Ameletus lineatus Traver
IV-VI 1979, 207 ♀

Only females were collected. Traver (1935) and Burks (1953) also reported collecting

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only females. Male specimens, either nymphal or adult, have not been reported for this species.

Heptageniidae

Epeorus fragilis (Morgan)
V-VI 1978, 9 ♂, 5 ♀

This species is typically eastern in its distribution.

Leucrocuta thetis (Traver)
V-VI 1978, 12 ♂, 24 ♀

Leucrocuta thetis was previously known only from North and South Carolina (Traver 1935, Unzicker and Carlson 1982). This Pennsylvania record indicates a considerable northern range extension from the previously known distributions.

Leucrocuta umbratica (McDunnough)
VII-IX 1979, 1 ♂, 7 ♀

The only previously published U.S. records for this species are Peters and Warren (1966) and McCafferty and Provonsha (1978) for Arkansas. Its known North American distribution is quite disjunct, with specimens reported only from Manitoba (Flannagan and Flannagan 1982), Quebec (McDunnough 1931), Arkansas (Peters and Warren 1966, McCafferty and Provonsha 1978) and now Pennsylvania. This unusual distribution may be the result of misidentifications, since the adults of *L. umbratica, L. aphrodite* (McDunnough) and *L. hebe* (McDunnough) are quite similar (McCafferty and Provonsha 1978). However, McCafferty and Provonsha (1978) also pointed out that the western Arkansas mayfly fauna shares affinities with the Appalachian and midwestern mayfly faunas.

Nixe perfida (McDunnough)
VI-VII 1978, 3♂, 3 ♀

This species also has a disjunct distribution, known previously from Ontario (McDunnough 1926), Illinois (Burks 1953) and Arkansas (McCafferty and Provonsha 1978). McCafferty and Provonsha (1978) also reported collecting this species from sites in the midwest.

Leptophlebiidae

Paraleptophlebia moerens (McDunnough)
V-IX 1979, 948 ♂, 1143 ♀

This species was the most abundant mayfly collected at the Sixmile Creek site. *Paraleptophlebia moerens* is typically eastern in its North American distribution, but Harper and Harper (1981) collected this species in the extreme northwest corner of the Northwest Territories.

Paraleptophlebia ontario (McDunnough)
VI-VIII 1978, 19 ♂, 26 ♀ (?)

Published descriptions of *P. ontario* females were not sufficient to distinguish them from females of *P. mollis* (Eaton) and *P. strigula* (McDunnough), which were also collected at the Sixmile Creek site.

ACKNOWLEDGMENTS

We would like to thank R.W. Flowers, W.L. Peters and two anonymous reviewers for critically reading the manuscript and R.W. Flowers for assistance with identifications. This study was supported by a research program (FLAX 79009) of CSRS/USDA to Florida A & M University and The Behrend College Faculty Research and Scholarly Activities Fund of The Pennsylvania State University.

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A NEW INTERNATIONAL AWARD

The Council for the International Congresses of Entomology recently approved a new "Distinguished International Award in Morphology and Embryology," to be presented to an outstanding morphologist or embryologist at each future Congress of Entomology.

The award has been sponsored by the International Journal of Insect Morphology & Embryology (IJIME) and its publisher the Pergamon Press, Oxford, England and will consist of U.S. $1,500 in cash and a gold medal.

Two awards will be presented at the next Congress in Vancouver, Canada: one retroactively for 1984 and the other for 1988. Full details of the selection procedures will be published in the December 1984 issue of the International Journal of Insect Morphology & Embryology.

For additional information regarding this award, one may write to A. P. Gupta, Editor-in-Chief, International Journal of Insect Morphology & Embryology, Department of Entomology & Economic Zoology, Rutgers University, New Brunswick, NJ 08903, U.S.A.

A MYRMECOPHILOUS COCKROACH NEW TO THE UNITED STATES (BLATTARIA: POLYPHAGIDAE)[1]

Mark Deyrup[2], Frank Fisk[3]

ABSTRACT: *Myrmecoblatta wheeleri* Hebard is reported from the nest of *Camponotus abdominalis floridanus* (Buckley) in Highlands County, Florida. Previous records are from Costa Rica and Guatemala. *M. wheeleri* is probably one of a number of examples of Florida species whose nearest relatives occur in xeric Neotropical areas.

In the course of a survey of the ant fauna of the Archbold Biological Station in Highlands County, Florida, a colony of myrmecophilous cockroaches was discovered in a nest of *Camponotus abdominalis floridanus* (Buckley). We have determined that these specimens represent *Myremecoblatta wheeleri* Hebard, a species previously known from Guatemala and Costa Rica (Fisk et al., 1976). The Florida specimens have been compared with Costa Rican specimens, which had been compared with the types from Guatemala. The male genitalia of a Florida specimen appear identical to those of a Costa Rican specimen. Both sexes of the Florida specimens are slightly smaller than their Costa Rican counterparts.

This species (Fig. 1) cannot be confused with any other U.S. cockroach. The only other myrmecophilous cockroach in the U.S. is the southwestern *Attaphila fungicola* Wheeler, which can be distinguished by its small size (under 3 mm), unsegmented cerci, broadly expanded tibiae, and large arolia between the tarsal claws (Helfer, 1953, Fisk et al., 1976). The only other species of *Myrmecoblatta* is *M. rehni* Mann, a Mexican species that can be distinguished by the non-truncate oval tegmina of the male (Fisk et al., 1976).

The biology of *M. wheeleri* remains almost unknown. The Florida specimens were found beneath a dead slash pine log in a scrubby flatwoods habitat. At least 20 roaches of all sizes were visible when the log was turned over. Ant crickets (*Myrmecophila* sp.) occurred in the same ant nest. The ants made no attempt to seize or carry off the cockroaches, but carried off brood to underground chambers. The cockroaches did not follow this rush to underground chambers, but concealed themselves under bits of bark and in cracks in the dead tree. The cockroaches can run rapidly and can also

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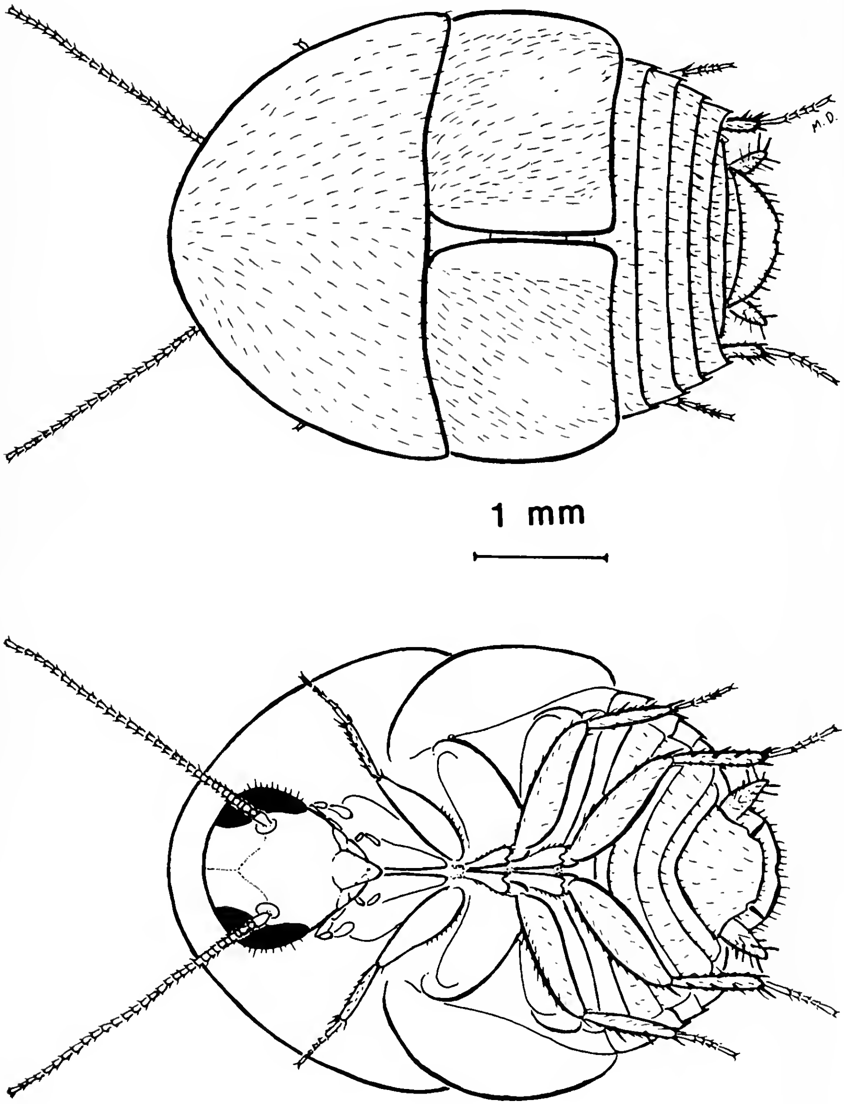

Fig. 1 *Myrmecoblatta wheeleri,* male.

withdraw their appendages underneath the body and adhere tightly to the substrate. The legs, antennae, and cerci of specimens examined are generally intact, showing no evidence of attacks by ants. There are no obvious tufts or glands that might produce secretions favored by ants, though the male cockroaches have a pair of obscure glands hidden under the third abdominal tergum. There are, in fact, no obvious morphological features that do not occur in various free-living roaches. The Costa Rican specimens are also from a nest of *Camponotus abdominalis,* while the Guatemalan type series is from a nest of *Solenopsis geminata* (Fabricius) (Fisk et al., 1976). *Myrmecoblatta rehni* Mann occurs in nests of both *Camponotus* sp. and *Formica* sp. (Fisk et al., 1976). There is, therefore, little evidence of strict host specificity in *Myrmecoblatta.*

We believe that *M. wheeleri* is native in south Florida in spite of the great distance from the nearest previously reported population. There is relatively small chance that a population of this species would be accidentally transported to Florida, become established, and remain undiscovered in the heavily collected coastal areas but rather turn up in a remote area of the interior of the state. There is good evidence that xeric habitats once extended around the Gulf of Mexico, providing a corridor to the Southeast for representatives of certain southwestern orthopteroid genera, such as *Arenivaga, Mantoida, Aptenopedes, Gymnoscirtetes,* and *Eotettix* (Hubbell, 1961). *Camponotus abdominalis floridanus* is itself an isolated population of a Neotropical species; the nearest population is *C. abdominalis transvectus* Wheeler, found some 500 miles away in southern Texas (Creighton, 1950). Among the ant inquilines of central Florida is also a recently discovered undescribed species of the histerid genus *Terapus,* whose nearest known relatives are in Mexico (Hinton, 1934).

Specimens of *M. wheeleri* are deposited in the collection of Dr. Frank Fisk (Columbus, Ohio), the collection of the Archbold Biological Station (Lake Placid, Florida), and the Florida State Collection of Arthropods (Gainesville, Florida).

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EPHEMERA COMPAR: AN OBSCURE COLORADO BURROWING MAYFLY (EPHEMEROPTERA: EPHEMERIDAE)[1,2]

George F. Edmunds, Jr.[3], W. P. McCafferty[4]

ABSTRACT: *Ephemera compar* Hagen is known only from the adult type specimen. The occurrence of this unique specimen and species in Colorado is discussed. Burrowing mayflies in the South Platte drainage area require investigation, and new collections are needed.

Adults of the burrowing mayfly genus *Ephemera* are conspicuous because of their large size and distinctive darkly speckled or spotted wings. Despite this, *Ephemera compar* Hagen (1875: 578) remains known only from a single specimen collected by Lt. W.L. Carpenter during the U.S. survey of Colorado Territory in 1873. The type locality is "Foot-hills, Colorado." No knowledge has been added since the original description. The objective of this paper is to stimulate interest in locating a population of this handsome, obscure mayfly in an effort to clarify the status of this species.

The widespread species *Ephemera simulans* Walker is the only other *Ephemera* known as far west as Colorado, and because Traver (1935) remarked on the similarity of *E. compar* with *E. simulans,* one might suspect that the two names are synonymous. Hagen, however, regarded *E. compar* as the American counterpart of the European *Ephemera lineata* Eaton rather than a close relative of the American *E. simulans.* We have examined the type of *E. compar* at the Museum of Comparative Zoology, Cambridge, Massachusetts; its striped abdominal segment color pattern resembles that of *Ephemera varia* Eaton of eastern North America, *E. lineata,* and several Asian species rather than the blotched segmental pattern of *E. simulans. Ephemera compar* is most assuredly not synonymous with *E. simulans.*

We regard *Ephemera* as one of the many North American mayfly genera that have a primary eastern and plains-prairie distribution (McCafferty 1975). *Ephemera simulans* extends into Wyoming, northwestern Colorado, northeastern Utah, Idaho, Washington and Montana. It occurs in rivers and lakes, and in Idaho and Montana it provides an important hatch for fly fishermen. *Ephemera traverae* Spieth occurs in

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Oklahoma (the third and only other species of *Ephemera* known west of the Mississippi River), its male genitalia differ markedly from *E. compar* and *E. simulans*, and its abdominal color pattern is distinctly different than that of *E. compar.*

We are unable to find a precise Colorado locality of "Foot-hills" or other evidence of the exact collection locality of *E. compar.* The survey area extended along the Front Range of the Colorado rockies west to the Park Range (average limit 106° 31′) and from 39° 30′ to 40° 20′ latitude (the south edge of greater Denver north to Loveland). Lieutenant Carpenter spent much of his collecting time above 12,000 foot elevations, but "foothills" is in contrast to this. Besides *E. compar,* Hagen described two species of stoneflies, *Isogenoides elongatus* (Hagen) and *Megarcys signata* (Hagen), from the same locality; both stoneflies range widely and over considerable elevation so they offer no clues in narrowing the type locality.

Hagen mentioned a number of other insects from "Foot-hills, Colorado," "foot-hills, Colorado" and "foothills of Colorado." In one case he used the terms "foot-hills, Colorado" and "foothills of Colorado" interchangeably. Evidence from several other insects suggests that the foothills collections were made in September.

Rumors persist of people collecting larvae of burrowing mayflies in the Front Range area of Colorado (South Platte River drainage), but as yet we have seen no specimens. Professor Robert W. Pennak (in letter) remembers collecting burrowing mayflies in about 1950 well east of the foothills in a spring and seep-fed billabong along the South Platte River. This site is on the south bank of the river about ¼ mile east of Colorado Highway 39 (about 15 miles northwest of Fort Morgan). The specimens no longer exist, and the exact genus was not determined. Subsequent collections by Pennak and his students at this site have not yielded additional burrowing mayflies. We have seen many specimens of *E. simulans* from the Yampa River in Colorado but no *E. compar. Hexagenia limbata,* another widespread North American ephemerid, was reported by Spieth (1941) from Clear Creek, in the survey area. *Ephoron album* (a burrower in the family Polymitarcyidae) occurs in the Green River in extreme northwestern Colorado, in southern Wyoming and in Nebraska just east of the Colorado border.

We are currently reviewing the genus *Ephemera* and believe that we would be able to recognize the unknown larvae of *E. compar* without rearing. In our attempt to locate *E. compar,* all burrowing mayflies from the South Platte drainage of Colorado are of particular interest to us. Discussions with Colorado aquatic entomologists indicate that burrowing mayflies are present but rare in the *Ephemera compar* "type area." Thus, any burrowing mayfly records will help focus our search.

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SOCIETY MEETING OF OCTOBER 17, 1984

The first regular meeting of The American Entomological Society was held on Wednesday evening, October 17, 1984 in Townsend Hall on the University of Delaware campus. Ten members and three guests were present.

Several notes of entomological interest were mentioned. An unusual number of walking sticks and earwigs have been encountered by several of those present. Bill Day suggested that perhaps, in the case of the earwigs, it might relate to the higher rainfall this year. Roger Fuester mentioned that the final results on 1984 gypsy moth defoliation have been tabulated. Approximately 1 million acres were seriously affected compared to 13 million in 1981.

The evening program was a slide show by Howard Boyd of his 1982 trip to the Galapagos Islands. He and his wife, along with four other people, chartered a 57 foot vessel to sail the islands. They landed on and explored twelve of the thirteen major islands. The Galapagos are volcanic in origin and have never had any connection to the mainland. The origin of most of the flora and fauna can be traced to the adjacent Ecuadorian area of South America. There is a high level of endemism. Two-thirds of the birds and all but one reptile are unique. The recent catastropic El Nino was just beginning at the time of their visit. Some loss of wildlife was already evident, but as the El Nino continued to develop, the unusually warm water resulted in a major ecosystem disturbance with much loss of life in the Galapagos area as well as along most of the west coast of South America.

Howard strongly recommends that anyone planning a visit to the Galapagos consider chartering a small vessel rather than joining one of the larger tours. For any visit a certified Ecuadorian naturalist guide is required. On the smaller vessels there is much more personal attention from the guide and more flexibility in setting the itinerary of the trip to meet the individual needs of those present.

Joseph Sheldon,
Vice President

STUDIES ON THE AUSTRALIAN CICINDELIDAE III: OBSERVATIONS ON THE AUSTRALIAN MEMBERS OF THE GENUS *CICINDELA* L. (COLEOPTERA)[1]

William D. Sumlin, III[2]

ABSTRACT: Bionomical observations and collecting data are presented for the following Australian species of the genus *Cicindela: C. iosceles* Hope, *C. sparsimpilosa* W. Horn, *C. crassicornis* Macleay, *C. doddi* Sloane, *C. arachnoides* Sumlin, *C. leai leai* Sloane, *C. leai demarzi* Mandl, *C. oblongicollis* Macleay, *C. nigrina* Macleay, *C. darwini* Sloane, *C.tetragramma* Boisduval, *C. albolineata* Macleay, *C. aeneodorsis* Sloane, *C. levitetragramma* Freitag, *C. ypsilon albicans* Chaudoir, *C. rafflesia rafflesia* Chaudoir, *C. rafflesia pseudorafflesia* W. Horn, *C. frenchi* Sloane, *C. saetigera* W. Horn, *C. semicincta* Brulle, *C. mastersi catoptriola* W. Horn, *C. mastersi plebeia* Sloane and *C. discreta* Schaum. Range extensions are presented for *C. crassicornis, C. darwini* and *C. mastersi plebeia.*

Although the tiger beetles are a popular group with collectors, there is a paucity of information concerning the behavioral ecologies, preferred habitats, etc. of the Australian members of the family. Noteworthy papers include W. Horn (1892, 1893, 1901 and 1913), Sloane (1905, 1906, 1909, 1913, 1914, 1917 and 1921), Mjoberg (1916), Lea (1917) and Freitag (1979), but the majority of these are taxonomic in content and disclose very little pertinent information concerning how to go about collecting Australian tiger beetles.

I developed the majority of the following data during my expedition to Australia in 1978-1979. Other observations were made by Allan Walford-Huggins of Jullaten, Queensland (Qld.), Australia and Noel McFarland of Nabawa, Western Australia (W. A.). Noel McFarland currently resides at Sierra Vista, Arizona.

For purposes of clarity, the species are ranked phylogenetically within their subgenera as set forth by Sumlin (1981). For a complete list of collecting localities, see Sumlin (1980).

SUBGENUS *ANTENNARIA* DOHKTOUROFF, 1883

Cicindela iosceles Hope

Cicindela iosceles Hope, 1841, Proc. Ent. Soc. London 4:45.

Observed Habitat: This species was always associated with light-

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colored sand and low-growing grasses in or near forests. North of Cooktown, Qld., I took over 80 specimens along a sandy roadrut leading into a closed forest. In the Northern Territory (N.T.), I found it on sandy roadcuts leading into open and closed forests.

Dates of Collection: Qld.: 17-18-XII-1978; N.T.: 6-I-1979, 8&9-I-1979.

Remarks: *C. iosceles* was usually quick to take flight, but normally flew only 2-3 meters and was easily netted. The species has a peculiar habit of antennating like a wasp. The antennation, or co-ordinated bobbing of the antennae, was most pronounced when the beetles were walking, although they also performed the action while at rest. I observed individuals near Cooktown for nearly an hour in an attempt to learn if the antennation was connected with any other activity. It did not appear to be as the beetles antennated constantly, no matter what they were doing. Another oddity noted for this species (and others) was that it spends its nocturnal hours off the ground clinging to pieces of vegetation (Fig. 1). This behavior was noted initially while I was searching for *Megacephala* species along a roadrut at night. What I took to be weevils attached to blades of grass and pieces of twigs, turned out to be individuals of *C. iosceles.* All beetles taken or observed were located at heights no greater than ca. 5 cm from the surface of the roadrut. Although *C. iosceles* is listed by Larochelle (1977) as coming to lights, it will normally not do so unless knocked from its nocturnal perch. Freitag (1979) listed the habitat of this species as being "open places, mainly near fresh water" which does not appear to be the case.

Cicindela sparsimpilosa **W. Horn**

Cicindela sparsimpilosa W. Horn, 1913, Arch. Naturg. Arb., 79(2):29.

Observed Habitat: *C. sparsimpilosa* was always taken in the same type of habitat as preferred by *C. iosceles,* but it tended to stay more in the shade of plants rather than out in the open.

Dates of collection: 30-XII-1978, 5&6-I-1979, 9&10-I-1979.

Remarks: This species was a little quicker to take flight than the preceding species and usually flew for a greater distance (5-10 m). Upon landing, it would normally seek cover in the shade of plants. Like *C. iosceles,* it antennated, although not as often nor as vigorously; it was also found to spend its nocturnal hours in the same manner. It is reported to come to lights by Freitag (1979), but it behaves like *C. iosceles* in that respect.

Cicindela crassicornis **Macleay**

Cicindela crassicornis Macleay 1888, Proc. Linn. Soc. N.S.W. (2), 3:445.

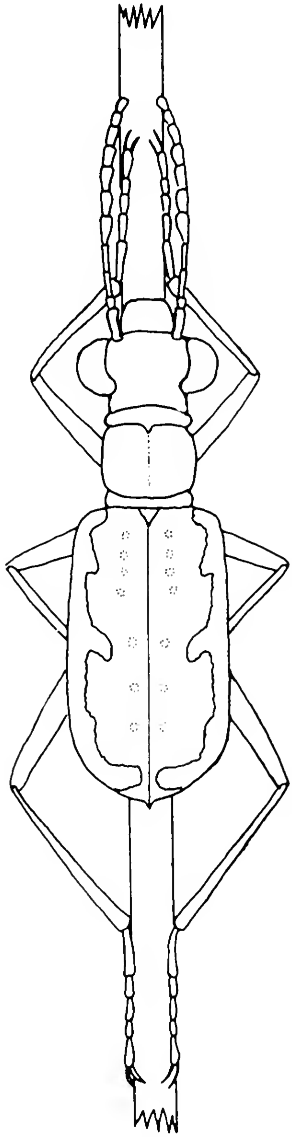

Fig. 1

Fig. 1. Dorsal view of *Cicindela iosceles* Hope in vertical, nocturnal, resting position on small twig.

Observed Habitat: This species was always taken in association with light-red sand supporting low vegetation. Most specimens were taken along sandy, grassy gullies near roadsides. The species seemed to prefer the open areas in such situations as it was rarely taken near the cover vegetation.

Date of Collection: 11-1-1979.

Remarks: Like *C. iosceles,* this species was a strong antennator, a weak flier and clung to vegetation at night. Mating pairs were seen at various localities and seemed to restrict themselves to areas where the sand was visibly wet or moist. The specimens reported by Sumlin (1980) from N.T., 17.2 km W. Timber Creek represent a new state record for the species.

Cicindela doddi Sloane

Cicindela doddi Sloane, 1905, Proc. Linn. Soc. N.S.W., 30:230.

Observed Habitat: *C. doddi* was collected on 2 occasions and, in both instances, was restricted to areas of heavy, red, clay soils supporting low-growing grasses. At neither location was it found near water as stated by Freitag (1979). Like the preceding species, *C. doddi* preferred open areas among the grasses.

Dates of Collection: 20-XII-1978, 28-XII-1978.

Remarks: This species proved to be the most aberrant of the *Antennaria* with respect to behavior and habitat. It is also structurally the most aberrant known species of the subgenus. It was never observed to antennate, which may indicate a correlation between dilated antennal segments (possessed by *C. iosceles, C. sparsimpilosa* and *C. crassicornis*) and the act of antennation; in contrast, *C. doddi* has non-dilated antennae. It is not known whether this species spends it nocturnal hours in the same manner as the other *Antennaria* as I never, knowingly, spent a night near a population.

SUBGENUS *MACFARLANDIA* SUMLIN, 1981

Cicindela arachnoides Sumlin

Cicindela (Macfarlandia) arachnoides Sumlin, 1981, Coleopt. Bull., 35:275.

Observed Habitat: This species was collected by Noel MacFarland on a fine, sandy-clay soil near low-growing, evergreen shrubs and on an adjacent sandy firebreak ca. 23 km SE Northampton, W.A.

Dates of Collection: 11-VII-1978, 6-VIII-1978, 10-VIII:1978.

Remarks: *C. arachnoides* is the only Australian member of the genus known to be active during the winter months.

SUBGENUS *MICROMENTIGNATHA* SUMLIN, 1981

Cicindela leai leai Sloane

Cicindela leai Sloane, 1905, Proc. Linn. Soc. N.S.W., 30:234.

Observed Habitat: *C. l. leai* was usually found in open, grassy areas near light-colored sand or coarse alluvium. It was usually found in the open, but not far from the surrounding vegetation.

Dates of Collection: 15-XII-1978, 20-XII-1978, 24-26-XII-1978, 28-XII-1978.

Remarks: This species, like *C. iosceles,* spends its nocturnal hours clinging to vegetation. The species is listed by Larochelle (1977) as coming to lights but it, again, is similar to *C. iosceles* in this respect. It was quick to fly, but normally flew only a distance of a meter or two. All sampled populations contained a high percentage of melanic individuals.

Cicindela leai demarzi Mandl

Cicindela nigella demarzi Mandl, 1960, Ent. Arb. Mus. G. Frey, 11:279.
Cicindela leai demarzi Mandl, Sumlin, 1981, Coleopt. Bull., 35:277.

Observed Habitat: This subspecies was taken in sandy situations associated with low-growing vegetation — usually grasses. It was taken, in many instances, along sandy roadruts and on the floor of open forests.

Dates of Collection: 5&6-I-1979, 9-I-1979.

Remarks: *C. l. demarzi* is apparently restricted to the state of N.T. Both subspecies were most active following rains and, in two instances, were collected during rainstorms.

Cicindela oblongicollis Macleay

Cicindela oblongicollis Macleay, 1888, Proc. Linn. Soc. N.S.W.(2), 3:445.

Observed Habitat: *C. oblongicollis* was taken at one location in northern W.A. on light-red sand associated with short grasses.

Date of Collection: 11-I-1979.

Remarks: The single specimen was taken running through grasses on small sand hummocks. It was an old specimen as it was missing tarsal segments and much of its setae were abraded.

SUBGENUS *ARCHIDELA* RIVALIER, 1963

Cicindela nigrina Macleay

Cicindela nigrina Macleay, 1863, Trans. Ent. Soc. N.S.W., 1:107.

Observed Habitat: This species was taken in two different habitats: on a salt flat north of Cooktown, Qld. and at blacklight near the Endeavour River north of Cooktown. On the salt flat it was found in association with grasses along the playa margin while the blacklights were located on a sandy roadrut leading into closed forest approximately 100 m north of the river.

Dates of Collection: 17 & 18-XII-1978.

Remarks: *C. nigrina* was quite wary on the salt flat and would fly for long distances (15-20 m). Several were seen, but only two were netted.

Cicindela darwini Sloane

Cicindela darwini Sloane, 1909, Proc. Linn. Soc. N.S.W., 34:299.

Observed Habitat: *C. darwini* was collected at light by Allan Walford-Huggins at Kelso Inlet, Delta Downs Station, Qld. on a mangrove beach located on the Gulf of Carpentaria.

Date of Collection: 3-XII-1982.

Remarks: The above mentioned specimens represent a new state record for Qld. as the species, heretofore, has only been known from N.T. Walford-Huggins states (*in litt.*) that he did not see any cicindelids at the location during the daylight hours, but *C. darwini, C. aeneodorsis* Sloane and *C. albolineata* Macleay all come to lights at night.

SUBGENUS *EUZONA* RIVALIER, 1963

Cicindela tetragramma Boisduval

Cicindela tetragramma Boisduval, 1835, Voyage de l'Astrolabe, 2:6.

Observed Habitat: *C. tetragramma* was taken on tidal salt flats at Nickol Bay and Carnarvon, W.A. and on sandy seabeach at Carnarvon.

Dates of Collection: 16&18-I-1979.

Remarks: This species proved to be quite wary and difficult to secure with a net. I spent over three hours on the flats at Nickol Bay and saw many individuals, but only managed to net nine of them during that time. Mating pairs were observed at that locality at dusk. During the day, the species normally would not allow me to approach any closer than 8 m before it took flight. Prior to flight, it would usually begin to run a rapid zig-zag pattern in much the same manner as members of the Nearctic subgenus *Ellipsoptera* Dohktouroff. After taking wing, the beetles would fly out onto the flats to distances of 10 to 20 m. The species was found to be heavily attracted to UV lights (15w longwave and 15W shortwave) as I collected in excess of 200 in that manner in less than an hour. *C. tetragramma* was the only species I encountered in Australia that emitted an odor when captured or handled. The odor was similar to that of stale beer.

Cicindela albolineata Macleay

Cicindela albolineata Macleay, 1888, Proc. Linn. Soc. N.S.W.(2), 3:444.

Observed Habitat: See *C. darwini.*
Date of Collection: See *C. darwini.*
Remarks: See *C. darwini.*

Cicindela aurita Sloane

Cicindela aurita Sloane, 1904, Proc. Linn. Soc. N.S.W., 29:528.

Observed Habitat: Not observed.
Dates of Collection: Unknown.
Remarks: Freitag (1979) speculated that this species may be found on ocean beaches. That is a possibility; however, the localities listed by him for *C. aurita* (Port Alma, Cooktown and Cairns, Qld.) have only one habitat in common — tidal salt flats.

Cicindela aeneodorsis Sloane

Cicindela aeneodorsis Sloane, 1917, Proc. Linn. Soc. N.S.W., 42:337.

Observed Habitat: See *C. darwini.*
Date of Collection: See *C. darwini.*
Remarks: See *C. darwini.*

Cicindela levitetragramma Freitag

Cicindela levittragramma Freitag, 1979, Aust. J. Zoo. Suppl. Ser., 66:39.

Observed Habitat: This species was taken on a sandy mangrove beach at Broome, W.A. Most of the specimens were collected near the water's edge.
Date of Collection: 14-I-1979.
Remarks: *C. levitetragramma* proved to be a wary species, but not nearly so as *C. tetragramma,* nor was its flight as strong. It is attracted to blacklights, although not as strongly as *C. tetragramma.* Mating pairs were observed at the water's edge near dusk.

SUBGENUS *HYPAETHA* LE CONTE, 1860

Cicindela ypsilon albicans Chaudoir

Cicindela albicans Chaudoir, 1854, Bull. Soc. Imp. Nat. Moscou, 27:117.
Cicindela ypsilon albicans Chaudoir, Freitag, 1979, Aust. J. Zoo. Suppl. Ser., 66:45.

Observed Habitat: This species was taken at Armstrong Beach, Qld. Most of the specimens were collected along the high-tide mark on sandy seabeach.

Date of Collection: 5-XII-1978.

Remarks: *C. y. albicans* was somewhat difficult to see when it flew as it blended quite well with the color of the beach sand on which it was found. It appeared to be most active during the morning and late afternoon hours and is attracted to blacklights. Its flight was usually not strong and covered only about 3 or 4 m.

Cicindela rafflesia rafflesia Chaudoir

Cicindela rafflesia Chaudoir, 1852, Bull. Soc. Imp. Nat. Moscou, 25:13.

Observed Habitat: *C. r. rafflesia* was normally encountered on sandy seabeach above the high-tide mark; although at Carnarvon, W.A., it was also taken on a tidal salt flat.

Dates of Collection: 6&7-I-1979, 18-I-1979.

Remarks: Like the preceding species, *C. r. rafflesia* was very difficult to see against beach sand due to its coloration. It normally flew only a short distance when pressed to fly. Mating pairs were noted at all localities where it was present.

Cicindela rafflesia pseudorafflesia W. Horn

Cicindela pseudorafflesia W. Horn, 1925, Ent. Blatter, 21:139.
Cicindela rafflesia pseudorafflesia W. Horn, Sumlin, 1981, Coleopt. Bull., 35:278.

Observed Habitat: This subspecies was encountered only at Broome, W.A. on a sandy mangrove beach above the high-tide mark.

Date of Collection: 14-I-1979.

Remarks: *C. r. pseudorafflesia* behaved in the same manner as the nominate subspecies, although it was easier to see on the beach due to its wide maculation. It is attracted to blacklights.

Cicindela frenchi Sloane

Cicindela frenchi Sloane, 1904, Proc. Linn. Soc. N.S.W., 29:527.

Observed Habitat: *C. frenchi* was taken at a single location — Derby, W.A. It was only found along the margins of a large tidal salt flat.

Date of Collection: 13-I-1979.

Remarks: This species was not in abundance at the above locality as only 8 specimens were seen and taken. Of those, 5 were collected at blacklights along the margin of King Sound. No mating pairs were seen.

SUBGENUS *RIVACINDELA* VAN NIDEK, 1973

Cicindela saetigera W. Horn

Cicindela saetigera W. Horn, 1893, Deutsche Ent. Zeitschr., p. 198.

Observed Habitat: This species was taken on a salt flat just south of Tailem Bend, S.A. Most specimens were taken along the margin of the playa.

Date of Collection: 23-I-1979.

Remarks: *C. saetigera* displayed a preference for running not seen in other Australian species. At first, I thought the species was incapable of flight as individuals would not fly. After netting several, I attempted to coax an individual to fly. With some nudging, it took flight and flew approximately 20 m. Mating pairs were observed in the late afternoon hours.

SUBGENUS *MYRIOCHILE* MOTSCHULSKY, 1861

Cicindela semicincta Brullé

Cicindela semicincta Brullé, 1834, Rev. Ent. 2, p. 100.

Observed Habitat: This species was normally encountered near the water, along streams, rivers, beaches, and salt flats in Qld. and N.T.

Dates of Collection: 3-5-XII-1978, 17-XII-1978, 24-26-XII-1978, 28-30-XII-1978, 5-I-1979.

Remarks: This is the most commonly encountered species on the continent. Although quite wary during the day, it is heavily drawn to blacklights at night — especially after rains have fallen. Mating pairs were observed at many locations.

Cicindela mastersi catoptriola W. Horn

Cicindela catoptriola W. Horn, 1901, Deutsche Ent. Zeitschr., p. 355.
Cicindela mastersi catoptriola W. Horn, Sloane, 1909, Proc. Linn. Soc. N.S.W., 34:301.

Observed Habitat: *C. m. catoptriola* was always taken in or near grasses not far from water.

Dates of Collection: 29-XII-1978, 5-I-1979, 9-I-1979, 11-I-1979.

Remarks: This subspecies was never abundant where it was found. It proved to be quite wary and would hide among the shadows of the grasses that dotted its habitat. Once discovered, it would fly quickly for 2 to 3 m and run back into the shadows. One specimen, previously reported by Sumlin (1980) as a nominate *C. mastersi,* came to blacklights at the Einasleigh River east of Georgetown, Qld.

Cicindela mastersi plebeia Sloane

Cicindela plebeia Sloane, 1905, Proc. Linn. Soc. N.S.W., 30:232.
Cicindela mastersi plebeia Sloane, Sloane, 1909, Proc. Linn. Soc. N.S.W., 34:301.

Observed Habitat: Like the preceding subspecies, this one was found to be associated with grassy areas near standing water. *C. m. plebeia* was normally found on very dark brown or black soils whereas *C. m. catoptriola* occurred on red or red-brown soils.

Dates of Collection: 17&18-XII-1978, 20-XII-1978, 9-I-1979, 11-I-1979.

Remarks: Although this species was examined by Freitag (1979) in some detail, it needs further study with respect to specific/subspecific rankings. At one location in N.T. (75.8 km N Katherine), I found *C. m. catoptriola* and *C. m. plebeia* together behaving as "good" species. During later studies on my *C. mastersi* specimens, I noted that all of my *C. m. catoptriola* specimens (17) possessed proepisterna that were quite setose and rugose while all my *C. m. plebeia* (31) were found to have proepisterna that were glabrous (except for the extreme ventral edge) and smooth. Although my samples are not large enough to draw valid conclusions from, it would appear that further study is needed on the species. The specimens reported as *C. m. catoptriola* from various localities in N.T. (75.8 km N Katherine, 10.1 km S Adelaide River and 9.1 km E Timber Creek) by Sumlin (1980) represent new state records for *C. m. plebeia.*

SUBGENUS ***CYLINDERA*** WESTWOOD, 1831

Cicindela discreta discreta Schaum

Cicindela discreta Schaum, 1863, Jour. Ent., 2:59.

Observed Habitat: *C. discreta* was encountered at but a single location just north of Cooktown, Qld. Six specimens were taken at blacklights set up on a roadrut leading into a closed forest. No diurnal observations were made on the species.

Date of Collection: 17-XII-1978.

Remarks: The species *C. froggatti* Macleay was long held as a synonym of *C. discreta* by Walter Horn and was retained in that capacity by Freitag (1979). However, van Nidek (1980) recognized it as a valid subspecies of *C. discreta* based upon a study series taken at Kuranda, Qld. My small series from near Cooktown bear no resemblance to Macleay's (1887) original description nor to characters pointed out by van Nidek (1980). As Freitag (1979) is the last reviewer of the species, his view is followed here.

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A UNIQUE COLLECTION OF TWO *RHANTUS WALLISI* IN THE BODY CAVITY OF A FEMALE *DYTISCUS ALASKANUS* (COLEOPTERA: DYTISCIDAE).[1]

R.B. Aiken, F.L. Leggett[2]

As part of a study on the reproductive biology of *Dytiscus alaskanus* (J. Balfour-Browne), we collected aquatic beetles every week in floating bottle traps (Aiken and Roughley, in press) from George Lake, Alberta 55°55'N, 114°05'W). *D. alaskanus* specimens were taken alive to the lab, killed in 70% ethanol and then the abdominal cavity injected with 70% ethanol to preserve the reproductive organs. While dissecting a female *D. alaskanus* collected in early June, we discovered two specimens of *Rhantus wallisi* (Hatch) in the abdominal cavity of the female *D. alaskanus.* The internal organs of the *D. alaskanus* female were gone except for a few muscle fibres. The female *D. alaskanus* was of average size for the species (total length = 2.56 cm).

The two specimens of *Rhantus* had apparently entered the body cavity of the *D. alaskanus* female at the intersegmental membrane between the last tergite and the genital capsule. In this area, there are numerous scallop-shaped bite marks along the posterior edge of the tergite. The most reasonable hypothesis is that the *Rhantus* probably attacked the *D. alaskanus* female when she was alive (we took only *D. alaskanus* from the lake and were careful to preserve only live animals) but weakened or injured. This concurs with other observations (Johnson and Jackinovich, 1970) that much of the diet of these 'predaceous' beetles is dead animal matter. Because of the methods of collecting and preserving, we are certain this attack occurred in the field. The confinment of the beetles in bottle traps for up to two days raised the probability of this occurring by bringing the two species in close and repeated contact.

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Fig. 1. Two *Rhantus wallisi* in the body cavity of a *D. alaskanus* female.

A BLOWFLY TRAP FOR STANDARDIZED FIELD SAMPLING[1]

Luis Fernando Jiron[2]

ABSTRACT: A useful trap for population studies on blowflies is described. This trap has advantages over others of its kind due to its simple construction and low cost. It also may be used for accumulative as well as non-accumulative adult trapping.

Literature on traps, chemical attractants, and other devices to collect adult insects is quite abundant (Bram 1978, Williams 1951). On the other hand, the majority of collecting methods and apparatus designed to collect adult Diptera are mostly for studies on mosquitoes, the Mediterranean fruit fly (*Ceratitis capitata* Wiedemann) and other tephritids, and the primary screwworm fly (*Cochliomyia hominivorax* Coquerel) (Brockway 1962, Cunningham et al. 1978, Villegas and Coto (1981). Although many of the necrophilous blowfly species are commonly collected in traps primarily designed for screwworm flies (as non target species), there are very few specifically designed for standardized trapping of this group of calliphorids (Bishop 1916, Vogt and Havenstein 1974).

Collecting blowfly adults in the field is not a hard task. Liver baits, live or dead animals, and even chemical attractants are very effective (Broce et al. 1977, Coppedge et al. 1977, 1981). Moreover the best way to measure population density fluctuations over several weeks or months in a given area is to use a standardized bait for necrophilic species. An adequate and safe trap is important, otherwise vertebrate scavengers will steal the bait. In some cases, bait does not last overnight in the field.

The object of this report is to describe an efficient and inexpensive blowfly trap which, by "sampling" blowflies at certain hours, weather conditions, etc., is able to detect differences in the behavior of natural populations. This is not possible using existing blowfly traps. This trap is useful for both cumulative and non-cumulative insect trapping.

MATERIALS AND METHODS

This trap is constructed of two green-painted wooden frames, a pole (1.30m) and two plastic pans. The outer frame fits over the inner frame (30 x 30 x 7.5 cm, extern. measur.) which is attached to the support pole (7.5 x 7.5 x 130 cm) by a 20 cm strip (Fig. 1A). The inner frame holds one

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of the plastic pans, which has five drain holes in the bottom (Fig. 1B). The outer frame (31 x 34 x 7.5 cm) has a 1.3 cm mesh screen over its upper side.

For collecting calliphorid flies as well as other carrion insects, a dead rat or chemical attractant or other bait is placed inside the bottom pan. Then the outer frame is put in place (Fig. 1C). Several hours or days later, the upper pan is carefully dropped over the screen on the upper frame. A few seconds later, 1.5 ml of chloroform are injected through a tiny hole in the pan wall, and the insects are easily collected once activity ceases (Fig. 1D).

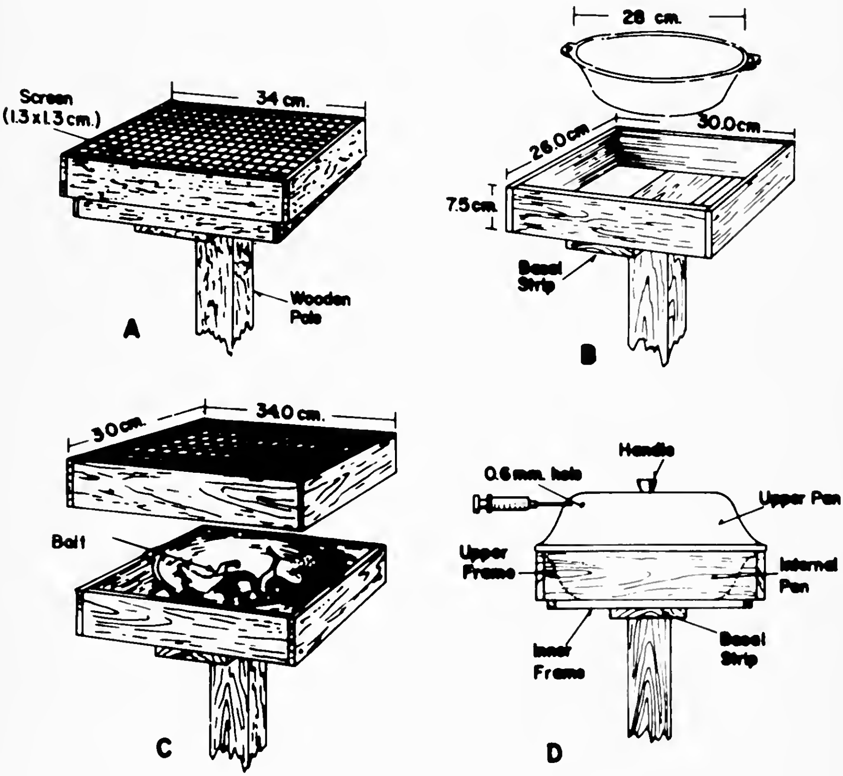

Fig. 1. Non-cumulative blowfly trap. A. assembled trap; B. The inner frame attached to the basal pole and the bait holding (internal) plastic pan; C. Exploded view of trap; D. trap in operating position (upper pan added).

RESULTS AND DISCUSSION

In our studies on blowfly population fluctuations in Costa Rica, we have been using this type of trap over many weeks with satisfactory results. In spite of being a very simple trap baited with a relatively small rat (approx. 200 g), we have collected up to 204 adult blowfly specimens in one sample. Unfortunately, in entomological literature, we could not find any non-cumulative trap to be compared with the one presented here. A non-cumulative trap like this permits the obtaining of data on the effect of different weather factors on the behavior of natural populations. Utilizing this trap we have observed that sampling rates improve with high luminosity

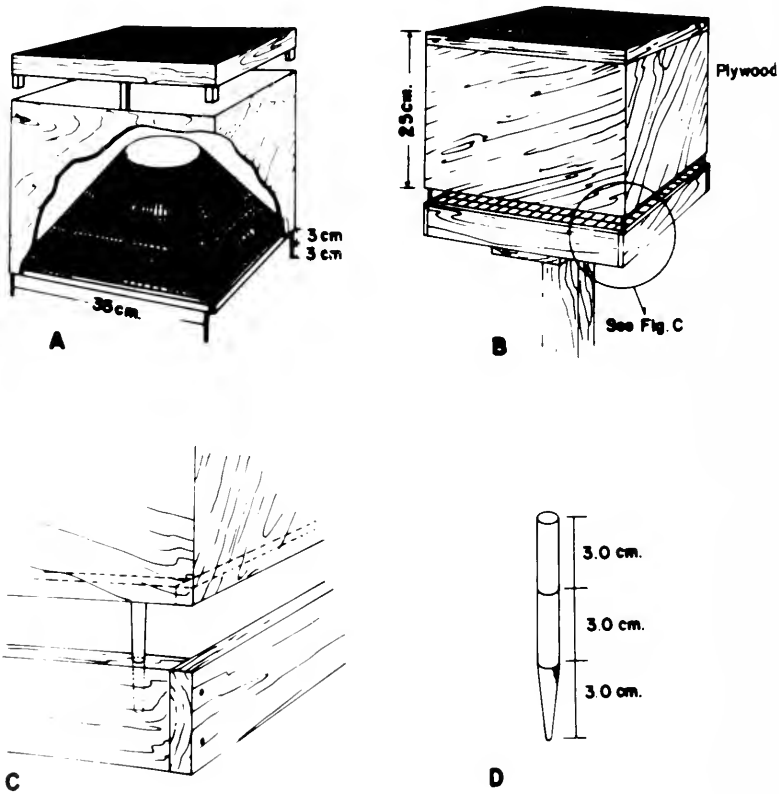

Fig. 2. A. Cumulative collecting box; B. Box attached to trap; C. Corner of accumulative collecting box attached to upper frame by mean of stell pin; D. Steel pin.

and relative humidity.

This trap can also be used for cumulative sampling, simply by placing a collecting box 3.0 cm above the upper frame (Fig. 2A). The four sides of the collecting box are made of thin plywood. The cover is made of mosquito screen. Internally, there is an inverted screen funnel with an opening of 2.0 cm, so that the insects can not escape through the bottom (Fig. 2B). The collecting box fits into the trap by inserting its four legs (steel pins) at the corners, into the 3.0 cm holes in the outer frame (Figs. 2C, 2D). To remove the insects, cover the top and bottom with plywood or cardboard and inject a small amount of chloroform or ether. With this attachment, baited with a rat, we have captured up to 414 adult flies in one week.

In general, absolute catching rates with our cumulative trap are clearly lower than those of Vogt and Havenstein (1974), who obtained as many as 2300 blowflies in one day from a single trap. However, in spite of the fact that both traps are comparable, ecological conditions in which they were used were very different: a sheep pasture in Australia compared with a secondary succession wet forest in Costa Rica. It is well known that in tropical wet forests the variety of species is much higher, and insect populations tend to maintain low densities. While we captured as many as nine species of blowflies from natural populations, Vogt and Havenstein (1974) reported only one, the sheep blowfly, *Lucilia (= Phaenicia) cuprina* (Wied.) in a very altered habitat.

Trap collecting of insects is affected by factors such as kind of bait, trap location, color, size, and trap height (Bram 1978). However, in many cases these differences may be interpreted as insect interspecific preferences for food, attractants, micro-climate, vertical distribution, etc. By utilizing this kind of trap, we have noticed differences in number and proportions of blowfly species at different trap heights in Costa Rican species.

In conclusion we consider the non-cumulative trap very useful for ecological studies on the behavior of natural populations. Other known traps seem to be adapted primarily for survey and control of populations, usually pests. Since it may be used for both cumulative and non-cumulative trapping, the researcher can use it at his convenience in population studies of blowflies.

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THIRD INTERNATIONAL CONGRESS OF SYSTEMATIC AND EVOLUTIONARY BIOLOGY, 1985

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GONIOZUS PAKMANUS (HYMENOPTERA: BETHYLIDAE), A NEW SPECIES IMPORTED INTO CALIFORNIA FOR THE BIOLOGICAL CONTROL OF PINK BOLLWORM, *PECTINOPHORA GOSSYPIELLA* (LEPIDOPTERA: GELECHIIDAE)[1]

Gordon Gordh[2]

ABSTRACT: *Gonziozus pakmanus*, new species, is described from material imported into California from Pakistan for the biological control of pink bollworm, *Pectinophora gossypiella* (Saunders). The parasite is being propagated at the University of California for release in northern Mexico and Arizona against this pest of cotton.

Goniozus Foerster is a cosmopolitan genus of primitive aculeate Hymenoptera (Chrysidoidea: Bethylidae). Presently I recognize 141 nominal species in this genus, all of which are presumed primary, external parasites of Lepidoptera larvae. Some details of the potential and realized usefulness of members of this genus to applied biological control programs have been published elsewhere (Gordh et al., 1983).

During 1982, Professor E. F. Legner, Division of Biological Control, UCR, imported an undescribed species of *Goniozus* from Pakistan where it was collected on cotton. This paper provides a name for that species. The parasite appears relatively restricted in its host preference in laboratory studies and details of its biology will be published elsewhere. The parasite is being released in untreated cotton near Mexicali, Mexico and Phoenix, Arizona.

The terminology of Evans (1964) is used in the following description.

Goniozus pakmanus, new species.

♀ Holotype 2.58 mm long (2.55 ± 0.19; n = 42). Body jet black, mandibles amber with apices darker. Coxae concolorous with body; trochanters pale; femora black, apically pale, middle and hind femora somewhat paler, tibiae, tarsi, antenna concolorous, tan. Wings hyaline.

Head in dorsal aspect slightly longer than wide (Fig. 2) (holotype 1.09; 1.09 ± 0.02; n = 39), surface finely, uniformly reticulate with moderate vestiture of shallow setigerous punctures except posteriad of compound eye. Clypeus protuberant, well formed with narrow, well-defined median longitudinal carina projecting caudad between dorsal margins of scrobes. Scrobes ecarinate. Ocelli forming an obtuse triangle, lateral ocellus about 0.5 times ocellar diameter from posterior margin of head. OOL:WOT 10:8 (holotype). Mandible quadridentate, teeth not large but third tooth largest. Antennal configuration as shown (Fig. 7).

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Propodeum shield-shaped (Fig. 3). Median discal and sublateral carinae absent; anteriomedial area forming a slightly elevated, polished, triangular area projecting well beyond half-length of propodeum anterior of transverse carina; remainder of propodeal disc reticulate. Lateral carina narrow, well-defined, complete; lateral face of propodeum reticulate, with pattern somewhat more bold than dorsal disc. Transverse carina complete, poorly defined; posterior declivity reticulate, pattern larger and weaker than discal pattern. Forewing shape, venation and chaetotaxy as illustrated (Figs. 4, 5). Metepimeron forming a small, acutely triangular sclerite with dorsal two thirds densely setose. Fore femur slightly less than two times longer than wide (holotype 23:12).

♂ Similar to female in habitus, sculpture and chaetotaxy. Differing in its smaller size (allotype 2.09 mm; 2.06 ± 0.14; $n = 38$), ocellar size, apical six segments of the antenna more dusky, mandible yellow with reddish apex and head in frontal view very slightly longer than wide (2 (1.01 ± 0.02; $n = 52$; allotype 1.03) (Fig. 1). Genitalia as illustrated (Fig. 6), and apical sternum with a well-defined posteromedial notch (Fig. 8).

Described from 111 ♀♀ and 79 ♂♂ card-point, lab reared specimens at the University of California, Riverside (importation number R-82-47) on *Pectinophora gossypiella* and parts of 28 slide-mounted specimens reared from the same facility. The original material was received by E.F. Legner from A.I. Mohyaddin, who collected parent stock from cotton at Bhai Phero (Lahore), Raiwind (Qasur), Pakistan during October 1982. Holotype, 5 ♀♀ and 5 ♂♂ paratypes deposited in the California Academy of Science, San Francisco; 2 ♀♀ and 2 ♂♂ paratypes deposited in the following institutions: U.S. National Museum, Washington, DC; Canadian National Collection, Ottawa; Colorado State University, Fort Collins; Zoological Institute, Leningrad; Plant Protection Research Institute, Pretoria; Ehime University, Matsuyama. The remainder of the paratypical series is deposited at UCR.

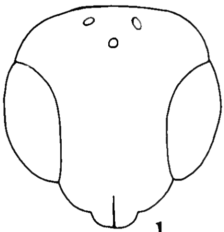
For nomenclatural purposes the specific epithet (*pakmanus*) may be regarded as an arbitrary combination of letters and is masculine in gender.

DISCUSSION

The morphological differences between sexes are slight with females being larger, the ratios of head length to width are different, males have pale mandibles, and the ocellar size and triangle formation is different. Understandibly, *G. pakmanus* does not fit well into the species groups of *Goniozus* proposed by Evans (1978) for North American representatives of the genus, and species groups have not been developed for other zoogeographical realms. The new species shares important features with the **Floridanus** and **Aethiops Groups** in lacking a scrobal carina, the forewing basal vein is long (Figs. 4,5) but the areolet is incomplete, the propodeum possesses a complete but weakly developed transverse carina (Fig. 3) and *pakmanus* further resembles *aethiops* in structure of the clypeus.

Goniozus pakmanus is provisionally assigned to the **Aethiops Group.** It runs to *G. aethiops* in Evans' (1978) key and is distinguished from

Figs. 1-8. *Goniozus pakmanus* new species. 1. Male head, dorsal aspect. 2. Female head, dorsal aspect. 3. Female propodeum, dorsal aspects. 4. Female forewing venation and chaetotaxy (detail). 5. Female forewing (obsolete veins represented by dashed lines). 6. Male genitalia, ventral aspect. 7. Female antenna. 8. Male apical sternal of gaster.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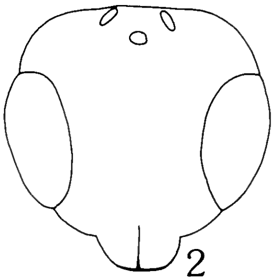
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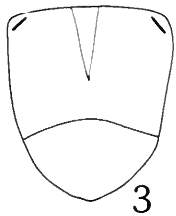
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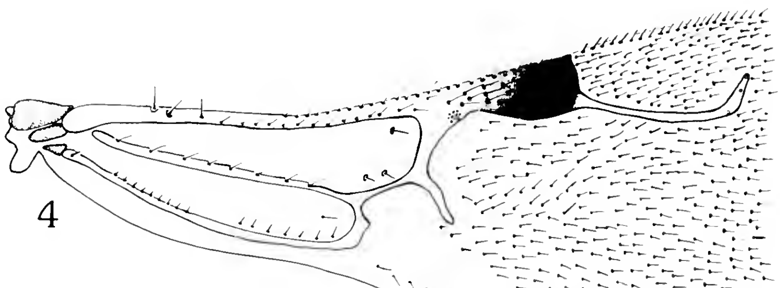
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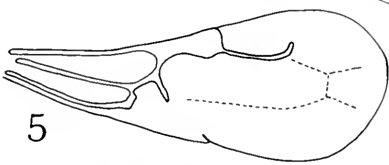
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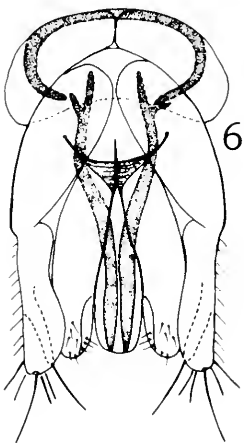
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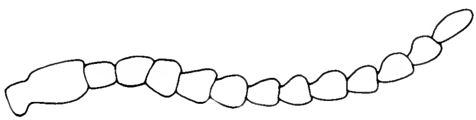
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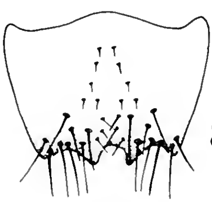
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aethiops by the large body size, black mandible, polished and nearly impunctate head, dark coloration of the prostigma, and sculpture of the propodeum of that species. Both species are on cotton.

Twenty-three species are current assigned to *Goniozus* from the Indian subcontinent (Gordh, unpublished). Kieffer's (1914) keys to oriental *Goniozus* are outdated and many types of species described by him cannot now be located. Kurian (1954a) prepared a provisional catalog of oriental bethylids and keys to the species then assigned to *Goniozus* and its synonym *Perisierola* (Kurian 1954b, 1955). Beyond these works nothing has been attempted on bethylids taxonomically. *Goniozus pakmanus* does not fit well in existing keys to oriental bethylids and a revision of the species of the region must be undertaken before an understanding of the affinities of *G. pakmanus* to the endemic fauna of that region can be attempted.

Thirty-six species of *Goniozus* are recognized in North America, including species previously assigned to *Parasierola* (in Krombein et al., 1979). Three species have been purposefully introduced for biological control programs in California. *Goniozus aethiops* Evans was described from material collected in Ethiopa during 1970 by B. R. Bartlett for control of PBW; it has not been recovered (but there have not been attempts at recovery). *Goniozus legneri* Gordh was imported from Uruguay by E. F. Legner for control of the navel orangeworm, *Paramyeois transitella* (Walker); this parasite has been recovered and is providing biological control of NOW. This parasite will attack PBW under laboratory conditions, but it has not been released against this pest on cotton in California. A third species, *G. emigratus* (Rohwer), was described from material taken in Hawaii, but Rohwer believed the species was originally from North America and noted that August Busck had reared it from PBW (Rohwer 1917). This parasite was collected in Texas by Legner and details of its biology have been published (Swezey, 1915; Busck 1917; Bridwell 1919; Poulton 1922; Gordh and Hawkins 1981). With the release of *G. pakmanus* we potentially have 39 described species of *Goniozus* occurring in North America.

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DETERIORATION PROBLEM IN *GENERA INSECTORUM* AND REPAIR RECOMMENDATIONS TO LIBRARIANS

The Preservation Librarian, Ms. Myra Jo Moon, Colorado State University, Fort Collins, CO 80523, has written *Ent. News* to alert readers, particularly institutional librarians, about a deterioration problem relating to the publication, *Genera Insectorum.* Over the years, the protective tissues for the illustrations have become adhered to the colored lithographics of the insects. These tissues can not be removed by merely trying to pull them away. Scraping with a sharp knife also removes the color along with the tissue. Ms. Moon indicates she was able to remove the tissues by carefully wetting the tissues with water and gently lifting them with a thin spatula blade so as not to remove the color of the lithographs. The color is not water soluble nor does the water absorb into the paper of the plates. After removing all the tissues throughout the entire set, the tissues were replaced with a neutral acid free glassine paper to prevent the illustrations from bleeding onto the facing pages. Further details may be obtained from Ms. Moon, to whom *Ent. News* expresses appreciation for writing to alert readers about this situation.

Readers, particularly institutional librarians, are encouraged to check any sets of *Genera Insectorum* in their libraries or other sets of which they may have knowledge.

NEST USURPATION OF *VESPULA VULGARIS* BY *DOLICHOVESPULA ARENARIA* WITH SUCCESSIVE PARASITISM OF *D. ARENARIA* BY *D. ARCTICA* (HYMENOPTERA: VESPIDAE)[1,2]

Margaret E. O'Rourke, Frank E. Kurczewski[3]

ABSTRACT: A nest containing three species of Vespinae was studied in upstate New York. The nest was probably established by *Vespula vulgaris* (L.). *Dolichovespula arenaria* (F.) was evidently acting as a temporary parasite of *V. vulgaris,* thus representing the first case of intergeneric social parasitism in the Vespidae. *D. arctica* (Rohwer) was acting as a permanent parasite of *D. arenaria.* The atypical nesting habitat — underside of a cliff overhang — undoubtedly facilitated the usurpation of the *V. vulgaris* nest by *D. arenaria.*

Taylor (1939) delineated four forms of social parasitism in the genus *Vespula.* Two of his forms: (1) interspecific, facultative temporary parasitism; and, (2) interspecific, obligatory permanent parasitism, pertain to a nest we studied in northern New York. The first situation occurs when established nests are invaded by queens of different species; the invading queen lays her eggs and the host workers rear them. The second situation develops when a species evolutionarily loses its worker caste and must depend upon another species to rear its reproductive young. Both forms of parasitism are characterized by individuals of different species cohabitating a nest simultaneously. Both forms of social parasitism apparently existed concurrently in a nest we observed.

The nest was found on the underside of a cliff overhang in a gravel pit at the SUNY-CESF Cranberry Lake Biological Station, St. Lawrence County, NY. It was situated in soil adjacent to the root system of a decaying tree. We observed the nesting activity for several hours on July 21 and 24, 1980 before removing the nest for close inspection. The nest was 6.0 cm diam. and 5.5 cm tall. It consisted of two combs, an upper one with a diameter of 2.2 cm and containing 47 cells, and a lower tier with a diameter of 3.3 cm and containing 91 cells. The upper comb contained a small central core of tan cells. A four-layer, light grey paper envelope covered the nest. One *Vespula vulgaris* (L.) worker, 9 *Dolichovespula arenaria* (F.) workers, 1 *D. arenaria* queen, and 1 *D. arctica* (Rohwer) queen were located inside the nest.

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[2]Submitted in partial fulfillment of FBL 498.

[3]Department of Environmental and Forest Biology, SUNY College of Environmental Science & Forestry, Syracuse, NY 13210.

The nest was probably initiated by *V. vulgaris*. Spadberry (1973) described *V. vulgaris* nests as being distinctly brittle and tan or red-brown in color. The presence of a central core of tan cells in the upper comb tier agrees with this description (see Akre *et al.* 1977). The subsequent addition of the grey-colored combs and envelope indicates that *D. arenaria* usurped the nest at an early stage.

The location of the nest also points to *V. vulgaris* as the original foundress. Balduf (1968) reported that the preferred nesting site for *V. vulgaris* is thoroughly decayed wood. Bequaert (1931) noted that this species almost always builds underground or in well-sheltered spots. *D. arenaria,* on the other hand, is an aerial nester, although it occasionally nests subterraneously (Greene *et al.* 1976; Roush and Akre 1978).

The *D. arctica* queen probably entered the nest shortly after the invasion by *D. arenaria. D. arctica* has been observed attempting to take over nests which are already parasitized (Evans 1975; Jeanne 1977). If such is the case, then this nest would represent a succession of parasitism, with *D. arenaria* acting as a temporary parasite of *V. vulgaris* and *D. arctica* acting as a permanent parasite of *D. arenaria.*

A *D. arctica* queen and a *D. arenaria* queen may live together harmoniously in the same nest for some time (Wheeler and Taylor 1921; Taylor 1939; Evans 1975; Jeanne 1977; Greene *et al.* 1978). Such a *D. arctica* queen depends upon the host workers to raise her brood. In the case of the nest we observed it would be the "secondary" host workers.

The absence of a *V. vulgaris* queen may be accounted for in two ways. The *V. vulgaris* queen may have died of natural causes. Alternately, the *V. vulgaris* queen may have been killed or displaced, probably by the *D. arenaria* female. Since the nest was collected at dusk, it is unlikely that she was in the field. Colonies that have lost their own queen will accept an invading one, in this case even of another genus.

There are no reports on aggressive behavior in intergeneric invasions. However, aggressive behavior by invading, interspecific, parasitic vespids is common. Inter- and intraspecific usurpations occur regularly between *Dolichovespula* queens but normally go unnoticed (Edwards 1982). MacDonald and Matthews (1975) found *V. squamosa* (Drury) parasitizing the nest of *V. maculifrons* (Buysson) via elimination of the host queen. Reed *et al.* (1979) and Reed and Akre (1983) noted that a *V. austriaca* (Panzer) queen will parasitize *V. rufa* (L.) and *V. acadica* (Sladen) nests, respectively, kill the host queen, and act aggressively toward the host workers.

On July 24 we found two dead *D. arenaria* workers directly beneath the entrance to the nest. Later, three larval vespids were observed being thrown out and two of them were alive. Greene *et al.* (1978) described similar behavior occurring during periods of colony instability, such as after the death of the host queen. The discarded larvae may have represented the last of the *V. vulgaris* brood. The parasitic invasions, coupled with the elimination of the *V. vulgaris* queen, may have led to colony instability and the eventual discarding of apparently healthy larvae.

AKNOWLEDGMENTS

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DISTRIBUTION OF CADDISFLIES (TRICHOPTERA) IN DELAWARE[1,2]

Robert W. Lake[3]

ABSTRACT: The distribution of Trichoptera in Delaware was studied. At the present time 54 genera and 143 species of Trichoptera are known from the State. Adult activity, method of capture and comments regarding abundance are included.

Published records of Delaware caddisflies are few. Thus far citations for nine species have been found: Betten (1934) (1) Ross (1944) (1) Gordon (1974) (1) Blickle (1979) (5) and Wiggins (1977) (1). Prior to the present study a survey of aquatic insects of Delaware was undertaken by F. Boys, T. Evans, L. Kelsey and D. Nye of the Department of Entomology and Applied Ecology, University of Delaware during 1967 and 1968. They concentrated on collecting the immature stages, therefore most determinations were made only to the generic level. They recorded 20 genera; nine taxa of trichopterans could be determined to the species level. Lesiewicz in 1971 continued the survey as a special problem on immature insects and reported 28 genera, 18 of which were determined to species. None of the above records were published but specimens from these studies were placed in the reference collection of the Department of Entomology and Applied Ecology, University of Delaware and these records in addition to mine have been used for reporting the distribution data herein. A few pinned specimens in the Department reference collection also yielded some state records.

Since 1976 I reared many caddisflies to the adult stage in the laboratory and thus obtained many species records for the state. In addition, through the cooperation of personnel in the Integrated Pest Management program of the Department, hundreds of UV light trap collections of insects were examined and adult trichopterans removed for determination. Some adults also were collected from traps operated by the Mosquito Control Section, Department of Natural Resources and Environmental Control of Delaware. Two types of traps are used by the Mosquito Control Section: (1) the conventional New Jersey Light Trap (NJLT) and (2) the Center for Disease Control (CDC) portable battery operated trap.

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[2] Published with the approval of the Director of the Delaware Agricultural Experiment Station as Miscellaneous Paper No. 1060, Contribution No. 548 of the Department of Entomology and Applied Ecology, University of Delaware, Newark, Delaware.

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As mentioned in a previous paper on Plecoptera distribution in Delaware (Lake 1980), Delaware lies within two natural physiographic provinces, the Piedmont and the Coastal Plain. The Piedmont comprises a very small portion at the northern end of the State with the Coastal Plain including approximately 75 percent of the land mass (Fig. 1). Much of the aquatic fauna is therefore found in warm lotic and lentic habitats with species associated with cooler water situations being absent or restricted to the Piedmont.

At the present time 54 genera and 143 species of Trichoptera are known from Delaware with all 18 Nearctic families being represented by one or more species.

Distribution data, adult activity plus additional comments are presented below in Table 1 for each species. More detail is included for rare or uncommon species. Abbreviations used in Table 1 and their explanations are as follows:

NC — New Castle County
K — Kent County
S — Sussex County
B — Adults collected near breeding site by net, hand or aspiration
R — Adults reared from larvae or pupae
CDC — Center for Disease Control Light Trap
NJ — New Jersey Light Trap
UV — UV Light Trap
X — Indicates larval collection; sometimes reared to adult for determination or determined to species in the larval stage.

ACKNOWLEDGMENTS

I am indebted to Oliver S. Flint, Jr., Smithsonian Institution, for confirming or determining a number of species. Kenneth Manuel, Duke Power Co., provided the record for *Triaenodes aba* and examined my collections of *Trianodes* to confirm or determine this material. I am especially grateful for the assistance of Mark R. Graustein and Joanne Whalen and their staff of the Department of Entomology and Applied Ecology, University of Delaware who allowed me to examine the many UV light trap collections made in conjunction with their Integrated Pest Management program. Lastly I particularly wish to thank Allisa Eggert, Charles MacMonegle and Ann E. Leipold who sorted most of the Trichoptera from the UV light trap collections and cleared countless specimens in KOH.

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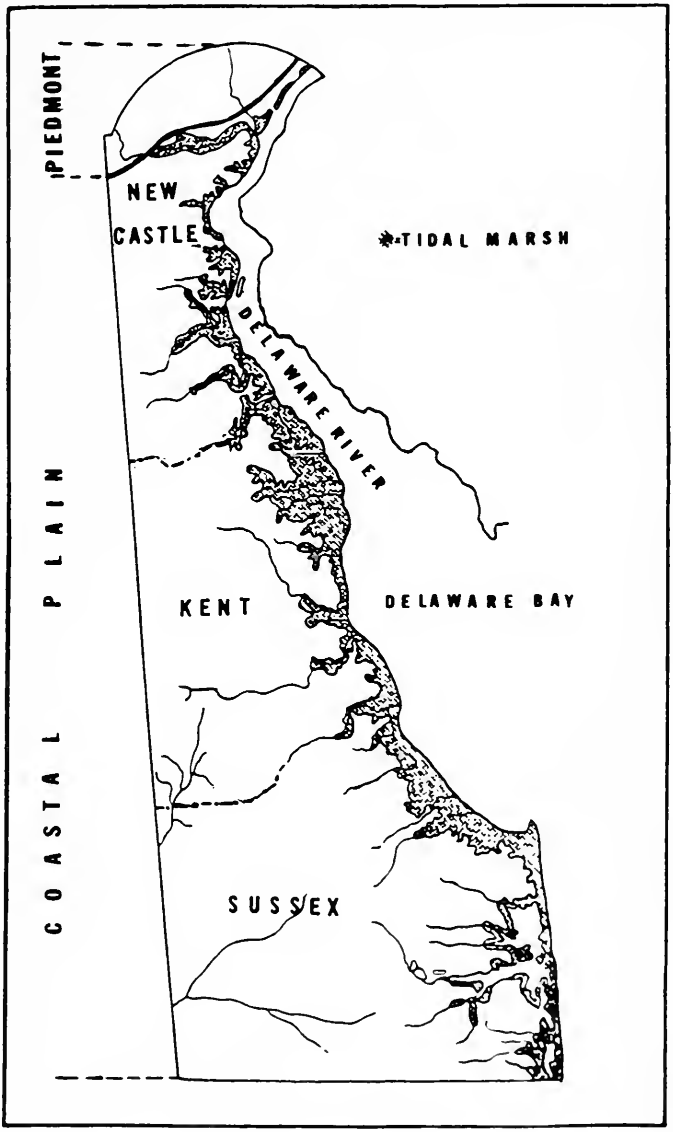

Fig. 1 Map of Delaware showing counties, tidal marshes and physiographic provinces.

Table 1. Distribution of Trichoptera in Delaware

Family & Species	County	Adults	Larvae	Adult Activity	Comments
Beraeidae					
Beraea nigritta Banks	NC	B	X	May	Found only in seepage areas in Blackbird Cr. drainage
Brachycentridae					
Brachycentrus numerosus Say	NC,K,S	B	X	Apr-May	Most abundant in Coastal Plain, Sussex Co.
Micrasema sp.	S	UV			1 female, Laurel, Sussex Co.
Calamoceratidae					
Anisocentropus pyraloides (Walker)	NC,S	R,UV	X	June	Larvae found in Blackbird Cr, NC Co. and Sheep Pen Ditch Millsboro S. Co.
Heteroplectron americanum (Walker)	NC,K,S	B,R,UV	X	May-Jun	Most abundant in Coastal Plain streams
Glossosomatidae					
Agapetus indis Ross	K	B			1 male from collection in red clover, Milford
Agapetus minutus Sibley	NC	B		June	In Piedmont only
Glossosoma nigrior Banks	NC	R	X	Apr-Oct	Most abundant in Piedmont
Protoptila sp.	NC		X		No adults have been reared or collected
Helicopsychidae					
Helicopsyche borealis (Hagen)	NC	R,UV	X	May	Larvae found in Blackbird Cr. only; 1 adult, Newark
Hydropsychidae					
Cheumatopsyche campyla Ross	NC,K,S	UV		May-Sep	
Cheumatopsyche ela Denning	K,S	UV		May-Aug	
Cheumatopsyche geora Denning	NC,S	UV		May-Aug	Most abundant in Newark, NC Co.
Cheumatopsyche pasella Ross	NC	UV			2 males, Newark, VI-10-11-1981, VII-7-8-1981
Cheumatopsyche pettiti (Banks)	NC,K,S	B,UV,CDC NJ		Apr-Sep	
Cheumatopsyche pinaca Ross	NC,K,S	UV		May-Aug	
Cheumatopsyche speciosa (Banks)	NC	UV,NJ		Jun-Aug	
Cheumatopsyche virginica Denning	S	NJ			1 male Frankford, VI-11-13-1976

Table 1 Continued.

Family & Species	County	Adults	Larvae	Adult Activity	Comments
Cheumatopsyche wabasha Denning	NC,S	UV			1 male, Millsboro VII-27-1978 1 male, Newark VI-16-19-1981
Diplectrona modesta Banks	NC,K,S	R,UV	X	May-Aug	More common in NC Co. Piedmont
Hydropsyche betteni Ross	NC,K,S	B,UV		Apr-Sep	
Hydropsyche decalda Ross	S	NJ,UV		May-Jul	
Hydropsyche dicantha Ross	NC	UV		Jun-Aug	
Hydropsyche hoffmani Ross	NC	UV		May-Jun	6 males Newark trap
Hydropsyche impula Denning	NC	UV			2 males VII-13-14-81 Newark Trap
Hydropsyche leonardi Ross	NC,S	UV		Apr-Aug	Most collections Newark NC Co.
Hydropsyche opthalmica Flint	NC	UV		May-Aug	Newark Trap only NC Co.
Hydropsyche phalerata Hagen	NC,S	B,UV		May-Jul	Most abundant in Newark Trap
Hydropsyche scalaris Hagen	NC,S	UV		May-Jul	Most abundant in Newark Trap
Symphitopsyche bronta Ross	NC,S	R,NJ,UV		May-Sep	More common in NC Co.
Symphitopsyche morosa (Hagen)	NC,K,S	UV		May-Sep	Most collections from Sussex Co.
Symphitopsyche slossonae (Banks)	NC	UV			1 male Newark NC Co., VI-7-81
Symphitopsyche sparna (Ross)	NC,K,S	B,UV		May-Sep	
Symphitopsyche walkeri (Betten & Mosley)	NC	NJ,UV		May-Aug	
Macronema carolina (Banks)	K	UV			1 male Wyoming, VI-25-27-80
Macronema zebratum (Hagen)	NC,K	UV		May-Aug	Common in Newark Trap; 1 male Clayton, Kent Co.
Potamyia flava (Hagen)	NC	UV		May-Sep	Abundant in Newark Trap
Hydroptilidae					
Agraylea multipunctata Curtis	NC	UV		May-Sep	3 females Newark
Hydroptila consimilis Morton	NC	NJ			1 male Arden IX-5-1980
Hydroptila metoeca Blickle & Morse					Blickle (1979) records this species from Delaware

Table 1 Continued.

Family & Species	County	Adults	Larvae	Adult Activity	Comments
Hydroptila perdita Morton	NC	NJ			1 male Newport VII-13-1980
Hydroptila spatulata Morton	NC	UV			1 male Newark VIII-27-29-1982
Hydroptila virgata Ross	S	R	X		A large series of adults reared from Smith Hill
Hydroptila waubesiana Betten	NC	B,NJ			1 male Delaware City IV-22-1980 1 male Newport VII-13-1981
Hydroptila xoncla Ross	S	R	X		Smith Hill — larvae 11-4-1975
Leucotrichia pictipes (Banks)	NC	B	X		Only in Piedmont
Ochrotrichia sp.	NC,K,S		X		4 larval collections
Orthotrichia aegerfasciella (Chambers)	NC	NJ			1 male Bellevue, 1 male Newport
Orthotrichia cristata Morton					Blickle (1979) records this species from Delaware
Oxyethira grisea Betten	S	B			James Branch IV-28-78 on bridge adults abundant
Oxyethira obtatus Denning					Blickle (1979) records this species from Delaware
Oxyethira pallida (Banks)	NC,S	NJ		Aug-Sep	Wilmington NC Co. Aug-Sept. Lewes S. Co. Sept.
Leptoceridae					
Ceraclea alagma (Ross)	K,S	UV		June-Jul	1 male Leipsic, 1 male Felton, K Co. 1 male Georgetown S Co.
Ceraclea ancylus (Vorhies)	NC	UV			1 male Newark NC Co. VI-20-22-1980
Ceraclea cancellata (Betten)	NC,K,S	UV		May-Jul	
Ceraclea diluta (Hagen)	NC	R	X		Found only in Blackbird Creek
Ceraclea flava (Banks)	NC	UV		June-Jul	3 males Newark
Ceraclea maculata (Banks)	NC,K,S	NJ,UV		May-Aug	
Ceraclea nepha (Ross)	NC,K,S	UV	X	May-Aug	More abundant in Sussex Co.
Ceraclea protonepha Morse & Ross	K,S	UV		May-Jun	Most collections from Sussex Co.
Ceraclea tarsipunctata (Vorhies)	NC,K,S	NJ,UV	X	May-Jul	

Table 1 Continued.

Family & Species	County	Adults	Larvae	Adult Activity	Comments
Ceraclea transversa (Hagen)	NC,K,S	UV	X	May-Aug	Most records from Coastal Plain
Leptocerus americanus (Banks)	S	UV		Jun-Jul	Four localities in Sussex Co.
Mystacides sepulchralis (Walker)	NC,S	R,UV	X	Jun-Aug	Uncommon
Nectopsyche nr. *diarina*	NC	R	X		Reared males close to *diarina*
Nectopsyche exquisita (Walker)	NC,S	UV		Jun-Aug	Newark NC Co. July-Aug Bridgeville Sussex Co. June
Oecetis avara (Banks)	NC	UV		Jun-Aug	Newark Trap 2 males 2 females
Oecetis cinerascens (Hagen)	NC,K,S	NJ,UV		May-Sep	
Oecetis inconspicua (Walker)	NC,K,S	B,NJ,R,UV	X	May-Sep	
Oecetis persimilis (Banks)	NC,K,S	R,NJ,UV	X	Jun-Aug	
Triaenodes aba Milne					1 male July 1874 Coll. SH. MCZ
Triaenodes ignita (Walker)	NC,K,S	B,R,CDC,UV	X	Jun-Sep	
Triaenodes injusta (Hagen)	S	UV		Jun-Jul	Greenwood 1 male Bridgeville 1 male
Triaenodes marginata Sibley	NC,S	UV		May-Jul	Most collections from Sussex Co.
Triaenodes ochracea Betten & Mosely	NC,S	R,NJ,UV	X	Jun-Aug	Collected more in Sussex County Traps
Triaenodes perna Ross	K	B			2 males Canterbury IV-22-55
Triaenodes tarda Milne	NC,S	UV	X	May-Jul	Only 3 males collected
Lepidostomatidae					
Lepidostoma americanum (Banks)	NC	UV			1 male New Castle VII-3-6-80
Lepidostoma costalis (Banks)	NC	R	X		1 female Ashland
Lepidostoma griseum (Banks)	NC,S	R,UV	X		Most specimens reared from larvae
Lepidostoma latipennis (Banks)	K,S	R,UV	X		Most adults from Wyoming Trap, Sussex Co.
Lepidostoma sommermanae Ross	NC	R	X		Larvae in seep Ashland VI-28-78
Lepidostoma togatum (Hagen)	NC,S	UV			1 male Bridgeville VI-10-71 1 female Newark VI-6-83
Limnephilidae					
Frenesia dificilis (Walker)	NC	R,UV	X	Oct-Nov	Mostly larval collections seeps and spring brooks

Table 1 Continued.

Family & Species	County	Adults	Larvae	Adult Activity	Comments
Frenesia missa (Milne)	NC	B,R,UV		Oct-Nov	Common in seeps & spring brooks
Goera calcarata Banks	NC	UV	X		Larvae in Pike Creek and trib of Shallcross Lake, 1 male Newark
Hydatophylax argus (Harris)	NC,K,S	R,UV	X	May-Jun	
Ironoquia kaskaskia Ross	NC,S	CDC,NJ,UV		Sep-Oct	4 males Sussex Co. - Rare 2 males New Castle Co.
Ironoquia parvula (Banks)	NC,K	UV	X	Oct	
Ironoquia punctatissima (Walker)	NC,K,S	R,CDC, NJ,UV	X	Sep-Oct	
Limnephilus moestus Banks	NC	UV			1 female Middletown V-30-1981
Limnephilus ornatus Banks	NC,K,S	UV		Jun-Jul	
Limnephilus submonilifer Walker	NC,K,S	NJ,UV	X	Mar-Nov	
Neophylax oligius Ross	NC	R,UV	X	Sep-Oct	In Piedmont streams
Platycentropus radiatus (Say)	NC,K,S	R,UV	X	Apr-Jul	
Pycnopsyche gentilis (McLachlan)	NC	R	X		In Piedmont streams
Pycnopsyche guttifer (Walker)	NC,S	R	X	Sept	Many adults reared
Pycnopsyche indiana (Ross)	NC,K,S	R,UV	X	Sep-Oct	
Pycnopsyche lepida (Hagen)	K,S	UV		Aug-Sep	8 males collected
Pycnopsyche luculenta (Betten)	NC,K,S	UV	X	Sep-Oct	
Pycnopsyche scabripennis (Rambur)	NC,K,S	R,CDC,UV	X	Aug-Oct	
Pycnopsyche subfasciata (Say)	NC,S	R,UV	X	Sept	
Molannidae					
Molanna blenda Sibley	NC,K,S	R,NJ,UV	X	Jun-Sep	
Molanna tryphena Betten	NC,K,S	B,R,CDC NJ,UV	X	Jun-Sep	
Molanna ulmerina Navas	S	B,UV		May-Sep	
Odontoceridae					
Psilotreta frontalis Banks	NC,K,S	B,R,UV	X	May-Jun	
Psilotreta rufa (Hagen)	NC	B,MR	X	May-Jun	Local in spring seeps

Table 1 Continued.

Family & Species	County	Adults	Larvae	Adult Activity	Comments
Philopotamidae					
Chimarra aterrima Hagen	NC,K,S	B,NJ,UV	X	Apr-Oct	
Chimarra obscura (Walker)	NC,S	UV		Jun-Aug	
Dolophilodes distinctus (Walker)	NC	B,NJ,UV	X	Jan-Dec	Common in Piedmont
Wormaldia moesta (Banks)	NC,K,S		X		Larval collections in Mar & May
Phryganeidae					
Agrypnia vestita (Walker)	NC,K,S	R,UV	X	May-Sep	
Oligostomis ocelligera (Walker)	NC,K		X		
Phryganea sayi Milne	NC,K,S	UV	X	Jun-Sep	
Ptilostomis angustipennis (Hagen)	NC,S	UV		Jun-Jul	1 male Georgetown Sussex Co. 1 male Clayton NC Co.
Ptilostomis ocellifera (Walker)	NC,K,S	R,UV		May-Sep	
Ptilostomis postica (Walker)	NC,S	UV		May-Sep	
Polycentropodidae					
Cernotina spicata Ross	NC,S	NJ,UV		Jun-Sep	
Cyrnellus fraternus (Banks)	NC	NJ,UV		Jun-Sep	Common in Piedmont
Neureclipsis crepuscularis (Walker)	NC	UV		Jun-Aug	Newark Trap only
Nyctiophylax affinis (Banks)	NC,K,S	UV		May-Aug	Locally abundant
Nyctiophylax denningi Morse	NC,K	R,UV	X	May-Jun	Collected twice, rare
Phylocentropus carolinus Carpenter	S	B,UV		Jun-Aug	Collected only at Smith Hill James Branch
Phylocentropus lucidus (Hagen)	NC,K,S	B,CDC, NJ,R,UV	X	May-Sep	Fairly common in seep areas
Phylocentropus placidus (Banks)	NC,K,S	B,CDC, NJ,R,UV	X	May-Oct	
Polycentropus blicklei Ross and Yamamoto	S	UV			1 male Milton VI-23-24-82
Polycentropus chenoides Ross and Yamamoto	S	UV			1 male Georgetown V-18-24-76 1 male Laurel IX-13-81
Polycentropus cinereus Hagen	NC,K,S	NJ,UV		May-Sep	
Polycentropus clinei (Milne)	K,S	UV			1 male Milford VI-18-81 1 male Wyoming V-6-7-82

Table 1 Continued.

Family & Species	County	Adults	Larvae	Adult Activity	Comments
Polycentropus confusus Hagen	NC	UV			1 male Newark VI-17-80
Polycentropus crassicornis Walker	NC,K,S	UV		May-Jun	Collected from 12 locations, DE
Polycentropus interruptus (Banks)	S	UV			1 male Bridgeville V/14-16/82
Polycentropus nascotius Ross	S	B			1 male on bridge — Smith Hill IV-28-78
Polycentropus remotus Banks	S	UV			Milton VI-14-15-82, V-26-27-82
Psychomyiidae					
Lype diversa Banks	NC,K,S	B,CDC NJ,UV	X	Apr.-Sept	
Psychomyia flavida Hagen	NC	UV			2 females Newark Trap VII-20-82, V-8-13-1981
Rhyacophilidae					
Rhyacophila carolina (Banks)	NC	B		Apr-Sep	Piedmont streams
Rhyacophila fuscula (Walker)	NC	B	X		Montchanin — 1 larva II-10-67
Rhyacophila invaria (Walker)	NC	B			1 male VI-9-77 Piedmont
Rhyacophila ledra Ross	NC	UV			3 males, 1 female Newark VI-6-12-83 Larvae-Townsend
Rhyacophila torva Hagen	NC	B		Mar-Aug	Piedmont
Sericostomatidae					
Agarodes grisea (Banks)	NC,K,S	R,UV	X	May-Jun	In spring seeps locally dist.
Agarodes libalis Ross and Scott	NC,K,S	R,UV	X	May-Aug	In coastal plain streams.

DISCOVERY OF FIRST RESIDENT POPULATION OF THE EUROPEAN BEE, *MEGACHILE APICALIS* IN THE UNITED STATES (HYMENOPTERA: MEGACHILIDAE)[1]

Kenneth W. Cooper[2]

ABSTRACT: The first resident population in the United States of *Megachile apicalis* Spinola is reported from Santa Barbara County, California.

North American records of the European *Megachile (Eutricharaea) apicalis* Spinola ("Canada, N.J., Va.") listed in the Catalog of Hymenoptera of America North of Mexico (1979) are old, none later than 1931, and are based on few specimens collected in eastern North America (4 females, 2 doubtful males; Mitchell 1937, 1962). Indeed Mitchell (1962) held that "It is not clear . . . that *M. (E.) apicalis* has been entirely successful in becoming established on this continent."

Returning from a collecting trip to San Marcos Pass (site at *ca.* 610 m elevation), Santa Barbara County, CA (Aug. 10, 1982), Jack Hall (Dept. of Ent., Univ. of Calif., Riverside) and I were surprised to find 2 female *M. (E.) apicalis* among the specimens taken. Exactly one year later, I returned to the same site, a small clearing within chaparral, and collected an additional 8 females and 7 males on thistle [*Cirsium ?vulgare* (Savi) Ten.] and on *Lotus scoparius* (Nutt. in T. & G.) Ottley. The following day three additional males were taken on a lavender "aster", *Erigeron* sp., growing along the yellow pine-wooded margin of a firebreak, adjacent to chaparral, (at 1160 m) near Cachuma Saddle, on Figueroa Mt., some 30 km east of San Marcos Pass.

There can be no doubt that *M. (E) apicalis* is now established in Santa Barbara County, a breadth of the continent distant from older, scattered records. Thus California alone has resident populations of all three species of the European subgenus *Eutricharaea* that are known to occur in the United States: *M. (E.) apicalis*, *M. (E.) concinna* Smith and *M. (E.) rotundata* (F.) [= *M. (E.) pacifica* (Panzer)], all readily recognized by means of F. D. Parker's fine key (1978). Gratitude is expressed to Dr. Parker for the loan of a pair of *M. (E.) apicalis* for comparison with the specimens from Santa Barbara County.

[1]Received April 19, 1984. Accepted July 2, 1984.

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Proceedings of symposium at Clemson Univ., SC, July 1983.

AN IMPROVED METHOD FOR PREPARING EXUVIAE OF PARASITIC HYMENOPTERA[1]

David Wahl[2,3]

ABSTRACT: The practice of preparing exuviae of larval parasitic Hymenoptera with KOH is discouraged. An alternative involves: 1) soaking in water for 12-24 hours, 2) ultrasonification to remove debris and unfold the exuviae, and 3) clearing in Nesbitt's solution. These techniques give more control over preparation and mounting.

For parasitic Hymenoptera, study of larval stages is invaluable for identification and phylogenetic investigation. Investigators of these insects have used the techniques of Beirne (1941) for preparing and mounting the cast skins of the final-instar larvae. Briefly, Beirne's methods involve: 1) cutting open the parasitoid cocoon and removing the meconium and final-intar skin, 2) boiling the larval skin in 10% KOH, 3) rinsing the skin in distilled water, and 4) dehydrating and mounting in Canada balsam or a similar mounting medium. From personal experience with larval Ichneumonidae, these methods proved unsatisfactory and led to experiments with other techniques. The following steps are a combination of various practices from other areas of entomology. I believe they give more control over the preparation and mounting of larval skins.

Cleaning and preparation: The cocoon (or host pupa) from which the parasitoid has emerged is left for 12-24 hours in a vial of distilled water to which 1-2 drops of mild detergent have been added. It is then transferred to 70% ethanol, and carefully opened with microdissecting scissors. The meconium and final-instar skin, which are usually found at the end opposite the emergence hole, are removed to a vial of 70% ethanol and subjected to ultrasound for 1-2 minutes (A small ultrasonicator should be used to avoid potential disintegration of the specimen). This removes all debris from the larval skin and tends to unfold it from its tightly wadded condition. The skin is then returned to 70% ethanol and, under a binocular dissecting microscope, the head and its associated sclerites are removed. Extraneous fragments of cuticle are then teased away from the head. A deep concavity slide is filled with Nesbitt's solution, a clearing agent, and the larval head

[1]Received January 16, 1984. Accepted May 5, 1984.

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[3]Contribution number 1892 from the Department of Entomology, University of Kansas, Lawrence.

is immersed for 1-5 hours, depending upon the degree of sclerotization of the cephalic sclerites.

Mounting: The head is removed from the Nesbitt's solution and, along with the larval skin, mounted on a slide using Hoyer's medium. The slide is then dried for several days at 40-50° C and ringed with Glyptol®, an alkyd resin made by General Electric (or a similar ringing compound, e.g., Zut). I prefer Hoyer's for the superior refractive properties and the advantage of being able to mount directly from Nesbitt's into the medium. Some institutions may require that euparol or Canada balsam be used in place of Hoyer's; the larval remains may then be passed through a standard dehydration series and mounted accordingly.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

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

ITZN 11/5 A.N.(S.) 131 24 August 1984

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 41, part 3, on 23 August, 1984 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.

239 *Tibicina* Amyot, 1847 and *Lyristes* Horvath, 1926 (Insecta, Hemiptera, Homoptera): proposed conservation by the suppression of *Tibicen* Berthold, 1827. Also, Arguments pour la suppression du nom de genre *Tibicen* et de ses derives dans la nomenclature de la superfamille CICADOIDEA.

2142 *Hypocryphalus mangiferae* (Stebbing, 1914) (Insecta, Coleoptera proposed conservation under the plenary powers.

R.V. MELVILLE, Secretary

MULTICOLORED 35 MM SLIDES FOR DATA PRESENTATION[1,2]

Robert W. Sites, Roger D. Akre[3]

ABSTRACT: A technique is described for producing 35 mm slides with alternating bands of color to define lines of data and, if desired, multicolored letters.

Many articles have appeared during the past 7-8 years on photographic techniques for preparing 35 mm slides for presentation of data. Most described techniques for producing slides with either black backgrounds and colored letters (Ignoffo 1972) or colored backgrounds and white letters (Elder and Agee 1977, Hefetz 1977, Ciesla 1979) or black letters (Eaton 1978).

Another method was described for producing slides with colored backgrounds and letters (Mack 1981), but this procedure does not allow for varied colors in either the background or the letters of an individual slide. Relative densities of background and letter color cannot be varied.

Presented here is a technique which not only allows for the background to be colored, but also banded to allow for segregation of data (Fig. 1). It is also possible to have letters of several colors on the same slide.

Preparation of Slides

This process requires 3 major steps: 1) preparation of a Kodalith negative with colored letters, 2) preparation of gelatin filters, with optional bands, for background, and 3) double-exposure of both of these onto a single frame of Ektachrome film.

STEP 1. Prepare your line copy with push-off letters, being careful not to include too much data. Pieters (1977) guidelines should be followed. Photograph the line copy with Kodalith Ortho film, 6556, type (Ignoffo 1972). The negatives may be left black and white. However, for colored letters on the final slide, paint the letters (e.g., Dr. Ph. Martin's Synchromatic Transparent Water Colors by Salis International, 4040 N. 29th Ave., Hollywood, FL 33020), attach transparent acetate colors (e.g., Zipatone, Inc., 150 Fencl Ln., Hillside, IL 60162) or place a colored gelatin filter (e.g., Special Effects Assortment by Spiratone, 135-06 Northern Blvd., Flushing, NY 11354) over the negative. Mount the

[1]Received March 29, 1984. Accepted June 14, 1984.

[2]Scientific paper number 6767. Washington State University, College of Agriculture Research Center, Pullman. Work done under project 0037.

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negative in a slide mount.

STEP 2. Place the desired color gelatin filter in an empty slide mount to provide background color. To create a banded effect, carefully cut neutral density filters (also available from Spiratone; Warming and Cooling Assortment), or other colors, to the band width desired, and place these on the background color filter. Care must be taken to position the bands in the same location on this slide as the data you want to delineate on the Kodalith slide. Pressure from the slide mount will hold the bands in position.

STEP 3. A camera body capable of taking double-exposures, such as the Nikon FM2, is loaded with Kodak Ektachrome 64 daylight film and attached to a bellows and slide copier. An electronic flash is used to individually expose each of the 2 slides prepared in steps 1 and 2. The order of exposure does not matter, and exposure should be varied by changing the distance of the flash to the slide copier, keeping the aperture constant (i.e., f/16) to maintain maximum depth of field. Different densities of color filters will require different exposures. For example, we positioned a Braun Hobby EF300 flash (guide number 80 at ASA 25) 40 cm from the slide copier for low density filters (e.g., lime green) and 20 cm for high density filters (e.g., dark blue). Exposure for the Kodalith slide must be determined separately, but holding this flash 40 cm away was correct for most backgrounds. Each photographer will have to determine the correct exposure for their equipment since light gathering capabilities of lenses

NEST	RM	DIAM
1	10	15
2	21	15
3	27	18
4	64	20
5	67	36

Fig. 1. A diagrammatic representation of a slide showing lines of data separated by color density. For additional segregation or emphasis, the numbers can be photographed in contrasting colors.

vary. However, bracketing 3 exposures, with one on either side of optimal, should yield the correct exposure. Extreme care should be taken to load the slides so the banding will be aligned with the appropriate data on the Kodalith slide. When exposing the background, move the lens off focus so that minor imperfections in the gelatin filter are not in sharp focus. Develop the film with E-6 processing. Most photographic laboratories offer 1-day service, or it can be done at home.

The backgrounds most pleasing to us are dark blue, lime green and olive green (orange + lime green). Most of the long wavelength colors (i.e., red to yellow) appear too gaudy, and probably should be avoided. Banding with neutral density strips gives alternating light and dark shades of the same color (Fig. 1). Letter colors (e.g., yellow, orange, red and blue) that contrast with the background should be selected.

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